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## A Study on the Users' Experience in Learning Using a Virtual Reality Laboratory for Medical Sciences

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**Abstract:** As a result of the worldwide dissemination of COVID-19, educational institutions across the globe, particularly those that serve students in the field of science, have been mandated to close their doors. Consequently, educators and students have increasingly relied on educational technology to obtain a diverse array of resources. This research aims to construct a science laboratory in virtual reality by employing the ADDIE Methodology, a well-established structure for designing instructional programs. Additionally, the study aims to evaluate the impact of the virtual reality laboratory on the level of immersion that 37 science students experienced during the learning process. This evaluation will compare the students' sense of presence before and after utilizing the facility. The concept of presence within the context of virtual reality (VR) pertains to the experience of being fully immersed in a digital environment, such that the user's cognitive processes interpret it as being authentic. The degree of immersion users perceive substantially impacts their engagement, conduct, and affective responses while engaging with virtual reality. For this experimental investigation, the participants were segregated into two distinct cohorts. Group 1 consisted of twenty participants who viewed scientific films in two dimensions, whereas Group 2 comprised seventeen participants who engaged in science education through a virtual reality laboratory. The findings suggest a significant presence in both cohorts, with the virtual reality (VR) cohort exhibiting superior performance compared to the other group. The present study offers significant findings for educators and software developers engaged in creating virtual reality (VR) resources for science instruction. In forthcoming studies of instructional technology that utilize virtual reality, it is suggested that cognitive load be scrutinized as a variable. In general, this research adds to the increasing corpus of evidence that showcases the favorable and comprehensive impacts of immersive learning in education.

**Keywords:** Laboratory, Sciences, Virtual Reality, Presences, CAMIL.

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## Introduction

In response to current conditions, educational institutions have promptly adopted efficient strategies for managing student interactions, delivering online courses, and assessing students. Institutions have recognized the need to adapt to the changing environment caused by COVID-19 (Mukhtar et al., 2020) despite initial concerns about the effects of investing in online education. This presents an opportunity to adopt technology that meets the requirements of contemporary education, especially for science students. Technology advancements have increased the desirability of online and web-based learning methods, mainly when traditional approaches are impractical. Such methods enable educational institutions to adapt their blended learning strategies quickly during a pandemic (Panchal et al., 2021). However, it is essential to ensure that online education operates efficiently.

Virtual reality (VR) is an interactive experience that immerses consumers in computer-generated environments (Fabris et al., 2019; Mokmin & Ridzuan, 2022). VR technology grants users access to interactive, three-dimensional virtual environments that enhance learning (Oigara, 2019). Users are transported to a 360-degree virtual environment by wearing a VR headset that monitors their movements, allowing them to explore, navigate, and interact with the content. This enables students to take charge of their learning process and choose content that corresponds to their abilities and requirements (Yin et al., 2021). However, virtual reality technology also raises ethical concerns and potential dangers, such as privacy, consent, representation, and bias issues.

This study has identified research voids regarding the long-term effects of VR exposure, including its effects on visual performance, visual fatigue, and cognitive aftereffects (Szpak et al., 2019). Additionally, when utilizing VR technology, ethical concerns regarding privacy, consent, representation, and bias must be addressed (Kenwright, 2018). Recent developments in the educational use of virtual reality include virtual field trips to historical and touristic landmarks, simulation-based learning for practicing psychomotor skills in preclinical dental students, immersive language learning for speaking and listening, VR integration in special needs education for social and life skills training, and iPad-based blended learning approaches (Crawford et al., 2022)(Jiao et al., 2021).

To facilitate this research, a Virtual Reality Biology Lab (VRBL) with virtual experiences for students was created. The VRBL combines Experiential Learning Theory (ELT) and the Cognitive Affective Model to generate the CAMIL model, an immersive learning environment. This instructional method integrates



multimedia design and effective pedagogical techniques by utilizing the interactive capabilities of virtual reality. The study will assess pupil participation, engagement, and comprehension utilizing the Virtual Reality Laboratory (VRL) and conventional two-dimensional films on the same topics. The final prototype was designed and developed using the ADDIE Model, a recognized framework for VR-based technologies in scientific education. Educators and designers can use the findings of this study to create more engaging learning environments.

### **Background Study**

Virtual reality encompasses four essential elements: virtual worlds, sensory feedback, immersion, and interactivity. Virtual worlds are computer-generated environments that permit real-time user interaction and simulate external sensations, providing a feeling of teleportation to the virtual world (Jiawei & Mokmin, 2023). Immersion enhances the authenticity of the experience by incorporating auditory and visual data, allowing users to become fully immersed using VR headsets and spatial audio. Sensory feedback replicates human perception, allowing VR equipment users to navigate, observe their on-screen movements, and interact with the virtual environment. VR can alter the perception of taste, scent, and force, in addition to audio and video. The fourth aspect is interactivity, which enables users to interact with the virtual world in real-time, fostering a sense of inclusion and immersion. Within the virtual world, users can perform actions such as slaying monsters, shooting, kicking, and selecting objects on the screen.

The technology seeks to simulate reality by utilizing VR equipment such as headsets, gloves, and goggles that transmit and receive data and display moving images and objects. When human motion is detected, the display alters in real-time, providing users with a realistic 3D experience. Explore the VR environment by walking, stepping, turning heads, and even touching 3D objects to experience them with their hands (Mokmin & Jamiat, 2021).

According to Heizenrader (2019), there are two primary types of virtual reality: non-immersive and immersive. Non-immersive VR technology provides the user with a computer-generated virtual environment in which they remain. There are two types of immersive VR: semi-immersive and truly immersive. Semi-comprehensive virtual reality provides a more immersive experience than non-immersive virtual reality, but is not as immersive as fully immersive virtual reality. Completely immersing the user in a virtual environment provides the most authentic experience possible. Fully immersive experiences require a headset or other wearable device that covers the user's eyes, hearing, and sometimes other senses. This research focuses on fully immersive technology because it provides a more interactive and comprehensive virtual reality (VR) learning environment.

Using avatars, students can engage in various virtual reality simulations and engage in learning without fear of making errors. For instance, Shorey & Ng (2021) explain how the performance of nurses during clinical training can be monitored and recorded using VR, which provides an authentic and distinctive training environment that enhances their sense of presence. Additionally, VR can be used for challenging educational duties, such as

assisting anxious patients receiving psychiatric care. Li et al. (2020) discovered that avatars in a virtual environment assist patients in identifying their emotions and practicing emotional responses.

### **Virtual Reality in Learning Science**

The study of biology is essential to comprehending science, and it is included in the secondary school curriculum. Biology investigates the processes within living organisms, such as humans, plants, and animals, and forms the basis of medical science. It addresses questions concerning the origins of existence. However, pursuing biology at the secondary and bachelor's levels presents obstacles, particularly regarding teacher preparation and subject understanding. The psychosocial aspect relates to the student's interactions with the instructor, peers, and environment, whereas the physical aspect relates to the classroom's environment and resources. Effective interactions between instructors and students are crucial for educational success.

Due to the global proliferation of COVID-19, educational institutions have been forced to close their doors, particularly those training future medical professionals. Online education has filled the void and allowed students to continue their education. The course materials are delivered via online platforms in a manner that encourages student engagement and facilitates the evaluation of their progress. Virtual reality (VR) immerses users in a computer-generated environment, facilitating user interaction. Through sophisticated interaction techniques, VR technology provides educational applications with access to 3D simulated environments. By donning motion-sensing VR headsets (and sometimes portable controllers), individuals can experience a virtual 360-degree environment that completely replaces their immediate surroundings. This adaptability enables students to direct their own learning, selecting pertinent topics based on their own circumstances and receiving individualized instruction tailored to their specific skills.

The use of virtual reality in medical education and learning can be highly advantageous. Several studies have demonstrated the benefits of combining VR technology with conventional instructional methods in medical science education. Chen et al. (2020) discovered that virtual reality technology improved students' learning capacity, satisfaction levels, performance time, and confidence. Samadbeik et al. (2018) discovered in a review of studies on using virtual reality in medical science that 74% of the studies indicated enhanced learning outcomes, while 87% demonstrated that medical professionals trained with VR exhibited increased accuracy. Despite the many benefits of VR-based learning materials and environments in medical science education, Baniyasi et al., (2020) identified specific challenges and limitations that organizations and educators should consider prior to investing resources in the development of such materials and environments. To effectively utilize virtual reality, it is essential to meticulously align its educational purpose and consider it throughout the design and development phases.

## **Experiential Learning in Virtual Reality**

Lewin, Dewey, and Piaget all created significant experiential learning models that have influenced the growth of the notion of experiential learning. These opinions all emphasize the value of experience or hands-on training. Students acquire knowledge through actual experience and subsequent processing of that knowledge. The process of learning by actual experience is referred to as "experiential learning". Relearning should always be a part of the learning process since learning is a process, not a product, and learning itself inspires people to learn. When experience is taken in and transformed, knowledge is created.

Four experiential learning methodologies were presented using this just as the foundation. The Active Experimentation, Reflective Observation, and Abstract Conceptualization Cycle in Four Stages (David A. Kolb, 2015). The experiential learning paradigm is one of the most frequently cited rationales for employing virtual reality in the classroom (Falloon, 2019). The knowledge required for efficient learning can only be obtained through firsthand experience. Because it centers the learner at the center of relevant lessons, virtual Reality (VR) has a lot of potential as a teaching tool (Alrehaili & Al Osman, 2019). Virtual Reality (VR) has also been shown to increase student engagement in chemistry, engineering education (Chang et al., 2022)(Halabi, 2019), and STEM subjects (Sattar et al., 2020).

Virtual reality (VR) technology's application in the medical sciences has been the focus of numerous studies that have looked at how to engage students' interest in learning. Virtual reality was used as a teaching tool for nurses to learn about childbirth throughout the trial. Their research indicates that when it comes to piquing students' interest in learning, employing virtual Reality (VR) to teach students is more effective than using more traditional methods. Students are significantly more engaged in virtual Reality (VR) learning than they are with video and text-based learning, according to research done by Sattar et al. (2020).

## **Cognitive Affective Model of Immersive Learning (CAMIL)**

According to the Cognitive Affective Model of Immersive Learning (CAMIL), immersive media, such as virtual reality (VR), improve the learning experience. The function of multimedia design in enhancing immersive virtual learning environments is crucial (Makransky & Petersen, 2021). Visual, audio, and tactile feedback are used as virtual sensory inputs during immersive learning. This strategy is supported by motivation, curiosity, and multimedia learning, among others. Figure 1 depicts the six emotional and cognitive CAMIL components that can facilitate learning in immersive virtual reality (IVR) environments. These variables include interest, intrinsic motivation, self-efficacy, embodiment, cognitive burden, and self-regulation. Makransky & Mayer, (2022a) research indicates that effective instruction in virtual environments can improve learning outcomes. The hypothesis outlines six influences of presence and agency on the learning process. Figure 1 illustrates the relationships between CAMIL variables and factors such as cognitive burden, self-regulation, self-efficacy, and intrinsic motivation. Investigating the impact of the user presence scale and the VR Science Laboratory experience on learning will be the primary focus of this study.

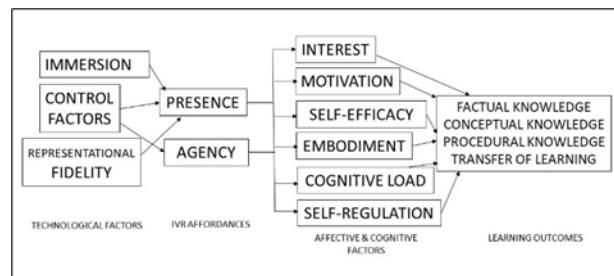


Figure 1. The Relations between the different variables in the CAMIL

### Presences in Virtual Reality

Due to its requirement for user interaction within a virtual environment, virtual reality (VR) has received scant research attention despite its pervasive use. The feeling of presence is crucial for creating a more realistic virtual reality experience because it enables users to focus on the content rather than become distracted by illusionary flaws. Elements such as displaying actual constraints and equipment awareness can assist in reducing this subjective illusion. Moreover, social interactions with VR characters and internal factors such as personality traits and immersion propensity can influence a user's sense of presence while using VR (Servotte et al., 2020). After respondents have investigated the VR research facility, a questionnaire will be administered to determine their level of presence.

The sensation of being tangibly present within a virtual environment. It requires the user to feel truly present, interacting naturally with avatars, objects, and the surrounding environment. The objective is to create sensory experiences that closely mimic "being there." User characteristics and media attributes determine their presence in mediated contexts, according to Riva et al. (2003) classifications. Individual component perception plays a significant influence on presence (Bachmann et al., 2021). As it involves the subjective experience of the learner, different individuals may have varying levels of presence in response to the same experience. As our brain perceives all sensory information as a unified entity rather than discrete channels, developing multisensory experiences is essential for creating impactful moments. However, most VR research has primarily focused on enhancing image fidelity.

The term "immersion" is used to describe both the objective measure of creating a visually and aurally engaging virtual environment and the subjective impression of believability in that environment (Cummings & Bailenson, 2016). "Presence" refers to the mental perception of being physically present in a simulated environment, resulting in a "presence illusion." Contrary to prevalent belief, the primary objective of virtual reality is not to make users feel physically present in a virtual environment (Samur, 2016). Instead, "presence" refers to the sensation of being fully immersed in a digital world, predominantly on a visual level, despite the brain and body's response to environmental stimuli. In the VR industry, "presence" can be subjective and sometimes used interchangeably. "Presence" can also refer to the sensory realism of a virtual reality (VR) system (Slater & Sanchez-Vives, 2016).

Immersive VR experiences require tactile feedback, minimal latency, and the full integration of visual and auditory elements (Slater & Sanchez-Vives, 2016). High-fidelity visuals, immersive audio, and natural interaction flow create an immersive experience (Jung & Lindeman, 2021). Virtual reality (VR) technology aims to thoroughly immerse users in a virtual environment by providing visual, auditory, and sometimes tactile sensory feedback. VR headsets, motion controllers, and other specialized technologies aim to make the virtual world appear, hear, and feel astonishingly natural (Witmer & Singer, 1998). In the development of virtual reality (VR) experiences, it is essential to prioritize a high level of presence because it increases user engagement and facilitates prolonged interaction within the virtual environment. A high level of presence can enhance immersion and engagement, thereby enhancing the efficacy of scientific learning in a VR environment. Considering factors such as realism, engagement, and multisensory integration, additional research is necessary to fully comprehend the impact of presence on learning outcomes.

## **Design and Development**

### **Virtual Reality Science Laboratory**

Throughout the design and development phases, the ADDIE (Analysis, Design, Development, and Evaluation) methodology is applied. Using cutting-edge interactive technologies, the virtual reality (VR) laboratory develops highly engaging 3D virtual worlds for scientific study. Under the supervision of an instructor, students are able to navigate a fully immersive virtual laboratory using motion-sensing VR headsets and portable controllers. Students can investigate in-depth information about pathological elements such as cancer cells, germs, and bacteria via interactive 3D models and informative instructional videos. Consequently, students have more control over their academic journey and can tailor their education to their specific requirements and interests.

### **Hardware**

Individuals can entirely immerse themselves in computer-generated virtual reality environments using various sensing devices, allowing them to experience and feel as if they are physically present in that location. Examples of such virtual environments include airplane cockpits and operating rooms. We increased participant engagement using the HTC Vive, a virtual reality headgear manufactured in the United States by HTC Corporation. With a field of view of 100 degrees and a resolution of 1,080 by 1,200 pixels per eye, the HTC Vive provides users with a high-quality visual experience. It also has a refresh rate of 90 Hz. The HTC Vive's built-in wireless adapter allows users to explore virtual environments without being physically tethered to a computer. To further facilitate interaction within the virtual world, we used a set of HTC controllers with two Vive trackers affixed to the feet and one Vive tracker placed on the torso (see Figure 2). Two lighthouse cameras continuously surveyed the 3x3 meter playing area, allowing precise tracking and movement within the virtual environment.



Figure 2. HTC headset and hand controller

Taken from: HTC VIVE (n.d.). Gadgets to Use. Retrieved June 17, 2023, from <https://gadgetstouse.com/blog/2017/08/23/htc-vive-price-cut-india/>

### **Virtual Reality Science Laboratory Development Platform**

The Virtual Reality component of the Virtual Medical System was created using the Unity platform. Creating a digital representation of the healthcare system was the initial step. Utilizing Blender and Photoshop, a detailed 3D model and texture were created for the virtual medical environment. This procedure required considerable time and effort. After creating the 3D model in Blender, it was imported into Unity and scaled accordingly. The roaming module functionality was implemented by encoding the required functions based on the predetermined design to facilitate user movement within the virtual laboratory scene. Individuals can immerse themselves in a computer-generated virtual reality environment using various sensing devices, providing an immediate sensation of presence and realistic experiences, such as being in the cockpit of an aeroplane or an operating site.

We employed the HTC Vive, a sophisticated virtual reality headset developed by HTC Corporation in the United States, to increase participant engagement. The HTC Vive features a 100-degree field of view and a display resolution of 1,080 by 1,200 pixels per eye. In addition, it has a refresh rate of 90 hertz, which ensures fluid and immersive visuals. The HTC Vive's wireless adapter enables users to freely investigate virtual worlds without requiring physical connections to a computer. To further facilitate user interaction within the virtual environment, we used a set of HTC controllers with two Vive trackers affixed to the feet and one Vive tracker placed on the torso (refer to Figure 2). Two lighthouse cameras continuously scanned a 3x3 meter area to accurately monitor user movements and interactions within the virtual environment.

### **Virtual Reality Science Laboratory**

In the Virtual Reality Science Laboratory, there are six distinct sections, each featuring labeled 3D objects, movies, and infographics. One of these sections is dedicated to the study of animal, plant, and fungal cells, allowing students to explore their structures and understand the importance of precise labeling in a laboratory setting.

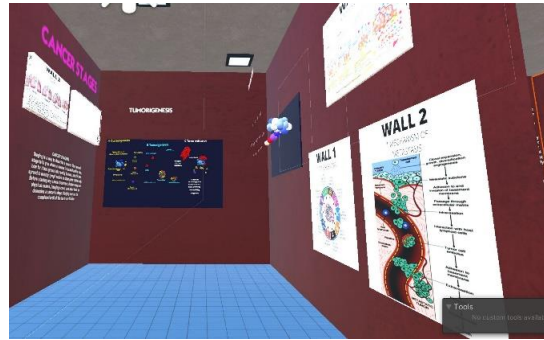


Figure 3. General view of VR science Lab

In the Virtual Reality Science Laboratory, viewers have the opportunity to observe 3D objects, such as Amoeba and Chlamydomonas, with their corresponding descriptions. This interactive experience enhances the understanding of the bacterial structures and their characteristics.

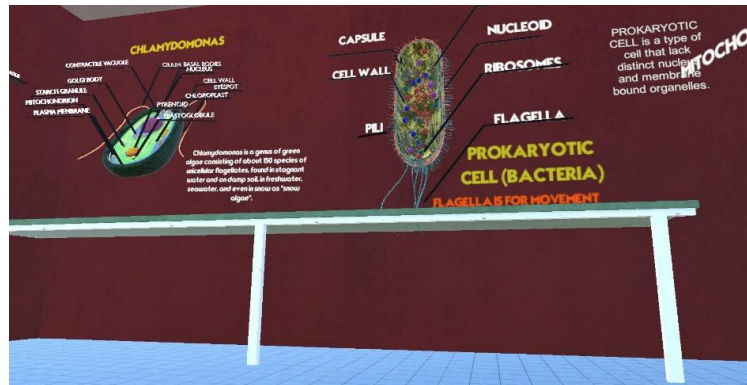


Figure 4. Cell and bacteria section

In the Virtual Reality Science Laboratory, the second area is dedicated to the exploration of cancer, tumors, and inflammatory diseases. Within this section, there are various three-dimensional objects, a movie, and interactive discussions that provide insights into inflammation, tumors, and the different stages of cancer.

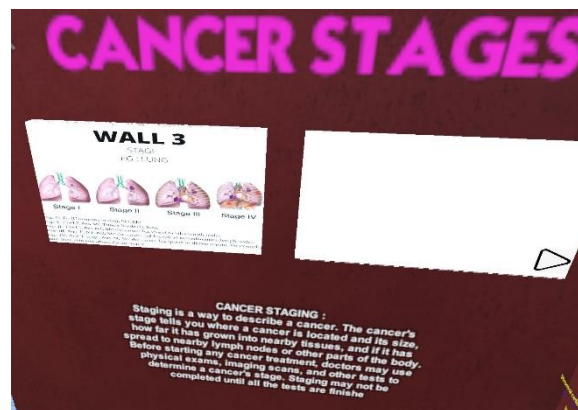


Figure 5. Cancer and inflammationsSection

The VR Science Laboratory features a Human and Skeleton wall where every part of the human skeleton is categorized and labeled. This setup aims to enhance visitors' comprehension of human anatomy by providing them with a comprehensive overview of each component of the skeletal system.

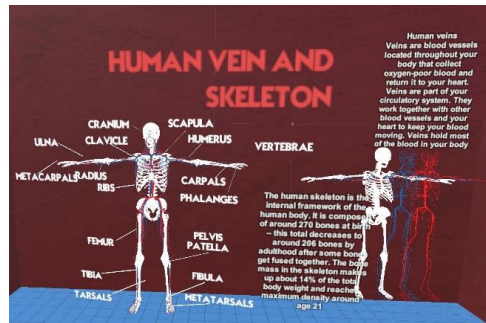


Figure 6. Human vein and skeleton section

In the next section, the VR Science Laboratory showcases a three-dimensional infographic wall that visually presents the progression of tumors, highlighting their significance within the study of cells. This interactive display aims to provide a comprehensive understanding of tumor development and its relevance in scientific research.

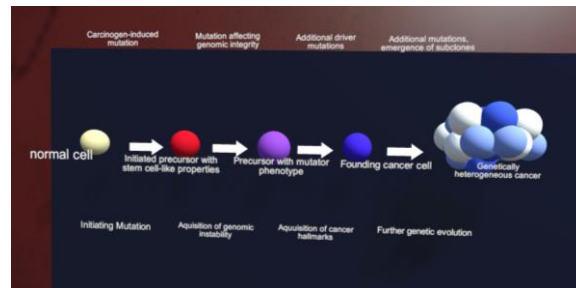


Figure 7. Infographic of tumor genesis

Within this section, users are granted unrestricted exploration, allowing them to navigate freely while accessing informative movies that provide a comprehensive overview of the activities within a pathology lab. Additionally, users have the opportunity to examine virtual microscope slides and interact with 3D models of various laboratory equipment, enhancing their understanding and engagement with the subject matter.



Figure 8. Pathology section



## Methodology

### Research Approach

A descriptive quantitative methodology is used to address the study's research subjects. Students are asked to voluntarily participate in the study using a Google form, a pre-posttest, and open-ended questions as research tools.

### Sample size and population

In this study, we assess participants' proficiency with the VR scientific lab and their presence experience about application when studying sciences. Two separate groups of 37 science students were given a set of questions as part of the study. Twenty kids will be in Group 1, studying Science through 2D movies, and 17 students will be in Group 2, studying Science using a Virtual Reality Science Lab. Both groups will get a set of questions following each session.

### Instrument

An online questionnaire was utilized as the instrument to gather data for this study because it is a quick and easy process. There are two sections to the questionnaire: Part A and Part B. The information about respondents' backgrounds, including name, student number, and course, is gathered in Part A of the survey. In Part B of the survey, participants are asked to score their replies on a Likert scale that spans from strongly disagree to strongly agree in response to six questions (three for each group) concerning their presences experiences while learning in a virtual reality science lab and 2D video. The layout of the questionnaire is shown in Table 1.

Table 1: Students' Feedback- Questionnaire Part B (Likert Scale)

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#### Questions

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##### Group 1 (Video)

1. The "Cell Structure and Function" video seems to help me to visualize the cell itself better
2. My experience learning with "Cell Structure and Function" video similar as learning in the actual classroom
3. The "Cell Structure and Function" video attracts my attention for learning about topics

##### Group 2 (Virtual Reality)

1. The virtual science laboratory seems real to me
  2. The virtual science laboratory gave me the feeling of being there myself
  3. My experience in the virtual science laboratory seemed as though I was there in the real world
- 

## Data Analysis and Findings

### Results

There are 3 outliers for this data collection. Therefore, the total collected is 37. Group 1 is 20, and group 2 is 17.

$H_0$ : There is no significant Different between Group 1(Video) and Group 2(VR) in the median mark score.

A non-parametric Mann-Whitney U test was performed to compare the mark scores between Group 1 (Video) and Group 2 (VR) in a data collection containing 37 observations, with 20 in Group 1 and 17 in Group 2. Since the data was not normally distributed, this test was chosen.

The results of the Mann-Whitney U test indicate that there is a statistically significant difference in the mark score distributions between Group 1 and Group 2. The test statistics show a U-value of 238.5, a z-value of 2.141, and a p-value of 0.036.

Based on the p-value being below the common significance level of 0.05, the null hypothesis, which states that there is no significant difference in the median mark scores between the two groups, is rejected.

Further analysis reveals that the median mark score in Group 2 (VR) is significantly higher (93.3) than in Group 1 (Video) (83.4).

In summary, the statistical analysis using the Mann-Whitney U test suggests that there is a significant difference in the median mark scores between Group 1 and Group 2, indicating that Group 2 (VR) has a higher median mark score compared to Group 1 (Video).

Table 2: Hypothesis test summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Mark is the same across categories of Group.	Independent-Samples Mann-Whitney U Test	0.036 <sup>a</sup>	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is 0.050.  
a. Exact significance is displayed for this test.

Table 3: Independent-samples Mann-Whitney U Test summary

Total N	37
Mann-Whitney U	238.500
Wilcoxon W	391.500
Test Statistic	238.500
Standard Error	31.997
Standardized Test Statistic	2.141
Asymptotic Sig.(2-sided test)	0.032
Exact Sig.(2-sided test)	0.036

Table 4 :Distributions of the two group Independent-Samples Mann-Whitney U Test

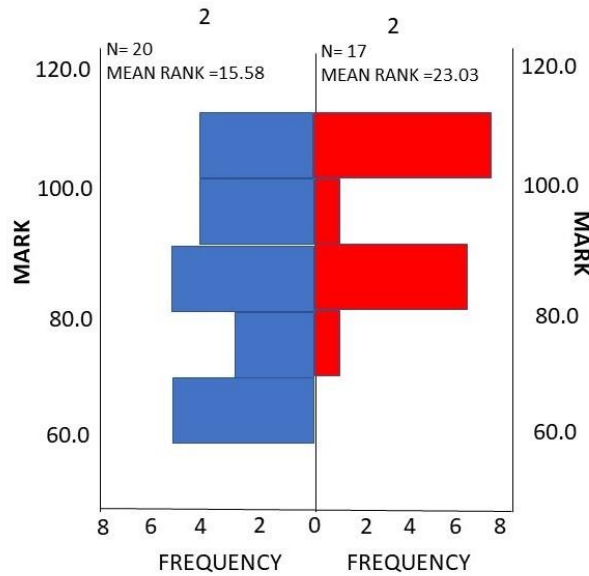


Table 5: The Mean, Std. Deviation and Median Report

Report				
Mark				
	Std.			
Group	Mean	N	Deviation	Median
1	83.000	20	13.4060	83.350
2	92.165	17	8.5712	93.300
Total	87.211	37	12.2042	86.700

## Discussion

The study results indicate that the group taught science using 2D film demonstrated lower levels of presence than the group taught using virtual reality. This outcome is consistent with the immersion principle of multimedia learning, which suggests that immersive experiences foster increased engagement and presence. Makransky & Mayer (2022b) also supports this idea, stating that increased immersion in learning environments results in greater levels of presence. These findings support previous research demonstrating that less immersive mediums like video provide less virtual presence than high-end VR systems (Riva et al., 2003).

This study's primary objective was to comprehensively investigate the impact of the immersion principle on multimedia learning and to comprehend how virtual reality influences a learner's sense of presence when engaging with science. Presence is vital in virtual reality experiences, as it profoundly influences user engagement, behavior, and emotions. When users feel physically present in the virtual environment, they become more engaged with the content. Numerous studies have demonstrated that students in virtual reality

environments retain information better and perform better on related tasks. The concept of presence in virtual reality has numerous practical applications, ranging from therapeutic interventions to medical training and simulations. Virtual reality enables users to acquire and practice skills in a safe and controlled environment by fostering a sense of presence.

## Conclusion

This research aimed to determine the efficacy of virtual reality (VR) applications incorporating the immersion principle in multimedia learning. The study compared the level of presence of two groups of students during scientific education, one using virtual reality and the other using conventional methods. The results revealed a significant difference between the two groups' levels of presence, with the VR group exhibiting higher levels of presence and performing better overall. These findings have significant implications for educators and developers, demonstrating the potential of virtual reality (VR) tools to improve scientific learning experiences.

It is recommended that future research investigate additional variables, such as cognitive load, in conjunction with VR learning aids. This will provide a deeper comprehension of the impact of virtual reality on learning outcomes and guide the development of effective VR interventions.

Virtual reality is not a permanent solution but a highly effective instructional instrument, especially for specialized learning applications. Its use in medical science, particularly in pathology education, has been thoroughly investigated. Virtual reality's future depends on its continuous incorporation into educational curricula and technological advancements that enable shared simulations of therapeutic encounters. This will enable the extensive and location-independent delivery of high-quality interprofessional education, thereby altering the educational landscape of the future.

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## Gamification Using Labyrinths and Mazes to Learn Biomolecule's Nomenclature of Biochemistry in Chemistry Degree

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**Abstract:** Gamification is a very useful technique, that has been fully increasing in the last years. During the CoVid19 pandemic, our innovation teaching group sent to our students several games, that were used by them for self-studying. Considering that many numerical problems can be proposed in Biochemistry, rather than numerical games (sudoku, adding and subtracting number games, ...) word games were preferred to learn biomolecule nomenclature. Among these word games, we adapted to Biochemistry: connecting dots, labyrinths, mazes, matching two sets, amidakuji, logic games, crossword puzzles, word search puzzles, knight's tour games or anagrams. In this work, we present several games related to labyrinths and mazes. Connecting dot games were adapted to Biochemistry by using intermediate metabolite of a pathway instead of numbers to develop a picture when connecting the dots. Anyway, as pathways don't contain a big number of metabolites, no difficult pictures can be used. Thus, a labyrinth with questions and answers and letters connecting questions with answers can be better used. Correct answers can develop the letters of a biomolecule's name. Other kind of labyrinth can be those where the letters can be taken from the shortest route. Labyrinths can also be used to develop a word following the route in labyrinths and taking letters to get the word, as an anagram. Several examples are shown hereby, adapted for Biochemistry students of Chemistry degree.

**Keywords:** Games, Labyrinth, Maze, Biochemistry

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## Introduction

Game-based learning is a term that is difficult to define, although it is often described as learning that involves game boards, cards, or dice, as well as video games [Stojanovska and Velevska, 2018]. According to Prensky [Prensky, 2000], it is crucial that students become fully engaged in the game process. To achieve this, games must contain six key elements for them to be effective: (1) rules of the game; (2) goals and objectives; (3) results and feedback; (4) conflict, competition, challenge, and opposition; (5) interaction; and (6) representation of a story or performance [Huang and Soman, 2013]. In fact, gamification is a popular method, that is increasingly being used to help students to acquire more knowledge and skills [Kim, 2013]. Traditional teaching methods in science, technology, engineering, and mathematics (STEM) often involve passive learning, which can lead to boredom and a lack of interaction on some students. The Moodle environment is highly suitable for gamification on self-learning tool, as it allows teachers to offer a wide range of games to students and analyzes which ones they prefer and how frequently they are used. This possibility of Moodle allows teachers to observe the interests of each student and encourages their personal fulfillment, just as is sought in the Montessori method [Palmarola, 2017]. According to this method, the teacher must promote students' interests by adapting the material to suit everybody individually. However, while some H5P activities can show if the student has been frequently connected, not all the games can be directly evaluated by Moodle.

In Biochemistry, gamification is not generally used since it is a more suitable methodology for non-scientific subjects. Learning based on solving numerical problems or medical cases is more commonly used. However, the nomenclature found in textbook glossaries [Stryer et al., 2015; Nelson and Cox, 2018] is complex and difficult to remember. For this reason, our consolidated teaching innovation group (GINDOC-UB/180) thought that gamification could be applied to self-learning the nomenclature and structure of biomolecules. After the pandemic we prepared several games based on four main groups: (a) words lacking a syllable or a group of letters [Centelles et al., 2021] [Centelles et al., 2022a] [Centelles et al., 2022b], (b) anagrams and labyrinths, (c) translation of codes [Centelles et al. 2022c], and (d) dominoes and other games to chain words [Centelles et al. 2022d] [Moreno and Centelles, 2021]. The aim of this work is to classify and apply the games that use anagrams and labyrinths (group b) to help Biochemistry students to self-learn the nomenclature of biomolecules.

Labyrinths are structures with one or several paths that deceive the visitor and make it difficult to find the center and the exit. In Greek mythology, labyrinths were used to hide something or someone inside them, and the labyrinth of Crete, for example, hid the Minotaur. Theseus was able to defeat the Minotaur and to escape the labyrinth because Ariadne showed him how to find his way back by unwinding a thread as he entered the labyrinth. In the Middle Age, labyrinths were Christianized, and the word "Ecclesia" was written in the center, or a cross was drawn, and their function was to protect this center. Only people initiated in the faith could access the labyrinth to follow the path to salvation. According to the path, the labyrinths are classified as unicursal and multicursal [Rivera-Dorado, 1995], where the unicursal labyrinths are those that have a single and complex path (labyrinth), while the multicursal labyrinths are composed of several paths (mazes). While the unicursal paths



follow a route from the entry point to the center of the labyrinth, and from there to the exit point, without the need to make decisions; multicursal labyrinths have dead-ends and sections not connected to the perimeter. A well-known unicursal labyrinth is the labyrinth of Chartres Cathedral, 16 m in diameter and 11 concentric circles, which traces a path of 264 m from the outside to the center of the labyrinth. This road was called the “Jerusalem Road” and had to be traveled on one's knees reciting the miserere to obtain an indulgence similar to that of pilgrimage to the Holy Land. On the other hand, the multicursal labyrinths are those that were designed in the romantic gardens at the beginning of the 19th century, such as the labyrinth in the Horta labyrinth park (Barcelona). The park is dedicated to love and its aspects, with allusions to Narcissus, Echo, the kidnapping of Europe, ..., and of course, Ariadne's thread.

In the field of education, labyrinths can be used as a tool to facilitate learning and promote problem-solving skills. They can be designed in different ways, including as mazes with dead-ends or as unicursal paths leading to a point. By navigating through these labyrinths, students can improve their cognitive abilities and enhance their understanding of complex concepts. Anagrams are another tool that can be used in gamification to facilitate learning. Anagrams are words or phrases formed by rearranging the letters of another word or phrase. They can be used to help students to learn vocabulary, spelling, and grammar. By rearranging letters and forming new words, students can develop critical thinking and problem-solving skills.

## Method

Biochemistry glossaries enable the identification of the most frequent biomolecules [Stryer et al., 2015; Nelson and Cox, 2018]. The words in the glossaries were classified into six groups: (1) carbohydrates; (2) lipids; (3) amino acids and proteins; (4) nitrogenous bases, nucleosides, and nucleotides; (5) intermediates of metabolic pathways; (6) cell components and other related words. Once the most important words that students should know were identified, we analyzed possible games within the “anagrams and labyrinths” section, that could be used as pastimes to identify these words. We decided to use anagrams or alphagrams inside the labyrinth, to make the game more challenging to solve and more enjoyable for our students.

### Anagrams or alphagrams

There are many anagram generators available on the Internet [Anagram generator], which makes it easy to prepare this type of games. However, it is also easy for students to solve these anagrams if they use them. Alphagrams, which involve sorting the letters in alphabetical order, are easier to prepare, if possible, than anagrams. However, for the players, anagrams or alphagrams are equally challenging to solve. If the anagrams make sense, they can provide an added value that helps players remember the new word more easily by simply recalling the anagram.

### **Unicursal labyrinths or labyrinths**

For Catalan speakers, labyrinths are divided in two groups: unicursal or multicursal. Unicursal labyrinths are those that show only one road, that goes from origin to destiny, and although they are easy to solve, they could be long lines with several changes of direction, and this makes difficult to see the solution at first sight. Multicursal labyrinths or mazes contain several roads, and their aim is that to obtain the shorter way that goes from origin to destiny. In labyrinth (unicursal labyrinths), there is only one road that leads from origin to destiny.

### **Multicursal labyrinths or mazes**

Multicursal labyrinths or mazes are those that show several roads, dead-end zones, and the player should find the shorter way from entrance to exit. A possibility to play a game with a maze consists in taking the letters found in the shortest road. The collected letters can form a word directly, or from them an anagram can be obtained that reveals the asked word. Another possibility consists in a maze containing labels connected with a letter, or questions and answers also connected with a letter. When answering the questions correctly, an anagram can be formed or a word can be obtained directly, just like in the labyrinths of letters found on the road.

### **Adapted amidakuji**

We adapted the Japanese Amida lottery to a unicursal labyrinth, to connect two sets containing the same numbers of elements. After connecting the road, the second set of elements contained a question in order that the student could answer a test of true-false answer. This game could be more enjoyable than a simple test.

## **Results**

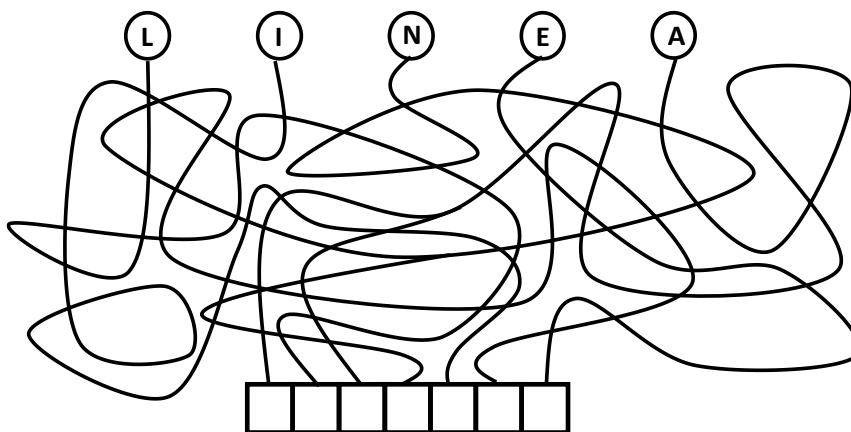
Unicursal labyrinth or labyrinths are roads with only one individual path. These kinds of games can be compared with anagrams or alphagrams, as the letters can be easily seen, although not their positions in the word. Nevertheless, labyrinths are easier to solve than anagrams or alphagrams, as it is easier to find the way than to try different possibilities. If roads are shorter or there are not so many roads, game is easier to solve, whereas complex roads lead to complex solutions. Multicursal labyrinths or mazes, instead, can show several paths. Nevertheless, the player should usually find the shorter way from the beginning to the end.

### **Unicursal labyrinth or labyrinths containing branched paths.**

In the following games, some letters are repeated in the solution word, but they are only written once at the statement. The game can be prepared showing only one word, or several words. When solution contains only one word, the game is easier, whereas it is more difficult when several words must be found.

*Labyrinths with branches paths developing only one word.*

Follow the paths for each letter, that lead to the grid of the word. The name of an amino acid will be developed.

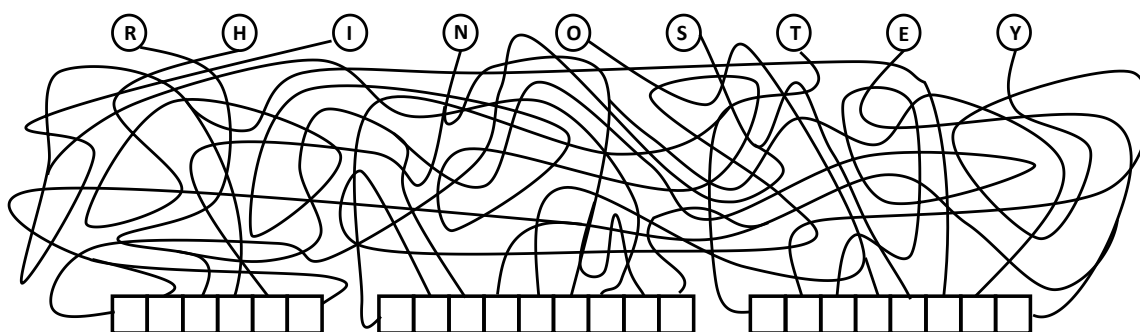


SOLUTION: Alanine

A and N have branched paths, as the letters are repeated twice in the solution word.

*Labyrinths with branched paths developing several words.*

Follow the paths for each letter, that lead to the grids of the words. The name of three amino acids containing hydroxyl groups will be developed.



SOLUTION: Serine, Threonine, Tyrosine

Serine and threonine are aliphatic amino acids, whereas tyrosine is aromatic. Serine contains a primary alcohol, threonine a secondary alcohol, and tyrosine a phenol.

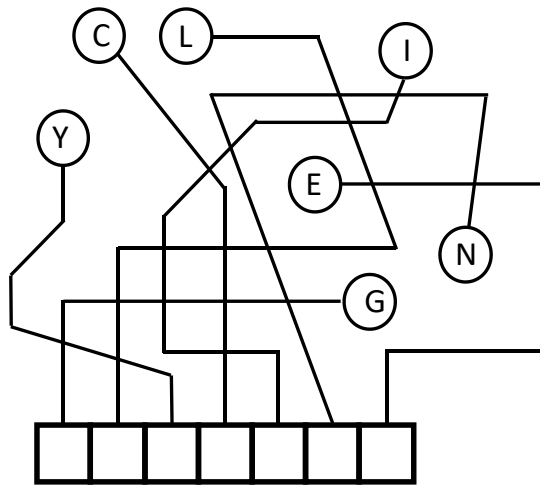
In this game, although H and Y have lineal paths, S, O and T appear twice in the grids, I and R three times, N four times and E five times. Paths for the last letters (S, O, T, I, R, N and E) are branched, in order that they arrive to the boxes of the grid several times.

**Unicursal labyrinth or labyrinths containing lineal paths.**

In the following games, although some letters could be repeated in the solution word, all the letters are written at the statement. The game can be prepared, as the previous one, showing only one word, or several words. When solution contains only one word, the game is easier, whereas it is more difficult when several words must be found.

*Labyrinths with lineal paths developing only one word.*

Follow the paths for each letter, that lead to the grid of the word. The name of an amino acid will be developed.



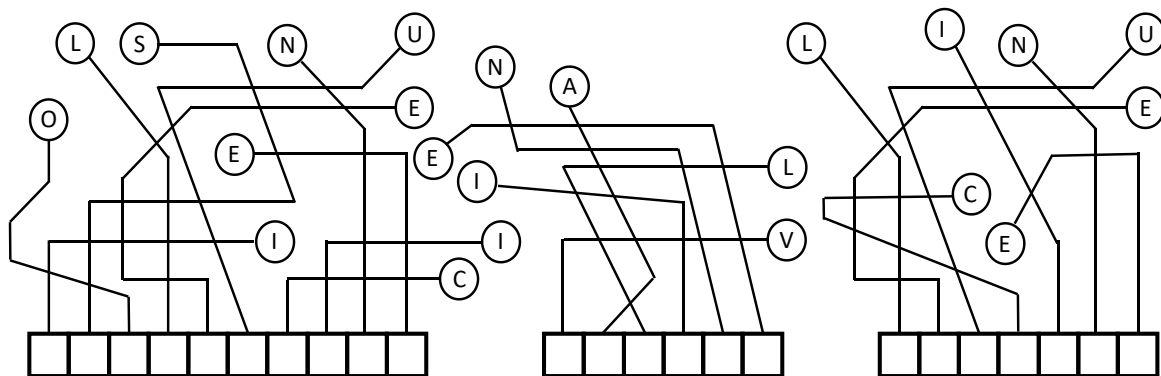
SOLUTION: Glycine

Glycine is the smaller amino acid in proteins. It is the only achiral amino acid in proteins.

The game is easier than a simple anagram or alphagram, since the lines reduce the number of options.

*Labyrinths with lineal paths developing several words.*

Follow the paths for each letter, that lead to the grids of the words. The name of the three branched chain amino acids will be developed.



SOLUTION: Isoleucine, Valine, Leucine

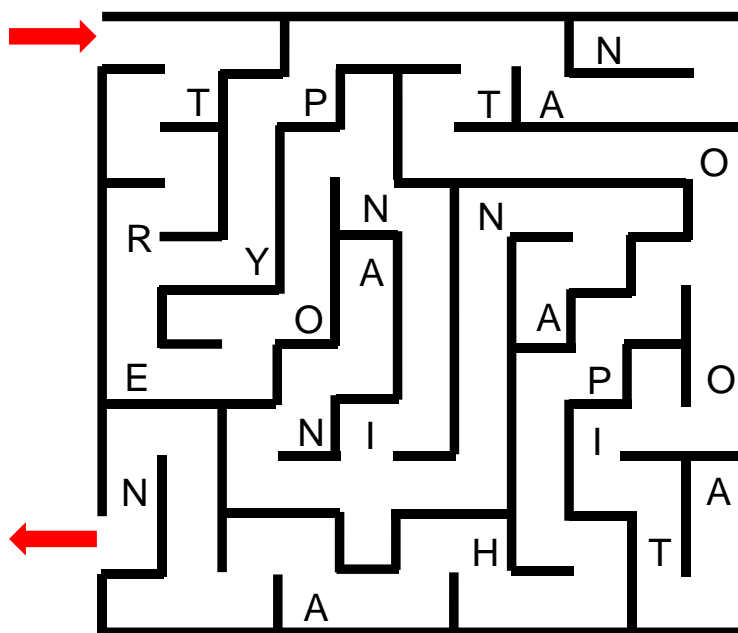
Valine contains 5 carbons, whereas leucine and isoleucine contain 6 carbons. All are branched chain amino acids.

**Multicursal labyrinth or mazes taking letters on the road.**

In the following games, some letters could be taken when walking through the correct path. Those letters could directly form a word, or an anagram and the word should be constructed from the anagram.

*Mazes developing one word by following the road.*

Follow the road through this labyrinth from the entrance (top arrow) to the exit (bottom arrow). Take all the letters found in the shorter path. The hidden word is the name of an aromatic amino acid.

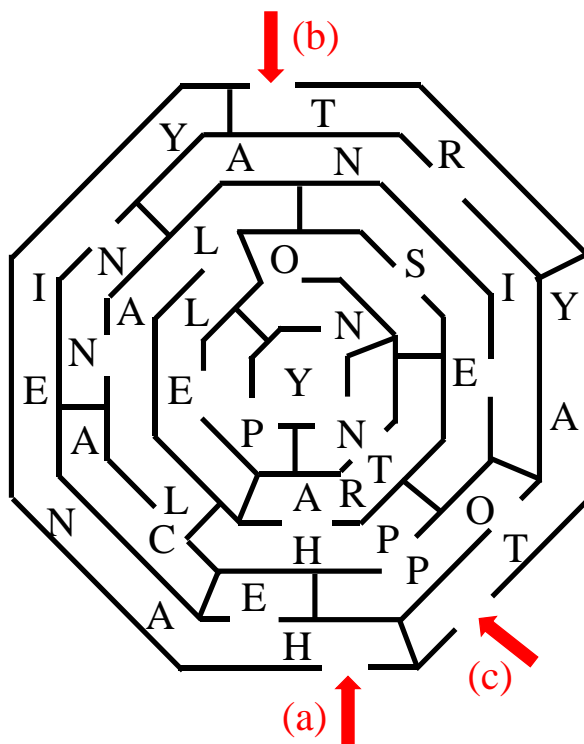


SOLUTION: Tryptophan.

Tryptophan is an aromatic amino acid. Neutral aromatic amino acids from proteins are phenylalanine, tyrosine, and tryptophan. Histidine is also an aromatic amino acid, but although phenylalanine, tyrosine and tryptophan are neutral amino acids, histidine is a basic amino acid.

*Mazes developing anagrams of several words by following the road.*

Follow the roads (a), (b) and (c) from the arrow to the center of the labyrinth. Take all the letters found in the 3 paths. Each road will develop an anagram of an aromatic amino acid. The hidden three words are anagrams of the three names of aromatic amino acids.



SOLUTION: (a) HANEINNALLEPY, Phenylalanine; (b) TRIESONY, Tyrosine; (c) TOPPHARTNY, Tryptophan.

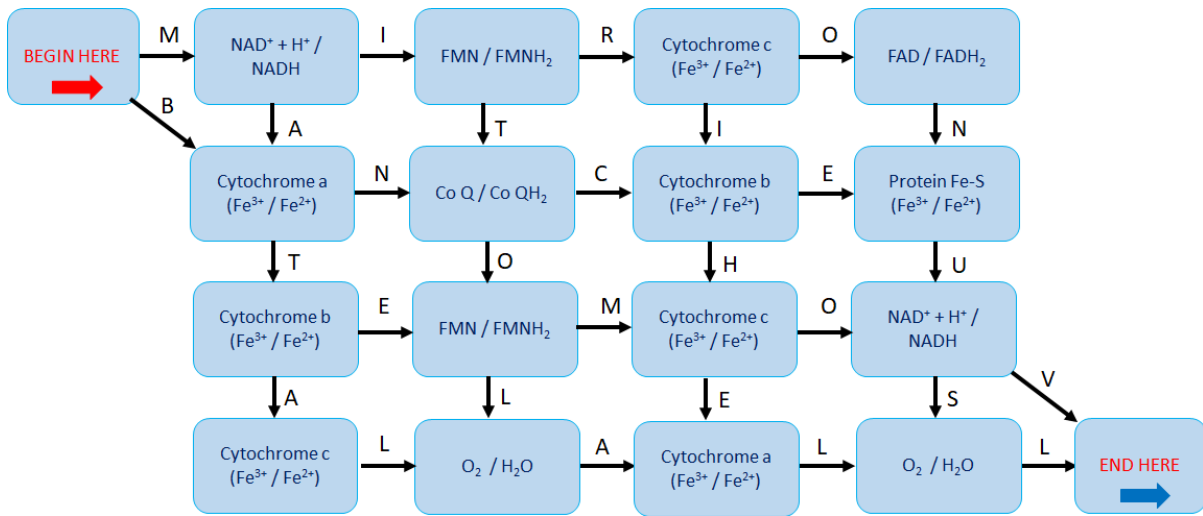
Neutral aromatic amino acids from proteins are phenylalanine, tyrosine, and tryptophan. Histidine is also an aromatic amino acid, but it is a basic amino acid.

**Multicursal labyrinth or mazes with questions and answers.**

The origin of this game in our group came originally from a dot-to-dot game, after labelling the dots as intermediate from a metabolic pathway [Centelles et al., 2022e]. As there were not many dots (not much intermediate in the metabolic pathway), we substituted the dot-to-dot figure with a label game. Different labels were connected by lines displaying a letter, and the students should order the labels following the metabolite intermediate in the order of the Biochemical pathway. Letters obtained in the road with the correct labels form a word (or an anagram or alphagram) related with the metabolic pathway. Later, a complex game was prepared using labels that contained questions and answers, and the letters collected between the questions and their correct answers could also form a word.

*Mazes with labels of intermediates from a Biochemical pathway.*

Beginning from the red arrow, order the intermediate of the electron chain. The letters that bind the labels show the surname of a scientist related with the electron chain metabolism.

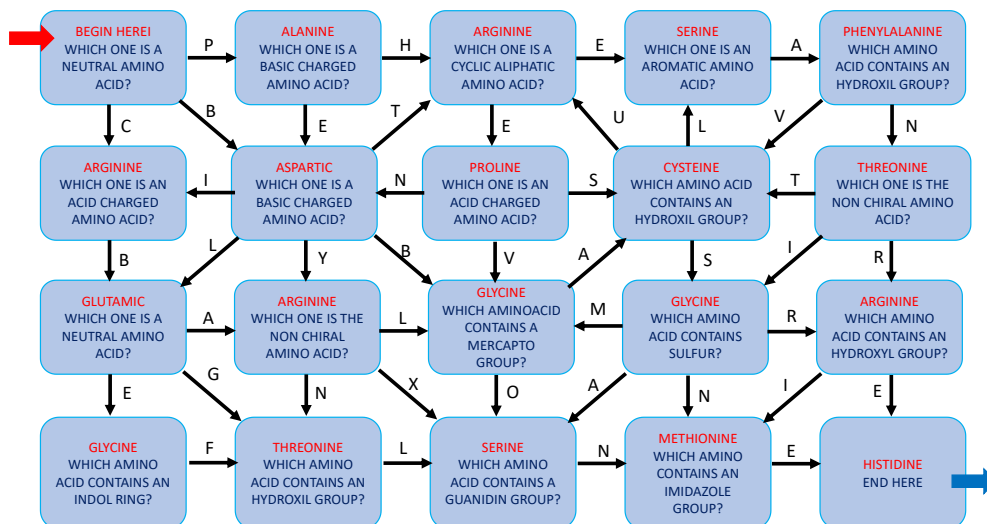


SOLUTION:  $\text{NAD}^+ + \text{H}^+/\text{NADH}$ ,  $\text{FMN}/\text{FMH}_2$ ,  $\text{CoQ}/\text{CoQH}_2$ , Cytochrome b ( $\text{Fe}^{3+}/\text{Fe}^{2+}$ ), Cytochrome c ( $\text{Fe}^{3+}/\text{Fe}^{2+}$ ), Cytochrome a ( $\text{Fe}^{3+}/\text{Fe}^{2+}$ ),  $\text{O}_2/\text{H}_2\text{O}$ . MITCHELL

Peter Mitchell (1920-1992) proposed the chemiosmotic theory, where ATP is formed due to the  $\text{H}^+$  gradient formed by the electron chain metabolism.

*Mazes with questions and answers.*

Beginning from the red arrow, answer the questions (in blue) and decide which is the label that contains the correct answer (in red) from the labels connected. Collect the letters that connect the labels and with all the letters collected form the name of an amino acid.



SOLUTION: Phenylalanine.

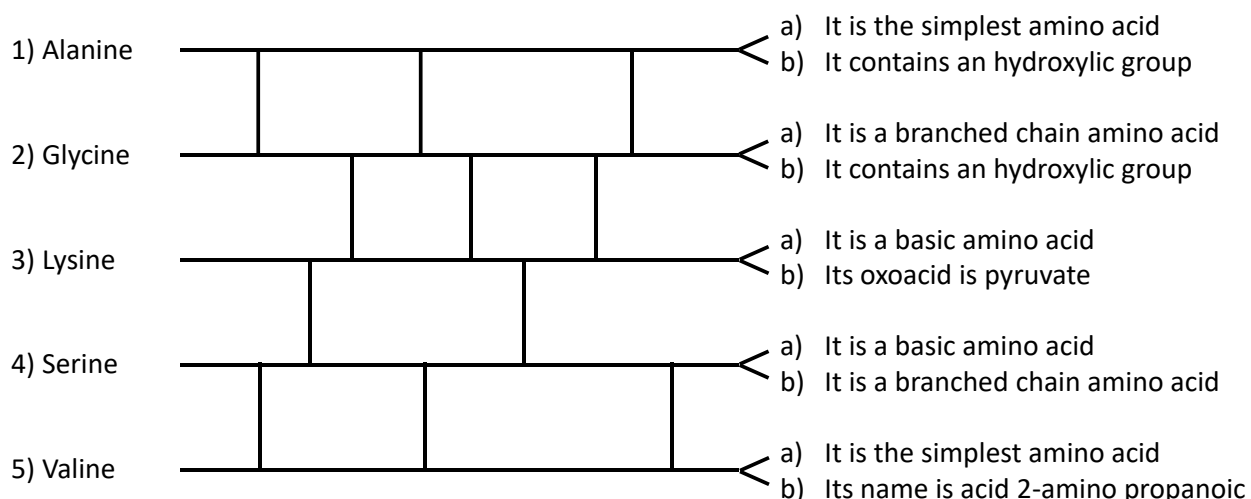
Which one is a neutral amino acid?: alanine / which one is a basic charged amino acid?: arginine / which one is a cyclic aliphatic amino acid?: proline / which one is an acid charged amino acid?: aspartic / which one is a

basic charged amino acid?: arginine / which one is the non-chiral amino acid?: glycine / which amino acid contains a mercapto group?: cysteine / which amino acid contains an hydroxyl group?: serine / which one is an aromatic amino acid?: phenylalanine / which amino acid contains an hydroxyl group?: threonine / which one is the non-chiral amino acid?: glycine / which amino acid contains sulfur?: methionine / which amino acid contains an imidazole group?: histidine.

### Labyrinths adapted from an amidakuji.

This is not really a labyrinth, but it can be considered related since the game starts from one label and ends in another label that matches with the previous one. This puzzle has its origin in the Japanese Amida lottery, and it is also named Ghost Leg in China or Sadaritage (ladder climbing) in Korea. It is based on matching two sets containing the same components, for example, a set of numbers and a set of letters. Amidakuji is based on vertical lines connecting one set to the other, but to relate one number to one letter, several horizontal lines are drawn between two vertical lines. The number of horizontal lines is not important, but at least one line should be between each pair of adjacent vertical lines. To choose which number matches with a letter, the vertical line is followed until a horizontal line is reached, then it continues with the bound adjacent vertical line until the next horizontal line, or the end of the vertical line. In our adaptation, we changed the vertical lines to horizontal lines and added a question at the end, so that students must decide between two possibilities.

Match each amino acid expressed with number with one of the sentences at the end of the line. To play, move along the horizontal line, and when encounter a vertical line, change to the other horizontal line. Continue in this way until you find the end of one horizontal line, and afterwards decide whether the correct answer is a. or b.



SOLUTION: 1. Alanine, b. Its oxoacid is pyruvate; 2. Glycine, a. It is the simplest amino acid; 3. Lysine, a. It is a basic amino acid; 4. Serine, b. It contains an hydroxylic group; 5. Valine, a. It is a branched chain amino acid.



## Discussion

In Internet there are many anagram generators, that could make easier to solve individual anagram games, although unicursal labyrinths can be solved in an easier way than games with only anagrams, just only following the road of each letter. Students can “cheat” with anagram generators [Anagram Generator]. When unicursal labyrinths contain branched paths, solution is more difficult to achieve, as anagram generators cannot be used to get the solution. Most of the students obtain the solutions by going from the letters to the grid, but other solve the game by going from the grid to the letter. Of course, games developing one word are easier than games developing several words, although in some cases it is easier to conclude the words. For example, for the branched chain amino acids, it could be easier to know that these amino acids are valine, leucine, and isoleucine, and afterwards to write them in the 10-grid, 6-grid and 7-grid places. Or to solve the 6-grid valine; and remember that the other two amino acids should be leucine and isoleucine. In all the cases, students will remember the three branched chain amino acids.

However, single unicursal labyrinths are easier to solve, since words contain a relatively low number of letters. Collective unicursal labyrinths are more complex than single ones and prevent anagram generators from being used to solve them. It is also easier to solve unicursal labyrinths when all the repeated letters are repeated also in the game. When some letters are missing, it is not possible to use anagram generators to “cheat”. Regarding to multicursal labyrinths or mazes, the usual shapes are rectangular, but any shape can be used (triangular, round, square, hexagonal, even star shape, and other shapes). Hereby we presented a square maze and a hexagonal maze. Anyway, all the mazes should have an entrance and an exit, although in some cases there are different possibles roads to arrive to the center. In children’s games, they could show a mouse and a cheese and ask to the children to find the road in order that the mouse could find and eat the cheese. In other cases, they can also show a mouse trap and ask to the children to find the road to the cheese but not the mouse trap. In our examples, we show letters for the roads.

In Biochemistry, we first though on a maze with only one road and the easy way was to write several letters inside the maze. The student should collect all the letters that he finds at the road. The game is more difficult if those letters are an anagram, and an added value is obtained when the anagram has a meaning. Nevertheless, if this anagram is an alphagram or is not a word, it could be difficult to find the right road, as the found letters give no clues about how to continue the road. Mazes with several roads can be used to collect families of biomolecules, where the letters obtained in each road generate the name of a biomolecule. In these cases, later it is possible to ask a question about the family of biomolecules obtained. Mazes with questions and answers are those that can give more knowledge to the student. Students should answer a question to solve this maze, and letters are collected from the line that connects the question with the answer. Students have several possible answers, and they must decide, which is the correct one. If they don’t answer correctly, they can get soon into a dead-end road, either because none of the answers is the correct one or because they get into a loop and they cannot get to the exit. Students have then to go back to the question answered with doubts. By the other hand,

the letters collected can also give a clue regarding the word obtained at the end of the maze. The game can be complicated if the word is an anagram or even more if it has no sense before solving.

Mazes with questions and answers evolved from our label games, where labels were intermediate of Biochemistry metabolism, and students should connect those labels by ordering these intermediates. In fact, these games were initially thought as dot-to-dot games. The new game is now more complete, as allows three games in one: to find the way inside the maze, to play answering the questions, to look for a word from the obtained anagram.

Regarding the amidakuji, the road is found following easy rules. In fact, a maze can be also solved by turning always to the right or to the left inside the labyrinths, although the road can be longer as can contain several dead-end roads and returning to original places. Thus, amidakuji can be considered as a special labyrinth, that we included in this paper.

## Conclusion

Anagrams can be easily solved by using anagram generators in Internet. Unicursal labyrinths (or labyrinths) are easier to solve than multicursal labyrinths (or mazes). Adapted amidakuji is a sort of labyrinth, and the last question is more enjoyable than a simple true-false question. The most enjoyable games presented here are the mazes taking letters on the road or the mazes with questions and answers, as they allow several games inside the same game.

## Notes

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## Evaluating Physical Activities of Disabled Young People: Expectations & Challenges

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**Abstract:** After rehabilitation or treatment in hospitals, young people with disabilities often could not engage in a variety of sports due to their physical limitations related to their illness or disability. This gives rise to certain psychological problems, reduced self-esteem and self-confident. The aim of the ReSport project is to enable young people with disabilities to participate equally in sports activities, considering their health condition. Professionals from 8 project partners' countries aim to recognize the problems that are preventing young people with disabilities from participating in sports after rehabilitation. Partners collected local, regional, national and Europe wide best practices and concepts in the field of innovative approaches for motivation of youth with disabilities for sports, and developed a set of exercises to raise their inclusion in sport activities. The project "Re-Sport" encourages social inclusion and equal opportunities in sport, while the parallel topics are to promote voluntary activity in sport and education in and through sports with special focus on skills development. Two main target groups will benefit from the project results: a) youth with disabilities and b) volunteers from sports organisations. The purpose of this study is to learn and evaluate which physical activities youth with disabilities prefer, their expectations, challenges and good practices. This research was conducted with young people with disabilities in Slovenia, Austria, Italy, Croatia, Serbia, Sweden, Greece, and Turkey. Total number of participants were 230. Analysis and graphics were prepared with a special software based on the survey's answers. According to the answers received, investigations, inferences were made and reported.

**Keywords:** Young people, Sport activity, Challenges, Expectations, Social inclusion

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### Introduction

After rehabilitation or treatment in hospitals, young people with disabilities often could not engage in a variety of sports due to their physical limitations related to their illness or disability. This gives rise to certain psychological problems, reduced self-esteem and self-confident. The aim of the project is to enable young people with disabilities to participate equally in sports activities, considering their health condition. Professionals from 8 project partners' countries aim to recognize the problems that are preventing young people

with disabilities from participating in sports after rehabilitation. Partners collected local, regional, national and Europe wide best practices and concepts in the field of innovative approaches for motivation of youth with disabilities for sports, and developed a set of exercises to raise their inclusion in sport activities.

The project "Re-Sport" encourages social inclusion and equal opportunities in sport, while the parallel topics are to promote voluntary activity in sport and education in and through sports with special focus on skills development. Two main target groups will benefit from the project results: a) youth with disabilities and b) volunteers from sports organisations. Creating an on-line learning portal for blended learning will enable execution of two kinds of workshops with the purpose to raise awareness about the importance of sport for health and prevention of injuries during execution of sports exercises for youths with disabilities. Particular attention will be given to the pursuit of outdoor sport activities in nature, using existing outdoor facilities, due to the free accessibility and the importance of being physically active outdoor.

The project "Re-Sport" can be easily replicated, enlarged, and multiplied; in the sense that it can become a model for providing a multicultural partnership, suitable for building better European conditions that promote physical activities for youth with disabilities in different European countries. As one of the first stages of the project, the consortium created a survey to learn and evaluate which physical activities youth with disabilities prefer, their expectations, challenges and good practices.

### **Goals of the ReSport Project**

The goals of the ReSport project listed as below:

- On-line pre-event and post-event survey among young persons with disabilities.
- Guide of Best Practices in the field of motivating young persons with disabilities for doing sports.
- Manual of various types of disabilities and disability management.
- E-learning portal for education and learning material, including developed exercises for youths with disabilities.
- Sport programme Re-Sport with optimal set of outdoor sports and exercises for youths with disabilities after rehabilitation/treatment.
- Workshop training of the innovative programme "Re-Sport Volunteers".
- Workshop training of the innovative programme "Re-Sport Youths".
- Multiplier sport events to demonstrate the developed of the sport programme "Re-Sport" including youth with disabilities.

### **Sport Participation of Youths with Disabilities**

Regular physical activity is a cornerstone of maintaining a healthy lifestyle. Engaging in continuous physical activity triggers health-enhancing processes, promoting muscle training and endurance. These positive effects extend to cardiovascular health and body composition, reducing the risk of cardiovascular diseases. Moreover, for individuals with disabilities, participating in sports and physical activities can significantly improve their

ability to carry out daily living activities, enhancing their overall quality of life (WHO, 2022). Over the past decade, there has been a decline in physical activity levels among people (Swanson, Colwell & Zha0, 2008). Office jobs necessitate employees to spend their day sitting at a desk, and post-work hours, many individuals prefer watching television or engaging in various forms of social media. This lack of physical activity may lead to adverse health consequences, including an increased risk of cardiovascular diseases, obesity, and type 2 diabetes mellitus (Dlugonski, Joyce & Motl, 2012). Individuals with physical disabilities tend to participate in sports at a lower rate compared to those without physical disabilities.

Sports participation offers similar benefits to individuals with physical disabilities as it does to those without such disabilities. Apart from the health-related advantages, like reducing the risk of heart disease, obesity, and type 2 diabetes (Tenenbaum & Eklund, 2007; Ellis et al. 2007), active people with physical disabilities also reported experiencing improved balance and psychosocial benefits, such as enjoyment, social interactions, acceptance of their disability, and enhanced self-confidence (Rimmer et al. 2004).

## Method

The survey is part of the Erasmus+ funded project Re-Sport, that is developed to encourage social inclusion and equal opportunities in sport, and that aims to promote voluntary activity in sports and education. As one of the first stages of the project, a survey was prepared to learn and evaluate which physical activities disabled young people prefer, their expectations, challenges, observations and sharing of best practices.

Intended data:

Disabled youth:

- Current activity status and satisfaction levels,
- Activities they want to participate in,
- Difficulties they face in participating in activities,
- The effect of environmental and individual factors on their activities,
- Expectations for a better physical life.

This research was conducted with young people with disabilities in Slovenia, Austria, Italy, Croatia, Serbia, Sweden, Greece, and Turkey. Each partner received support from relevant organizations and educational institutions in their own country, through which young people with disabilities were reached. The questionnaire, developed by the project consortium, was prepared in English on a Google Forms digital platform, and translated into local language by each partner. With the prepared questionnaire forms, social media announcements, link sharing, young people who met the criteria were asked to fill out the questionnaire.

In addition, the survey links were sent to the managers of the relevant institutions and organizations by e-mail, and they were asked to share with the members, volunteers, and students. The survey was administered online. The answers given to the forms were automatically taken to the servers. With the completion of the survey

process, the answers in all different languages were duplicated and the open-ended answers were coded and duplicated. Analysis and graphics were prepared with a special software based on the survey's answers. According to the answers received, investigations, inferences were made and reported.

## Results

### Demographic Features

It was observed that the gender ratios of the participants showed relative similarity according to the gender ratio of the country and world population distribution. This shows the importance of results in terms of representation. The gender distribution of the 230 disadvantaged young people who filled out the questionnaire was observed as 51% for Male, 48% for Female, and 1% for Not Preferring Answering.

There are significant differences between the age groups of disadvantaged youth who participated in the survey. Accordingly, 57% of the participants were aged 20 and under, 29.25% were in the 21-23 age group, and 13.61% were in the 24-26 age group.

### Life and Activity

Most of the participants stated that their disability is physical with a rate of 44.35%. This research, which included young people with neurological (22.61%), sensory (17.83%) and mental (15.22%) disabilities, respectively, revealed that young people do not isolate themselves from social life despite their disabilities, and they desire to socialize.

The fact that the participants were physically disabled at a high rate also revealed the importance of going into the details of the obstacles to the participation of disabled individuals in physical activities. When the participants were asked whether they wanted to participate in physical or sportive activities, almost all of them showed a positive attitude with a rate of 91.30%. When asked how often they participate in physical activities, it was observed that they were similarly active. The research also revealed that the rate of young people with disabilities participating in any sportive/physical activity at least once a week is as high as 71%. When the participants were asked how often they wanted to be physically active, it was understood that they wanted to be more active than they are now. It was observed that the rate of 71% who were in intense activity on weekdays increased to 86%, while the rate of 26% who did not participate in any sportive / physical activity decreased to 12%. When the participants were asked whether they were satisfied with their current physical activity level, 46.52% Yes, 53.48% No. It has been observed that dissatisfied individuals are in physical disability groups with 45% and in other disability groups with 55%. When the activities preferred by the participants were examined, it was concluded that 40.87% were group activities and 59.13% were individual activities.

Individuals with physical disabilities are in the first place in the preference of both activities, in the second

place; It was observed that those who preferred individual activities were neurologically disabled with 26.03%, and those who preferred group activities were individuals with sensory disabilities with 21.28%. When the sports and physical activities they want to participate in are examined, the first 5 places are: Swimming 23.55%, Athletics 13.04%, Football 10.87%, Cycling 9.06%, Table Tennis 7.97%. Bowling, which was answered in the other option, was preferred at the same level as Handball among the multiple-choice answers.

Considering the most preferred sports and physical activities; It is seen that individual, group and individual activities come to the fore. Participants gave the answer that their access to sports and physical activities is generally satisfactory (58.70%), 29.57% average and 11.74% bad. When the distribution of those who gave the bad answer is examined; It has been observed that there are individuals with 36% Physical, 24% Mental, 20% Sensory, and 20% Neurological disabilities. When asked to evaluate the variety of equipment offered to them, the participants replied that they were satisfied with 49.57%, found the average at a rate of 34.35%, and found it bad at a rate of 16.09%. When the distribution of those who gave the bad answer is examined; It has been observed that there are individuals with Physical disabilities with a rate of 46% and with Mental, Sensory and Neurological disabilities with equal rates of 18%. When the participants were asked how suitable the existing equipment was for their needs, 59.57% answered that it was satisfactory, 27.83% average, and 12.61% answered that it was not suitable for the needs. When the distribution of those who gave the answer "Not Appropriate" was examined; It was observed that there were individuals with 54% Physical, 18% Neurological, 14% Mental and Sensory disabilities.

It was observed that 83.91% of the participants, who were asked how much their parents supported them about their participation in sports and physical activities, answered that their families were supportive. 10.43% answered as average and 5.65% answered that they could not find enough support. When the distribution of those who gave information that their families did not support enough; It has been observed that there are individuals with Physical, Sensory and Neurological disabilities with a rate of 31% and individuals with a Mental disability with a rate of 7%.

Those who are quite satisfied with the support of their families; 50% Physical, They are 22% Neurological, 15% Sensory and 13% Mental disabilities. It was observed that 53.48% of the participants, who were asked whether they were supported by their schools regarding their participation in sports and physical activities, answered that their school was supportive. 28.26% answered as average, and 18.26% answered that they could not find enough support. When the distribution of those who gave information that their schools did not support them enough was examined; It was observed that individuals with Physical, Mental 28%, Neurological 20% and Sensory disabilities gave the answer 7% with a rate of 45%. Those who are very satisfied with the support of their schools; 45% Physical, 26% Neurological, 18% Sensory and 11% Mental disabilities.

It was observed that 66.96% of the participants, who were asked whether they were supported by their peers regarding their participation in sports and physical activities, answered that their peers were supportive. 25.22% answered as average, 7.83% answered that they could not find enough support. When the distribution of those



who gave information that their peers did not support enough; It was observed that 36% responded with Physical, Mental and Neurological 23%, and individuals with sensory disabilities gave the answer 18%. Those who are quite satisfied with the support of their peers; They are individuals with 45% Physical, 21% Neurological, 20% Sensory and 14% Mental disabilities. When asked to evaluate the Physical Factors (Transportation, Facility, Material, etc.) and Social Factors (Family, School, Peer, etc.) of the participants participating in this research, it was observed that their satisfaction levels were high. While this rate is in the first place with "Conformity to Need" with 60% in physical factors, it has been observed that the average satisfaction with physical factors is 56%.

Similarly, it has been concluded that while the support of families stands out with 84% in social factors, the average satisfaction rate in social factors is 68%. On the other hand, while the equipment variety is evaluated as bad in physical factors, the number of individuals who claim that the school's support is low in social factors is relatively higher than the others. The difficulties encountered by the participants while participating in sports activities; Environmental Factors by 42%, Individual Factors by 58%. When the sub-theme is examined, Physical Factors with 36%, Psychological Factors with 24%, Economic Factors with 19%, Disability Status with 15% and Social Factors with 6%. When the environmental and individual factors are analyzed on the basis of countries; It has been observed that the intensity range of environmental factors is 36%. This can be interpreted as the relatively low number of people with disabilities who do sports or participate in physical activity, so the probability of the society to meet people with disabilities engaged in physical activity is low. Among the difficulties of the participants: Transportation, High Costs, Lack of Activity and Pain of Injury take the first place. In addition to the benefits that sportive activities improve health, help prevent musculoskeletal problems that may develop due to inactivity, support independent living, increase self-esteem, reduce stress it is among the benefits that cannot be ignored that it provides socialization and gains new skills. The fact that the participants evaluate these benefits in parallel can be considered as the expected benefit from the survey and research. When the answers are examined; Health benefits ranked first with 32.83%. while the benefits for socialization took the second place with 24.92%, the benefits for mental health were observed as 20.67%, and the acquisition of new skills was observed as 11.55%. Thanks to the competitions, it has been observed that the benefits that can be added to each item above are mentioned at a rate of 10.03%. When the participants were asked whether they were in contact with people with disabilities or special needs like themselves, they answered Yes at a rate of 75.22% and No at a rate of 24.78%. It was observed that those who answered yes were 44% Physical, 21% Neurological, 19% Sensory, and 16% Mental disabled individuals. When the participants were asked whether they participated in activities with disabled individuals, 53.04% answered Yes, 46.96% answered No. It was observed that those who answered yes were 50% Physical, 19% Neurological, 16% Mental, and 15% Sensory disabled individuals. When the participants were asked which activities they participated in together; In the open-ended question, which also includes answers such as outdoor activities such as Traveling and Walking as well as volunteering activities, group trainings, and workshops, among the sports activities Swimming 22.41%, Athletics 12.97%, Table tennis 10.34%, Basketball-Walking-Football 7.76%, Gymnastics 6.90%.

## Conclusions

Today, with many regulations regarding people with disabilities, it has been relatively easier for them to be intertwined with social life compared to the past (Alhassan& Osei, 2022; Al-shummarani, & Nasr, 2022; Alzahrani, & Flynn-Wilson, 2021; Hamadneh & Almogbel 2023; Ostryn, Wolfe, & Wertalik, 2023; Nkomo, Dube, & Marucchi, 2020; Rodrigues, 2023; Utomo, & Syarifah, 2021). Arrangements such as the employment of people with disabilities, the fact that there are better opportunities to use many more places with environmental regulations, and more people with disabilities can go out with better regulations in public transportation vehicles are at a better level compared to the past, but of course they are not sufficient.

Another situation that is getting better in terms of disabled people is the initiatives to increase the participation of disabled people in physical activity. The benefits of physical activity are well known. These benefits apply not only to healthy individuals, but also to individuals with disabilities. Situations such as the sponsorship of many companies so that disabled people can be involved in sports / physical activity, municipalities opening sports clubs and centres with an increasing rate, universities developing and implementing physical activity programs for disabled individuals, the possibility of federations to reach children studying in schools for disabled people increase the participation of disabled people in physical activity.

The importance of physical activity, whose health benefits are so well known, is more important for disabled people than for healthy individuals. For this reason, it should be the duty of many individuals and institutions to ensure that many more disabled people meet and continue with physical activity.

According to the obtained results of the need analysis, we recommend the project steering committee to identify already existing solutions for easily accessible ways to be more physically active and select the best practice from each partner country at IO2 and it looks better to select them from swimming, athletics, football, cycling and table tennis.

In the light of the results obtained in this study, knowing the situations that prevent disabled individuals from participating in physical activity, removing them from obstacles and thus ensuring the participation of more disabled individuals in physical activity should be one of the ultimate goals. According to this research, people with disabilities have fears according to the geography they live in, their disability and especially when environmental factors are considered. In addition, initiatives for the participation of disabled people in collective physical activity should be seen among important goals.

According to the results of this research, municipalities have responsibilities especially in transportation, facilities and materials and urban planning. In addition to the state, private institutions should assume roles in directing disabled people to physical activity with the facilities they will establish, the organizations they will organize and sponsorships.

## Recommendations

As a result of the need analysis, we recommend developing a manual of various types of disabilities and disability management as a unique pedagogical resource to describe various types of disabilities (physical, mental), disability management and injury prevention with instructions about what we must take care according to disability and sport activation. It is clear that it will raise awareness about health concerns and prevention of injuries during the sport exercise performing. It can be an important resource for training workshops for volunteers and sport trainers in the project, as well as for parents, teachers, mentors of disabled young people and wide public awareness of the severity of the disability and knowledge of it in the exercise of physical and sports activities.

It looks also good decision to prepare the set of physical activities and short exercises with guidelines for youths with disabilities, which they could performed after rehabilitation/treatment in hospital. In the light of the need analysis, it is important to educate volunteers about on the proper implementation of selected exercises for young people with disabilities after rehabilitation. We recommend the project partners to check defined good practices to find and select a best motivation strategy to motivate children with special needs to be more physically active.

In addition, media, educational institutions, public institutions should play an active role in raising the awareness of the whole society, especially the families of the disabled, about physical activity for the disabled. To reach the goals and objectives of the project, the project partner organisation should develop an easy navigate, attractive and accessible open education resource such as e-learning portal for education and learning material, including video and guidelines for developed exercises for youths with disabilities. This e-learning portal can be accessible for wider audience such as parents, mentors, teachers, volunteers, youth workers, coaches, and sport trainers.

As an intensive pedagogical resource in the project, it will be important to develop an innovative programme “Re-Sport Volunteers” for volunteers, coaches and trainers from different local sport organisations, associations, and clubs. By this method, they will be trained in performing the outdoor sport program “Re-Sport” for youth with disabilities in Austria, Croatia, Greece, Italy, Serbia, Slovenia, Sweden, and Turkey.

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## Virtual Reality Trainers for Students with Disability: Analysis of Students' Motivation and Motor Performance

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**Abstract:** There are few studies have examined the effective inclusion of Students with Learning Disability (SLD) in teaching and learning, despite the growing policy, educational, and political concern following the progressive trend towards enrolling students with disabilities in regular public schools. As inclusive education is a fundamental human right, educators should find more ways to include the SLDs. A highly motivating learning environment is provided by virtual reality (VR), which combines 3D virtual settings with technologically advanced modes of interaction. VR provides an interactive experience wherein one can become immersed in a computer-generated environment. Nonetheless, there is limited research on using VR for Students with Learning Disability (SLD). Physical Education (PE) has been a compulsory subject in Malaysia to develop skills, knowledge, values, and attitudes to stay healthy. Many studies have tested the use of VR in helping students learn PE. Thus, this study tested VR trainers in teaching PE to the SLDs. A VR application is being created as part of the study, and the users will be asked for their opinions. In this study, the motor performance and motivation of the experimental group were evaluated to measure the effectiveness of the VR trainers in helping the SLD to learn. The results proved that combining immersive technology with motor learning theory made it possible to motivate SLDs and increase their motor performance score in learning PE.

**Keywords:** Disabilities; Motivation; Physical Education; Sport; Virtual Reality

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### Introduction

An important component of the academic course that aims to enhance students' emotional, social, and physical development is Physical Education (PE). A person can learn about the body and how to maintain a healthy and

attractive body and how to keep our bodies free of injuries and illnesses through PE (Ravinder Kumar, 2023). Students with learning disabilities (LD) often face limitations when it comes to participating in physical activity and enjoying it. Coaching these students can be challenging as they require special attention and support to enhance their physical abilities while overcoming academic obstacles (Allam & Martin, 2021) and (Azlina & Rassy, 2022). In order to support students' physical, social, and emotional growth, PE is an essential component of the school curriculum. According to UNESCO, the educational environment should include opportunities for PE appropriate for kids with varied talents and interests, and inclusive education is a fundamental human right (Pocock & Miyahara, 2018).

Students with disabilities or SWD continue to be excluded in both conventional classroom settings and when the educational system is disrupted, for example during the COVID-19 epidemic, as the current research by Mullen & Hunt (2022). Teachers must be a key component of achieving the goals of the Malaysian National Education Philosophy by ensuring that SWD have the same access to education as other students (Noraini Abdullah et al., 2016). Physical activity is essential for a person's well-being and for preventing health problems, according to the World Health Organization (WHO) (Glance, 2020). School-based PE may provide essential opportunity for SWD to acquire the information required to promote a healthy lifestyle (Bertills et al., 2019). However, (Hildt, 2021) proved that when compared to healthy persons, In PE, SWD was six times prone to exhibit greater levels of self-efficacy and had a 57 percent greater chance of subsequently having health problems.

Despite the government's support for incorporating disabled students in the classroom, a research by Hss, (2016) found that just 41% of these students reported successful inclusion, while another 20% experiencing moderate success. Most students that require assistance go unnoticed or choose for different educational courses to reduce segregation. It is still unclear whenever the academic programmes were successful in Malaysian classrooms. According to (Wee & Chin, 2020), due to a shortage of teacher training, students' dislike of physical education, a lack of facilities and equipment, and certain schools replacing other topics for PE classes, implementing inclusive programmes is challenging.

One category of disability is a learning disability; by the year 2020, eighty-two percent of Malaysian students with special needs were classified into this category (SLD) (Bahagian Pendidikan Khas (Special Education Division), 2021). Due to the high percentage, this group of children deserves more attention. Physical educators must employ strategies to promote physical activity if they are to instruct students with learning disabilities effectively (Abdi, 2017). The crucial age group for PE is 13 to 17-year-old secondary school students. It's important to be mentally stable as well as physically well. According to studies, this group follows an unhealthy lifestyle and lacks desire for physical activity (Gaintza & Castro, 2020). Lack of educational resources that encourage SLDs to exercise and improve their motor skills may make the issue worse.

The effectiveness of learning experiences for children during traditional PE instruction may be affected by factors like space availability, equipment, and teacher skill (Laar et al., 2021). Fortunately, technology advancements have opened up new possibilities for improving PE teaching and learning (M. A. A. M. Hamizi et

al., 2022). One such emerging technology that shows promise for increasing physical education training is virtual reality (VR) (M. A. A. B. M. Hamizi et al., 2022). Virtual reality (VR) can revolutionise how students learn about movement, sports, and physical activity by imitating real-world surroundings and offering immersive and engaging experiences.

Technology advancements are growing more complex and modern as individuals become more accustomed to using digital gadgets both offline and online (Series & Science, 2021). To experience and interact with VR, specialised equipment is needed, such as VR glasses or a headset (Poetker, 2019). Utilising both VR gear and software, a multisensory experience must be created. Virtual reality (VR) technology brings together a number of different technologies to create multisensory, three-dimensional (3D) environments that allow users to completely immerse themselves in a virtual setting (Poetker, 2019). These tools include a head-mounted device (HMD) with a head-tracking system, headphones for sound or music and noise cancellation headphones, and manipulation/navigation tools.

VR creates new possibilities for inclusive and accessible physical education classes for students with disabilities. By providing virtual environments and interactive experiences, VR provides the potential to provide personalised coaching and adaptive learning opportunities, making PE more approachable and enjoyable for children with disabilities (Fu & Ji, 2023). This study investigated the possibility of VR as a tool for SWD PE training in order to enhance physical learning outcomes and support inclusive education.

## Literature Review

### Physical Education

Primary and secondary schools offer physical education classes that focus on the human body and psychomotor development (Tabuñar Fortunado, 2016). PE programmes can teach students how to live a healthy lifestyle, increase their physical fitness, and combine physical and mental activity (Dan et al., 2021). Direct teaching increases students' self-assurance and capacity to solve issues on their own, in groups, or in bigger groups (WHO, 2019). The encouragement of teamwork, sportsmanship, and physical togetherness as well as the teaching of basic body management techniques should be the goals of PE in schools. The lesson may spark the interest of students in physical education classes, attract in wandering students, encourage movement, and stress the value of exercise and good health (Speciality, 2019).

By taking into consideration students' intellectual, spiritual, emotional, and physical needs, Malaysia's educational system promotes students' overall growth (Wee, 2017). Thus, both primary and secondary schools must include physical education in the curriculum along with academic subjects. The main source of instructional materials for teachers in Malaysia's educational system continues to be textbooks. Pendidikan Jasmani dan Pendidikan Kesehatan (PJK) is the name of the physical education programme used in Malaysian

schools (Mustaffa et al., 2019), and It must cover the following five areas of study: (i) physical ability; (ii) application of physical skill; (iii) fitness for health; (iv) application of fitness capability; and (v) sports.

### **Students with Learning Disability**

The Malaysian Ministry of Health estimates that 10% to 15% of students struggle with a learning disability. Statistics from the Division of Special Education indicates that almost all of SWD across Malaysia struggle with learning disabilities (LD). There are several terms for learning disability used globally, namely intellectual disabilities, learning difficulties (in the UK) or Down syndrome (in the US) (Mokhtar et al., 2022). In 2020, children with LD comprised about 82 percent of SWD. According to Abdullah and Hanafi (2017), the government's Ministry of Women, Family, and Community Affairs (KPWKM) now recognises six different kinds of disabilities as specific impairments: visual, communication, physical, learning difficulties, psychological, and other disabilities (Nurhidayah Abdullah & Hanafi, 2017). When IQ does not correspond to biological age, there is said to be a learning disability. This category also covers conditions involving autism (Autism Spectrum Disorder), Attention Deficit Hyperactivity Disorder (ADHD), and specific cognitive difficulties like dysphagia, dyslexia, and writing difficulty that affect a person's ability to learn (Radzi et al., 2019). LD students usually face learning issues that are complex, linked, and invisible (Adesokan, 2023). When creating appropriate learning resources for LD students, we should consider the distinct personalities of each LD child (Radzi et al., 2019). Motivating SWD with LD to learn may be difficult since they frequently lose interest in what they are learning.

### **Motivation in Physical Education**

Kueh et al. (2019) pointed out that maintaining the health of Malaysian adults relies in large part on motivation for physical activity. Hidrus et al. (2020) and Mokmin, (2020) discovered that PE motivation is crucial for maintaining Malaysian adults' health. Any physical activity requires desire and incentive to get people to participate. The lack of good-quality physical activity in school environments may be the reason for the drop in physical activity among high school students (Kurniawan et al., 2022). Users' motivation for fitness activities may depend on a variety of things. Ennis & Ennis, (2017) found that motivation improved students' capacity to learn physical activity. Ferriz-valero (2023) stated that designing an effective strategy to improve student's motivation is the primary goal for educational systems including PE. Additionally, a great application design for physical activity could boost users' motivation to exercise (Pasco et al., 2017).

Therefore, practitioners should employ useful techniques to facilitate learning particular physical tasks. Fisher et al., (2019) state that there are numerous key components to making sure that children master particular skills. Making sure students obtain the right training they need, which may be divided into three different types: (i) randomly practice, (ii) blocked practice, and (iii) varied practice, is the most significant aspect to think about. Unlike the variable practice, which involves having students repeat similar actions or skills with varied parameters, random practice demands that the students alternate between various tasks that constantly call for



diverse skills. In another research, the students employed random practise to put the teaching strategy suggested by Haji Vosoogh et al., (2022) into practise after viewing the motions of the virtual model. The sensation of enthusiasm to do something, which we will do deliberately and not as a result of other things, is known as motivation. High motivation levels for any action result in more effort and persistence in performing that one thing until it becomes ingrained (Molanorouzi et al., 2015).

Therefore, this study also looked into how well fitness programmes engaged the intended users, primarily students with learning difficulties. To support their learning activities, children who exhibit some challenges in their learning processes involved approaches that are specialized and flexible Omar & Sulaiman, (2018), and technology, also known as assistive technology, can support the educational process. Both educating and motivating students are aided by these materials. Playing is very important for children's cognitive and emotional development, since it promotes reflection and practical thinking (Rocha et al., 2019). This research suggests that all these factors can be developed through an interactive environment.

### **Virtual Reality**

The fast growth of diverse technologies gives opportunity for the advancement of fresh innovations in the field of education (Zeng, 2020) and sports (Félix et al., 2019). VR technology usually comes in three flavors (Poetker, 2019). Firstly, the greatest real world conceivable is fully immersed in for users, including hearing and seeing. The second style is semi-immersive, which combines real items with a sizable projector. This sort of VR is frequently used in instruction and training. Neither in a video game, the last choice is not immersive VR. Due to its potential to offer an exciting learning experience and the fact that users' learning effectiveness can be greatly increased by being immersed in a virtual environment, VR technology has become particularly popular in the field of education (Jiawei & Mokmin, 2023). It is straightforward to record and monitor performance when using VR for practical education of nursing (Shorey & Ng, 2021). Nurses can experience VR training, giving students a legitimate and unique atmosphere to study.

Due to the rise in fitness app popularity, VR technology is now used for health-related apps, PE, and training. According to studies by Guo et al. (2017) and Liu et al. (2017), using an agent to help with exercise activities is helpful. Senior users of a guided virtual Tai Chi training program gave it high ratings (Liang et al., 2018). VR technology can assist in displaying proper and incorrect swimming strokes, preventing injuries (Guo et al., 2017). It has been suggested that a VR simulation can motivate pregnant women to work out frequently to improve the flexibility of their muscles and joints. Practical and theoretical investigations indicate the effectiveness of virtual trainers in improving individual health (Vollrath, 2021).

VR has countless potential applications in PE. Jiao & Qian, (2020) employed VR in their study to teach PE by using the flip learning technique. According to their research, when VR and flip learning combine, students' satisfaction with physical education is considerably higher than in a typical classroom setting. It was demonstrated in Lee's 2020 study that Badminton coaching might make benefits of the technology. According to

the results of Lee et al. (2021) study, VR-based PE instruction could: (i) enhance comprehension; (ii) teach repeated practice; (iii) foster teamwork and mutual support; and (iv) boost motivation. These findings demonstrate that VR might be used to practice or teach PE skills.

In their study on the usefulness of Virtual Reality for Physical Education, Porter et al. (2016) suggested that if the VR system enables the training of significant invariant elements of behavior, underlying skill structures can be taught in VR and applied to the real world. This agreed by Syed-abdul et al. (2019) who believed VR may improve PE lessons, modernize the teaching approach, and enhance the effectiveness of PE instruction. Before deploying fully VR-based PE instruction, developers and teachers should consider a few application-specific difficulties. For students with learning difficulties, PE can be a difficult subject (Mokmin & Rassy, 2022). The students might not be adequately engaged by traditional coaching techniques, which would lower their drive and interest in the subject. VR coaching can offer a more individualized and engaging approach to PE by offering immersive and interactive experiences. This paper aims to analyze the motivation, opinions of SLD toward VR coaching in physical education.

## **Methodology**

### **Study Design**

This mixed-mode study measured students' motivation when learning using VR technology. The respondents were from a special needs school that specialized in teaching students with disabilities. The teacher selected all the respondents from the school using selected inclusive criteria such as: (i) guidelines must be understandable by students; and (ii) no underlying health issues. Despite the fact that the inquiries came in the format of a survey and an interview, the researchers and the teachers assisted in asking them directly one at a time.

### **Research Procedure**

This study is divided into three main phases. In the first phase, the students were given a pre-test to know their motivation level. A group of 20 students with five teachers from the school were invited to the experiment center. They were first given instructions on the experiments and seated in a room. For the experiment to run well, the students were grouped into five students per group and were given the HMD to try on first. They could proceed to the experiment if they had no problem using it. Their motivation was assessed using a Pelletier et al. questionnaire (2013). Table 1 shows the questions from the questionnaire. The experiment ran for an hour and was facilitated by experienced school teachers who were certified to work with SLDs. In the second phase, an interview was conducted to know the students' opinions on learning lessons with virtual trainers. The students' response patterns were collected from observation in the third phase. The ethical committee has cleared this study by the university.

## Research Instrument

For the first phase, a set of questionnaires was given to the student to measure their motivation before and after using the VR trainer. The questionnaire was divided into three parts assessing the students' intrinsic regulation, introjected regulation, and motivated regulation. Table 1 further describes the items included in the questionnaire. These questions have been validated and checked by an expert in the field.

Table 1. The Questionnaire

Types of Motivation	Pre- and Post-Motivation Questions
Intrinsic regulation	For the pleasure it gives me to know more about the sport that I practise. For the pleasure of discovering new training techniques. For the satisfaction I experience while I am perfecting my abilities. For the excitement I feel when I am really involved in the activity. Because I like the feeling of being totally immersed in the activity.
Integrated regulation	Because practising sports reflects the essence of whom I am.
Identified regulation	Because it is important to me to get better at my sport. Because, in my opinion, it is one of the best ways to meet people.
Introjected regulation	Because it is absolutely necessary to do sports if one wants to be in shape. Because I must do sports to feel good about myself.
External regulation	To show others how good I am at my sport. I play sports of my own choice.
Motivated regulation	I have the impression that I am incapable of succeeding in this sport. I can't seem to achieve the goals that I set for myself.

The second phase used a set of interview questions based on the technology acceptance model (TAM) and adapted from Kwak (2014). The interview was divided into four parts: (i) Item 1: perceived ease of use (PEU); (ii) Item 2: perceived usefulness (PU); (iii) behaviour intention (BI); and (iv) attitude (AT).

## Design and Development

### The App Design

The design and development follow the guide from the ADDIE model. For the analysis part, trainers' movement information was obtained from a secondary source. The movement followed the guidance from the special needs school. The app was validated by an instructional technology expert and content expert in PE for students with disabilities. Figures 1 and 2 are screenshots from the app.

**Analysis**

For the analysis at the beginning of the study, we interviewed a group of teachers and students from a special needs school. We assessed the ability of the students to understand 3D objects, use technologies, and follow steps listed in a certain task. The preliminary study showed that SLDs can understand 3D objects and have no issue using technology in learning. However, several students do need guidance from their teachers. Several documents and books were also used to get more information on SLD learning materials. Their module and textbook were used with permission to understand the required PE activity.

**Design**

A storyboard was constructed by following the instructions and movements guided by the textbook. Figure 1 displays the exercise training from the Malaysia textbook.

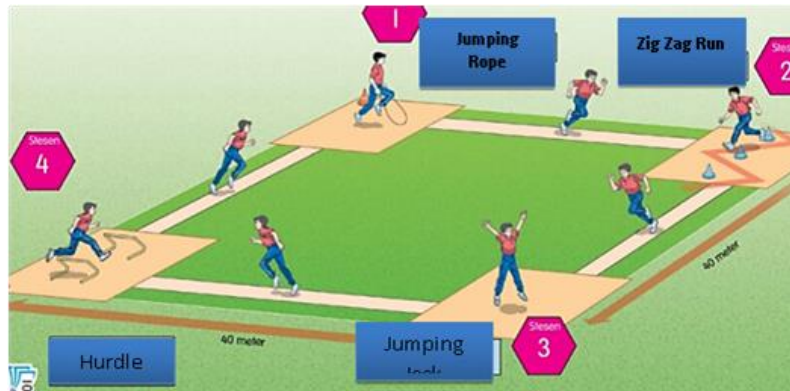


Figure 1. The PE Activities from Textbook

**Development**

The VR trainer was developed using Unity 3D software, a popular open-source software for VR app development. It was tested and deployed to the Steam platform and was then ready to be tested using an HTC Vive HMD.

**Implementation**

Implementation involved setting up the data collection lab with the track for the fitness activities. Figure 2 shows the HMD used in the data collection.

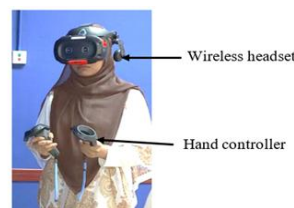


Figure 2. The HMD used for the data collection process

**Evaluation**

The evaluation process was carried out in a lab and is explained further in the methodology section. Figure 3 displays a screenshot from the app.

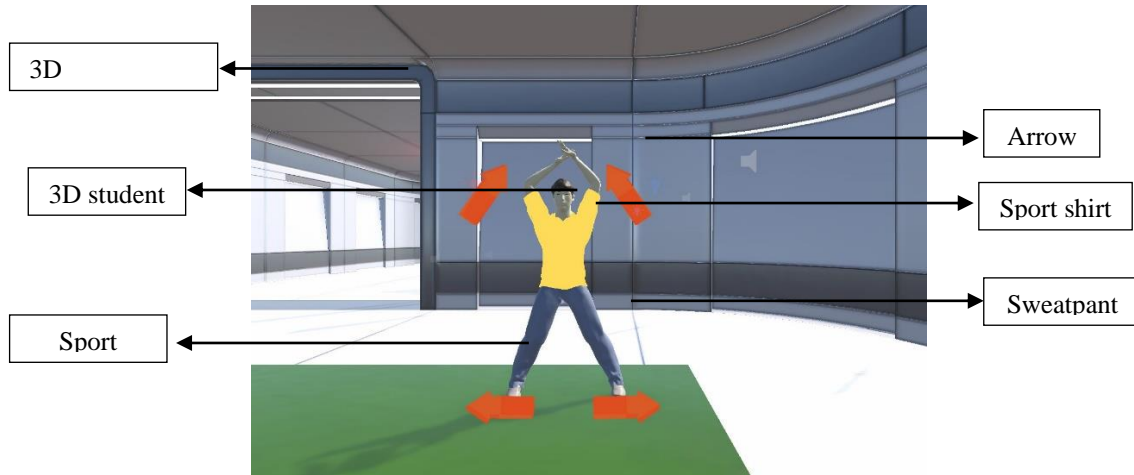


Figure 3. The VR trainer shows the Jumping Jack movement in the app



Figure 4. The VR trainers show the movement in the app

**Results**

**Phase 1: Assessing the SLDs' Motivation**

A total of 20 students with learning disabilities were involved in this study. Eight of the respondents were female and 12 male. The age range was from 16 to 21 years. None of the students had prior experience of using VR. Information on PE results was obtained from their school to know their understanding of PE. Their PE exam results showed very low achievement. Please bear in mind that these students are special needs students and cannot be compared with the normal classroom. They were given training by the virtual trainer that was personalized according to their profile. Table 4 displays the demographic profile of the students.

Table 4. Students' demographic profile

Data*	Gender	Age	Experience	PE exam grade	Trainer
Data 1	Female	21	No	E	Trainer 3
Data 2	Male	17	No	D	Trainer 3
Data 3	Female	18	No	D	Trainer 2
Data 4	Female	18	No	D	Trainer 2
Data 5	Female	17	No	D	Trainer 3
Data 6	Male	17	No	D	Trainer 2
Data 7	Male	17	No	D	Trainer 2
Data 8	Male	18	No	D	Trainer 1
Data 9	Male	17	No	C	Trainer 1
Data 10	Male	16	A little	D	Trainer 1
Data 11	Female	17	No	C	Trainer 4
Data 12	Female	17	No	D	Trainer 4
Data 13	Female	18	No	D	Trainer 1
Data 14	Female	16	No	C	Trainer 4
Data 15	Male	16	No	D	Trainer 3
Data 16	Male	16	No	D	Trainer 3
Data 17	Male	16	No	D	Trainer 3
Data 18	Male	16	No	D	Trainer 3
Data 19	Male	16	A little	D	Trainer 3
Data 20	Male	17	No	D	Trainer 3

A paired sample t-test was used to test the means of the two tests of the same group. A paired sample t-test was performed to compare the pre-test and post-test motivation. There was a significant difference in motivation between pre-test ( $M = 4.18$ ,  $SD = 0.41$ ) and post-test ( $M = 5.69$ ,  $SD = 0.60$ );  $t(19) = -8.34$ ,  $p = 0.00$ . Table 5 shows the paired t-test statistics from SPSS, and Table 6 shows the significant results of the sample test.

Table 5. Paired t-test statistics

		Paired sample statistics			
		Mean	N	Std. deviation	Std. error mean
Pair 1	Pre-test	4.18	20	0.41	0.09
	Post-test	5.69	20	0.60	0.14

Table 6. Paired t-test results

		Paired sample test				t	df	Sig. (2-tailed)
		Paired differences		95% confidence interval of the difference				
	Mean	Std. deviation	Std. error mean	Lower	Upper			
Pair 1 Pre-test – Post-test	-1.52	0.81	0.18	-1.90	-1.14	-8.34	19	0.00

## Phase 2: Interviews to Investigate Opinions

Eight interview questions were asked to help understand the students' opinions on doing the activities using VR. Table 7 displays the interview results. The results show that most of the students informed the researchers that the VR coaches did help them to understand the movements in PE. They also found it to be fun and agreed that it could improve their performance. However, after the learning session, the students still preferred training in the outdoor setting. Table 7 shows the information that was extracted from the interviews.

Table 7. The interview results

Questions	Conclusion
What is your opinion on the VR trainer?	Most commented that it helped them to understand the steps because it showed step-by-step movements
Is the technology easy to use?	It was difficult to use at the beginning, but it became easier after some time
Do you think this VR technology is suitable to use in PE?	All the respondents said it was suitable
Do you like using VR for learning?	All except one student preferred VR to normal class
Why do you think it is good to use in learning?	Most said because it was fun. However, one respondent said he preferred to learn in the field
Do you feel satisfied and motivated?	All felt satisfied and agreed that it could improve their movements

### Item 1: Perceived Ease of Use (PEU)

Question: Is this technology easy to operate and easy to understand?

“Easy to use and can view the demo.”

“Being able to play sports in another world, can see examples.”

“Easy to use and take anywhere, can be used inside and outside of class.”

Question: Do you like this VR technology?

“I like it because it is great like in the game. This is the first time I have used it.”

Question: Based on your answer (do you like this VR technology), please state your opinion.

“Because the graphics are the best. It feels like in a game.”

“Because it feels fun like in a game, like entering another world.”

“Because I feel like I am in another place.”

*Item 2: Perceived Usefulness (PU)*

Question: How do you feel about the virtual trainer?

“He (virtual trainer) helped me by showing an example to do the activity.”

“He is so sporting because he shows how to jump.”

“He was helpful and did not bother me.”

“He bothers me a little, like he is distracting and I cannot focus.”

Question: Can virtual trainers improve your motor performance results?

“It helps because after watching it, I understand how to do it.”

“Yes, at first I was not sure how to jump using virtual reality, but after watching the teacher (virtual trainer) I knew the steps.”

*Item 3: Behavioural Intention (BI)*

Question: Would you recommend the use of Virtual Reality in PE to others?

“Yes, I will recommend others to use VR for PE because it is so great.”

“Yes, everyone should try using VR in PE.”

*Item 4: Attitude (AT)*

Question: Do you feel satisfied after successfully doing the given activity?

“I am so satisfied to be able to do 60 jumps.”

“Very satisfied because this is the first time I used VR and I managed to complete the given number of jumps.”

## Discussion

The motivation of the students is crucial when educators and learning material creators evaluate a suitable design for PE instruction. The results from this study find an increase in motivation for the post-test when the students learn using the VR coaches. The motivational aspect is what keeps the students working on the activity until certain goals are met (M. A. A. M. Hamizi et al., 2022). This idea claims that in order to motivate students, they need to have control over their education and autonomy so that they may finally concentrate on their objectives. It has been demonstrated that giving students some control over particular activities or assistance technology might improve their motor learning. Students must be motivated and persistent in order to complete training in order to maintain exercise and physical fitness during periods of movement restriction when they must primarily stay at home.

The ideal approach for PE in online education at home is to complement the instruction with materials that have



been imaginatively created and tailored to the requirements of the students. However, several more tests and improvements should be added to the subsequent development process to ensure correct and efficient training in PE, which can then be delivered to the target student and help to increase their health and improve their fitness. This study has also shown how observation is useful for PE instruction. Demonstration or observing is one of the most popular teaching strategies for acquiring motor skills observation (D’Innocenzo et al., 2016). The student's ability to learn by observing increased when various skill levels were raised (Mokmin & Ridzuan, 2022). Previous studies such as those by Bashabsheh et al., (2019) and Fu & Ji, (2023) described the effectiveness of VR for students with disabilities. However, in this study, we can see that there was still a mixed response among the students when VR coaching was introduced. The SLDs may have personal preferences regarding the type of coaching they receive. The results from the interviews supported this, where some of the students still preferred in-person coaching or a combination. Added to that, the accessibility of VR coaching is still very low for SLDs in Malaysia and some technical issues can cause frustration for SLDs during learning. This can impact their overall experience when using VR coaching.

## **Conclusion**

The study investigated the best virtual trainer designs from the students' point of view, as well as how students may acquire physical education using virtual trainers. The outcomes proved that with a proper design, VR could function as an additional learning material and increase learning motivation. Although there was a mixed response among the students on the use of a VR coach for PE, most of the students agreed that the VR coach was a fun and great way to learn PE. The results from this study can increase understanding of the process of learning PE using VR and how the technology can help in learning motor skills. The study examines the effectiveness of VR coaching in improving students' motivation, participation, and overall performance in PE. The investigation's findings shed light on the potential of VR coaching as a tool for promoting PE for SLD. However, this study was only limited to a few workout routines. The study also ran for a limited time, and the results can only be applied to specific students.

## **Recommendations**

We encourage researchers to look at how VR-based instructional materials affect students' interest and enjoyment. There should be an increase in the number of exercise treatments and respondents.

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## Exploring Learning Disability Students Experiences in Using AR Technology in Physical Education

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**Abstract:** In this century, Augmented Reality (AR) is a "reality" technology that has begun to be integrated into the school curriculum and subjects. As one of the learning strategies, the goal is to help increase student learning motivation, the effectiveness of learning activities, and much more. Unfortunately, only a few studies incorporate AR into teaching and learning activities for Adaptive Physical Education (APE) disciplines. Many types of disabilities, including learning disabilities (LD), can be found. Just like their peers, children with learning disabilities are intelligent. However, because of an impairment in their physical, mental, behavioral, or sensory abilities, they need adaptive learning activities that are as similar to the surroundings of children with special needs as possible to help them develop their abilities (Sukriadi, 2021). This study will explore how AR technology affects PE learning experiences for students with learning disabilities (SLDs). This study will use a qualitative exploratory case study to collect comprehensive data for each students learning experience using pre-interviews, observations, and in-depth interviews as the research instruments during PE class. The results of this study are expected to provide an overview of future PE subjects where technology has started to be incorporated and can be used as a new learning medium for teachers and students to create new learning experiences. It will also offer research opportunities for researchers and developers to enhance this application further.

**Keywords:** Augmented Reality, Physical Education, Student with Learning Disabilities, Mobile Application, Learning Strategies

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### Introduction

Technology in education has increased significantly over the past decade (Li et al., 2020). Educators can now employ technology to improve the learning experience for students, supported by the development of digital technology and the Internet (Mohalik & Sahoo, 2020). There are many ways that technology can be applied in

education, which can be used as an online learning platform (Abuhassna et al., 2020; Agormedah et al., 2020; Z. Y. Liu et al., 2020; Mokmin & Masood, 2015): learning management systems (Irfan et al., 2020; Putri & Sari, 2020): educational apps (Poláková & Klímová, 2019; Widyaningrum et al., 2020): and Digital textbooks (Cheng, 2020; Mahdy, 2020). Augmented Reality (AR) is one of the technologies that can be implemented as an educational app that is now being applied worldwide in educational technology to enhance help in teaching and learning processes (Mokmin, 2020). It also suggests that there has been ongoing interest in this topic, as evidenced by the growing number of related articles. However, A total of 174 studies used AR technology in the field of education shows the highest use of AR in education is applied to mathematics and statistics, the second is biology, and the third is manufacturing, construction, and engineering education (Ajit et al., 2020; Garzón et al., 2019; Saidin et al., 2015; Sirkaya & Alsancak Sirkaya, 2018). The results also showed that there was a lack of research on the use of AR in physical education.

Physical education is more than just a game or a recreational activity that gives people pleasure and comfort. It is the public face of education and shares the same goals as education. Physical education should be viewed as one of the fundamental components of the educational curriculum. It makes numerous contributions to the overall experience of students in schools, and encouraging students' physical and mental well-being is one of the most important (Harris & Cale, 2022). According to Caspersen et al. (1985), Physical Activity (PA) is any skeletal muscle-driven body movement that requires energy expenditure. Most children learn about the importance of PA in PE classes (Cheung, 2019). Physical activity has a favorable influence on children's physical and mental functions, and it is also significant in terms of risk factors for lifestyle-related diseases that are being discovered at a younger age, such as overweight/obesity and type 2 diabetes (Berman et al., 2012). However, the right kind of physical activity can be challenging for children with disabilities, whereas PA is crucial for their health development (Boman & Bernhardsson, 2019). Úbeda-Colomer et al. (2019) state that people with disabilities are commonly hindered from engaging in physical activities at all levels of society due to their health state and associated challenges such as discomfort, weariness, and a lack of energy. This is one of the challenges faced by people with disabilities in carrying out physical activities.

Individuals with Disabilities Education Act (IDEA) defines "learning disability" (LD) as "a specific disorder in one or more areas of psychological processes involved in understanding and using spoken or written language, resulting in deficits in the ability to listen, think, speak, read, write, spell, or do mathematics," but it excludes learning issues caused by sensory disorders, emotional disturbance, intellectual dissonance, or other conditions (U. Muktamath et al., 2022). Naset (2018) defined learning disability as a group of disorders that affect people's capacity to interpret what they see and hear or connect information from different brain sections. These limitations can manifest in various ways, including specific difficulty with spoken and written language, coordination, self-control, or attention. These challenges can extend to education and impair learning to read, write, and do math. Physical education and health are two related aspects, and they are two sides of one coin (Harris & Cale, 2022). Health is an essential component of physical education and health, which are both ways of achieving high levels of health.

Adapted physical education is a subset of physical education created to provide programs for students with special needs (Abdoellah, 1996). According to Hendrayana (2007), adaptive physical education is an individualized program incorporating physical activity, movement fitness, fundamental movement patterns and skills, swimming skills, dancing, and solo and team sports games developed for people with impairments. According to Putra (2019), adaptive physical education has several purposes:

- To assist students in improving conditions that can be improved.
- To assist students in protecting themselves and any conditions that may affect their condition by participating in certain physical activities.
- Provide children with disabilities the opportunity to learn about and participate in various sports activities.
- To assist students in making social changes and developing self-esteem.

However, sports learning should be tailored to each child's demands and degree of specificity to meet the physical and mental health needs of children with disabilities (Winnick et al., 2017). According to Jalip (2018), various factors inhibit the learning process in adaptive PE classes; Teachers rarely use fun teaching methods; Teachers rarely bring media or learning tools into the classroom; Learning materials that are not tailored to children's abilities, although the learning process of motion for children with disabilities necessitates a special program tailored to their level. In Malaysia, due to ambiguous regulations, a lack of human resources, and inadequate special education facilities, it has been observed that children with disabilities do not fully realize their constitutional right to an education (Ozel et al., 2017). In their research on Special Education in Malaysia, Abdul Nasir and Erman Efendi (2016) noted that these programs face a number of challenges, including a lack of facilities, preparation, resources, and instructional materials. Studies by Riyadi (2017) found that the obstacles faced by children with learning disabilities in conducting physical education activities are; weak thinking power and adaptive behavior, which results in their ability to capture responses that are not well coordinated, requiring a long time to receive teacher explanations. However, in traditional physical education, the instruction does not usually allow students to fully comprehend correct motions due to their viewing angles or teachers' quick demonstrations (Liang et al., 2023). Furthermore, because the teacher cannot provide individual coaching to many students, beginners cannot recognize the faults in their activities (Papastergiou & Gerodimos, 2012).

### **Augmented Reality in Physical Education**

With many uses in many industries, including education, augmented reality (AR) has emerged as a promising technology (Khan et al., 2019). Integrating augmented reality (AR) into physical education classes was relatively new (Mokmin & Rassy, 2022a) It is crucial to remember that technology and teaching methods can advance quickly. Its inclusion in physical education lessons can potentially improve learning opportunities and student engagement (Guerrero et al., 2020).



**Table 1. The use of augmented reality in physical education**

Authors	Purpose	Results
(Liang et al., 2023)	To investigate the incorporation of information technology into physical education and use augmented reality (AR) as an auxiliary tool to examine the impact of this teaching style on the learning motivation, knowledge, and learning behavior of beginning runners.	The study's findings are as follows: First, the experimental group (using AR) outperforms the control group (video) in motor skill learning. The experimental group also has stronger motivations and outperforms the control group in motor skills, and the experimental group has a more favorable attitude towards and acceptance of the instructional materials.
(Y. Liu et al., 2022)	To analyze the impact of instructing using more realistic physical education techniques for developing and acquiring spatial orientation compared to traditional exhibition instruction.	The AR training method is effective, especially for improving student participation in sports and instructing schoolchildren in advances in physical education.
(Chang et al., 2020)	To validate the impacts of different difficulty levels on instructional materials and the effects of learning outcomes, motor skills, and learning motivation with AR-assisted teaching	The findings from the study suggest that AR-assisted learning with the 3D model improved learning and performed well for more challenging motor skill acquisition rather than video learning.
(Guerrero et al., 2020)	To compare the impact of augmented reality training in physical education for developing and acquiring spatial orientation to more traditional training based on the display approach.	It has been proven that the augmented reality teaching approach is effective in teaching high school students, in physical education subjects, particularly in the acquisition of spatially oriented knowledge.

Several articles have examined the use of AR technology in physical education subjects, as seen in the table above. The results show that using augmented reality to teach physical education is helpful, especially for helping students learn spatial concepts (Guerrero et al., 2020); the use of AR technology also increases motor skill learning, motivation, more favorable attitude toward the adoption of the educational materials (Liang et al., 2023); using the AR training method works well too for increasing student engagement and educating students on the latest developments in physical education (Y. Liu et al., 2022); Lastly, it was shown that AR-enhanced learning and performed well when learning more difficult motor skills. According to (Garzón, 2021) research, the future route of AR research in education is to use AR in learning environments populated by students with

special needs. However, Mokmin and Rassy's (2022b) study found that AR technology in adaptive PE is still lacking.

Due to the lack of learning facilities and material instructions for teaching children with disabilities, this research will try to use augmented reality technology as a learning strategy in physical education classes for learning disability students as an assistive tool in learning. The research questions to be answered in this study are:

1. What problems are faced by learning disability students in the traditional PE class?
2. How are the learning experiences of students with learning disabilities when using AR as an assistive learning tool in PE classrooms?
3. What are the results of student's movement abilities before and after using AR in the PE class?

## **Methodology**

This paper uses qualitative case study methods with ten learning disability students in one of vocational senior high schools in Malaysia as participants. The procedure is divided into three stages: before intervention, the intervention, and after intervention. Before the intervention, students will be given an AR module (as a representation of the textbook that they usually use in the classroom when learning) to do a pre-test to try demonstrating the exercise movements in the module based on their understanding of the module. After they do the pre-test, a pre-interview will be conducted to find out the current situation in the traditional PE class according to the student's experiences.

After that, the intervention will be carried out (students will learn PE in the classroom with AR as an assistive tool); while the learning process takes place, observations will be carried out by teachers and researchers. Then after the learning process is done, students will be asked to do a post-test and in-depth interview. The data obtained will then be analyzed using thematic analysis. Meanwhile, the students selected to be participants in this study were required to be enrolled in a physical education class, a learning disability student with no difficulty in movement ability, visual problems, or physical problems, and fluently communicate with the Malay language.

## **Learning Materials**

During this research, students will get the AR exercise applications and AR modules as learning materials in the PE classrooms. The content in the module is adapted from books on physical education for special education, and the exercises chosen have been adapted to the learner's needs and abilities. The picture below is an AR module used as a textbook representation that students usually use in class and as a marker used to trigger 3D objects in the AR application to come out. As explained earlier, this module has been adapted from PE textbooks. Also, the exercises selected have been adapted to the needs and abilities of students.

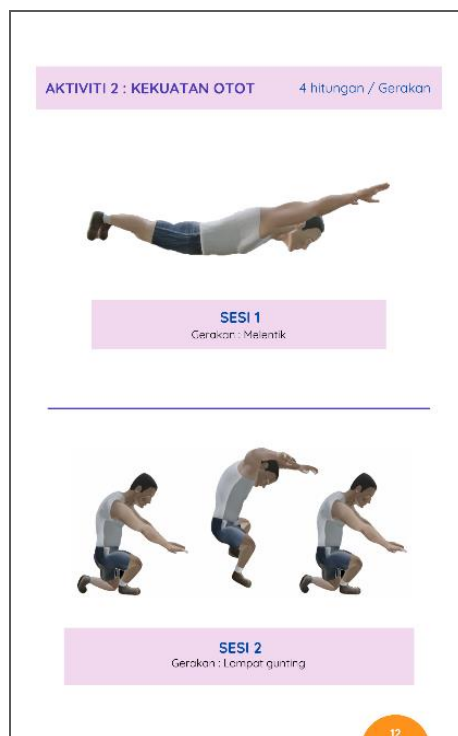


Figure 1. AR module

In this module, there are three chapters, where the first chapter contains balanced food suggestions for students, the second chapter includes suggestions for physical activities that students can do daily, and chapter three contains activity exercises that have been integrated with AR applications. This chapter has three sub bab: flexibility, muscle strength, and muscle endurance. Where in each activity, there are four movement exercises.

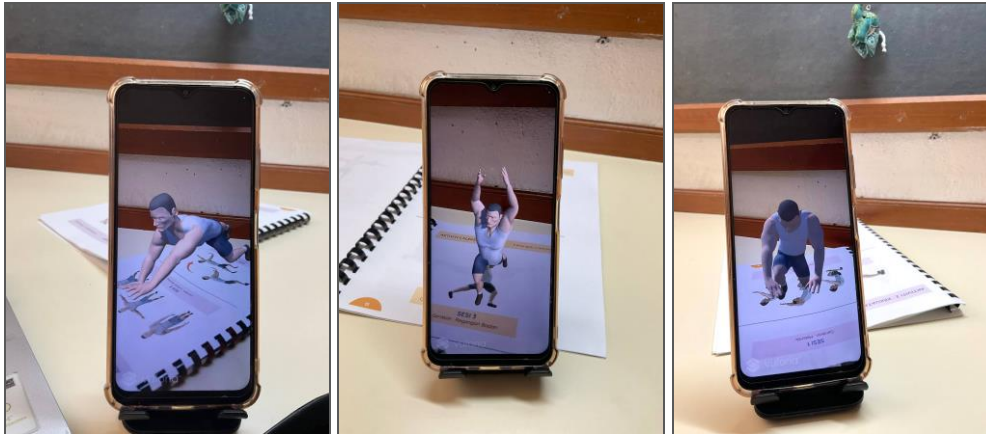


Figure 2. AR exercises App

The picture below is the AR Exercises App used; as seen in the application, no user interface is available to avoid the overload of memory on the students. The application was designed to make it easier for students to use, so students only need to open it before the camera appears. Students need to point the camera to the 2D image on the module they want to visualize. The image in the module will act as a marker that will trigger the animation in the form of a 3D object that will demonstrate the movement of exercises to students.

**Results**

The figure below shows the results of data analysis using the thematic map to show the relation of each theme. Two main themes exist regarding the student's learning experience in PE classrooms. The first is the student learning experiences while in traditional PE classrooms, and the second is when learning using AR Apps in PE classrooms, and there are sub-themes for each of these main themes.

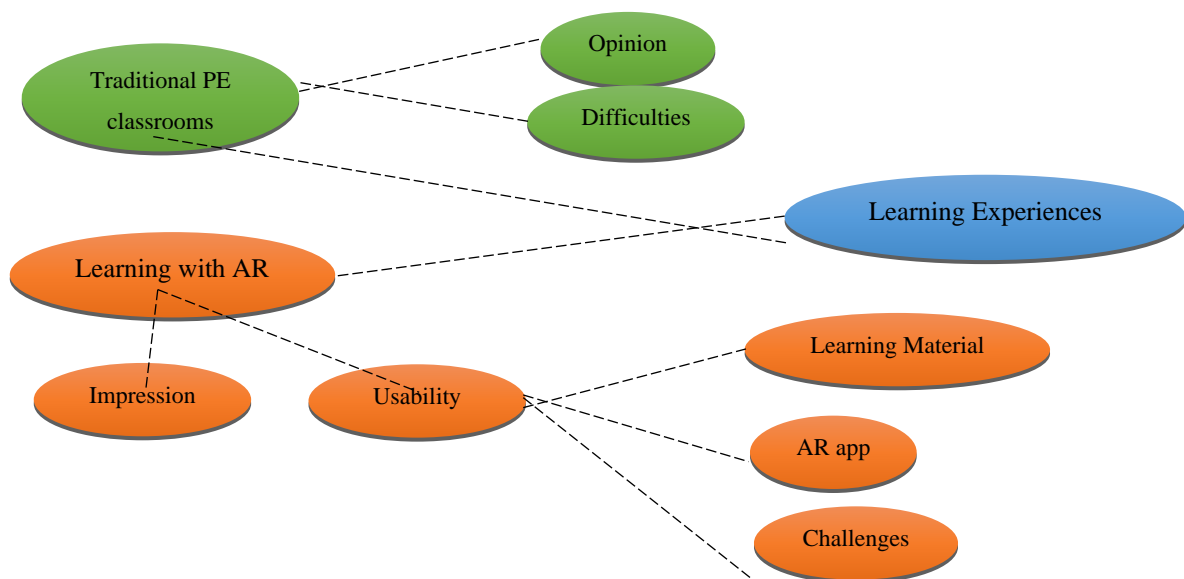


Figure 3. Thematic map

### **Problems Faced by LD Students in Traditional PE Classrooms.**

There are two ways of learning in the PE learning curriculum: when students have to learn in the classroom using textbooks, they will also learn in the field to practice the material they have learned before. The analysis results found one theme about students' learning experiences in traditional PE classrooms with two sub-themes: opinions and difficulties. The first sub-theme describes student's opinions that students felt and experienced during learning in PE classrooms;

- Students said they felt bored when learning PE in the classroom because they were required to sit, write, and read a book. Meanwhile, they prefer to learn PE in the field.
- Students felt happy and enthusiastic about learning PE rather than other subjects because they could do any exercise and sports in the field.
- Students also said PE was good for their health and could release stress when they were tired of studying.

The second sub-theme describes student's difficulties that students experience during learning in PE classrooms;

- The students said that it is challenging to interpret 2D images in physical education textbooks.
- They have difficulty imagining the movement and how to exercise they should.
- Students also felt that reading the exercises movement descriptions in the textbooks and looking at the 2D images was insufficient to understand how the actual movements had to be made.
- Meanwhile, students felt that teachers do not have much time or opportunity to repeatedly show these movements to each student.

### **LD Student's Experience When Using AR.**

After the intervention, in-depth interviews were conducted to know the students' experiences using the AR app. The result shows that there are fifth sub-themes found: Impression, Usability, Learning Materials, AR applications, and challenges exist.

The first sub-theme describes their Impression while using AR as a new technology in their PE classrooms;

- Students said this is a new learning tool since it is their first time using AR technology in their learning.
- They all like using the AR app and feel that learning by using it is fun because it can help them visualize the image on the module since it can show the animation of the exercise movement.
- Students are interested in using AR applications because now everyone uses technology, so this app helps them make their learning easier in classrooms and still up to date.

The second sub-theme describes AR Usability while using it in PE classrooms;

- Students said that by using the AR app and module, they did not need to rely on the teacher when they had difficulty understanding the 2D images (exercise movement) in the module, and they could also study at home.
- Students also said using this application in the classroom would make teaching easier for teachers.

Apart from that, the third sub-theme is the Learning materials which shows the student's impression when using

the AR module in learning;

- Students said that the instructions in the module were easy to understand because it focused on essential descriptions.
- The exercise movements shown by the 2D characters in the module were also easy to understand.
- The overall exercise movement in the module was easy to do.

The fourth sub-theme is the AR Application which shows the use of AR applications on students;

- AR application was easy to use.
- 3D objects used are clear, and the AR app's animations were easy to understand.

The last sub-theme is the Challenging when using the AR Application in the classroom;

- Students said that it was challenging to do the scissor jump movement.
- Students said that several 2D objects were difficult to detect, so 3D objects in the application did not appear immediately, and there were also blinking 3D objects.

### LD Students Movement Ability Results

Before the intervention, students are asked to do a pre-test to see their movement ability of students without using the AR app. After learning, students will do a post-test using the same movement ability rubric. Below is a descriptive analysis of students' movement ability's pre and post-test results. The results showed that there was an increase in movement ability from the pre-test to the post-test.

Table 2. Student's movement ability results

	Pre	Post
<b>Sample Size (Students)</b>	10	10
<b>Mean</b>	8.28	9.68

### Discussion

From the data collection and analysis results, this study found several difficulties that LD students faced when learning physical education in a traditional classroom. They stated, "It is challenging to translate 2D images from physical education textbooks into a movement for physical activity or exercises". By only looking at the images in the book and reading the explanation, it is considered insufficient by students because some students have difficulty remembering and understanding an instruction. Some students also need repeated explanations or demonstrations from the teacher when learning new exercise movements. This is in line with studies by Riyadi (2017) found that the obstacles faced by LD children in conducting physical education activities are weak thinking power and adaptive behavior, which results in their ability to capture responses that are not well coordinated, requiring a long time to receive teacher explanations. Tommy et al. (2022) found that LD students face difficulties in PE learning are understanding the material and the student interest; meanwhile, the problems teachers face are difficulties in delivering the material and the available learning tools.

With the discovery of several gaps in the pre-interview and after the in-depth interview, it was found that students were very impressed with the use of this technology in their learning and found it interesting since they had never used it in the classroom before. Research by Kraut & Jeknić (2015), which uses Augmented Reality Applications in the Field of Vocational Education and Training, found that students felt using augmented reality (AR) software in the classroom for their lessons wa AR also helps assist in student comprehension by visualizing various physical processes in the learning (Daineko et al., 2020). Then for its use in the classroom, AR can be their learning assistant that can help students and teachers so that they do not need to repeatedly demonstrate the movement of the exercises to each student since some students have a slow response in learning. According to Samuel's (2020) research, AR is one of the assistive technology that can help disabled students with their vision. In line with this research, AR act as assistive technology that helps students visualize 2D image on the module and become the 3D animation that demonstrates the exercise movement to the student. For the module used, students felt that there were no problems with the content, the text, label, design, or 2d images used, all of which were good. Karamanoli et al. (2016) suggested in their research that the creation of supplemental materials for history and other school subjects taught to students may be the subject of future research. This research followed PE textbooks to create the module and the guideline of cognitive load theory when designing and choosing the content for the module. Similar to the module, the AR app is easy for students to use, and the use of animation helps students understand the movements of the exercises described in the module. Since in the application and module, we do not want to provide too many menus or descriptions to avoid memory overload in students.

## Conclusion

This study aims to explore the use of AR technology in PE subjects with learning-disabled students as a learning aid in the classroom. The results show that AR has successfully assisted and helped students understand the 2D image of the exercises movement on the module without reading any longer description by visualizing the exercises images in the module. Students with learning disabilities usually have a slow response to learning which requires the teacher to repeat in demonstrating the exercises movement to several students. On the other hand, AR also helps teachers minimize the repetition of demonstrating exercise movements to each student, saving teachers time and energy in the classroom. Teachers can focus on other things, such as observing student understanding, instead of repeatedly demonstrating movements to each student because the learning time is less effective if this happens continuously. Moreover, students can also repeat lessons and study independently at home. Using this app as an assisting tool in the adapted PE classroom also increased the students' interest and curiosity. However, this research also finds some limitations; the AR app is only suitable for Android users, with a minimum Android version being 7.0. If installed on a smartphone that has a version below that, several possibilities can occur, such as difficulty detecting the marker (image on the book), a black screen appearing, a line on the screen appearing or objects appearing with imprecision, and the last is that there are difficulties when detecting some markers.

## Recommendation

Researchers suggest further research to adjust the availability of AR applications that will be built on the current operating system version at that time so that more users can use them. The second is to make an iOS version of the AR application as well since this app and module have been brought to the technology innovation exhibition, and it was found that many iOS users are also interested in this application. Last, to keep it updated on technological developments, it is recommended that future research be able to build AR applications for children with disabilities that have been integrated with AI and gamification on it to make it more interactive.

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## New Curriculum of Education in Indonesia: How Do Natural Science Teachers Think about?

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**Abstract:** The 21<sup>st</sup> century learning leads to create new skill of students, so the Indonesian government offers the new curriculum. In vocational school, project-based learning for the subject of the *Ilmu Pengetahuan Alam dan Sosial* (IPAS) Project is required to increase the creativity of student. Informations about the perspective of vocational teachers to conduct these learnings require to be elaborated more deeply. This research aims to describe the perspective of teachers to Kurikulum 2022. This study is phenomenology research. Participants of this study were 8 teachers of IPAS Project for vocational high school, in Indonesia. The data was collected by interviews. Data analysis was performed using ATLAS.ti 22 software. The results showed that the majority of teachers's response to the Kurikulum 2022 is positive which they explained that Kurikulum 2022 has more advantageous than the lack. The final goal is to improve quality of education in Indonesia. Pancasila profile has good response by teacher because it is more explicit and complex for building the character of student. The vocational teachers have totally prepared by their own creativity. The recommendation from teachers are expressed as a hope for improving quality of education, such as training for teacher, facilities and massive socialization.

**Keywords:** New Curriculum, Project-Based Learning, Pancasila Profile, Preparation, and Recommendation

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### Introduction

The development of science and technology is fast. This disruption requires fast change also in the learning area, and it means that education requires an adaptable approach. Indonesia is one of the G-20 members, which is

expected to have the ability for competing in Industrial Revolution 4.0. as it refers to the industrial system that is based on digitalization, smart machine, and the Internet of things (IoT). In other words, technology of factories in industry mobilized by robots uses cyber-physical system. This is a huge revolution, and Indonesia should change its industrial system, from the manual system to the digital system.

The competition in the 21<sup>st</sup> century is inversely proportional to the facts about Indonesia's position in Program for International Student Assessment (PISA) and Trends in International Mathematical and Science Studies (TIMSS). The results in 2015 PISA show Indonesia was ranked 64 out of 74 countries that are members of the Organization for Economic Cooperation and Development (OECD) with a score of 406 for scientific literacy. This score is still very low when compared to the average score for all OECD member countries, which is 493. Meanwhile, Indonesia's position in the TIMSS shows that students' science score was ranked 45 out of 48 countries with a score of 397. This means that there are still many things that need to be evaluated from the education system in Indonesia as a future projection.

As a solution to these problems, Indonesia government offers new curriculum, such Kurikulum 2022. This curriculum is expected to increase literacy and competence of 21<sup>st</sup> century skill. Another policy of government is Asesmen Kompetensi Minimum (AKM). AKM is minimum competence assessment to measure literacy level of student. This program aims to identify how the level of student in literacy level. Therefore, government could determine appropriately the best program for increasing level of literacy and competence of 21<sup>st</sup> century skill. New curriculum addresses that students should be taught to develop their thinking skills, so they could think complexly and have high order thinking skills (HOTS). Complex thinking described by skill that includes critical thinking skills, creative thinking, problem solving, and conclusion taking. Meanwhile, HOTS based on the revision of Bloom's Taxonomy by Anderson and Krathwohl includes the ability to analyze, evaluate, and create. Combination of complex thinking and HOTS become the 21st century skills (Anderson, 2011). The *Create* (C6) level is the highest taxonomy level in cognitive which government offers project-based learning as the main model in learning in the school.

The concept of curriculum develops in line with the development of educational theory and practice, also varies according to the flow or theory of education that it embraces. What needs to get an explanation in curriculum theory is the concept of curriculum. According to (Sukmadinata, 2000) that there are three concepts about the curriculum, curriculum as substance, as a system, and as a field of study. The first concept is curriculum as a substance. The curriculum is seen as a plan of learning activities for students in school, or as a set of goals to be achieved. A curriculum can also refer to a document containing formulations of objectives, teaching materials, teaching and learning activities, schedules, and evaluations. A curriculum can also be described as a written document as a result of mutual agreement between curriculum compilers and holders of educational wisdom with the community. A curriculum can also include a specific scope, a school, a district, a province, or an entire country. The second concept is curriculum as a system, namely the curriculum system. The curriculum system is part of the school system, the education system, and even the community system. A curriculum system includes the structure of personnel, and working procedures for how to structure a curriculum, implement, evaluate, and

perfect it. The result of a curriculum system is the arrangement of a curriculum, and the function of the curriculum system is how to maintain the curriculum to stay and be natural. The third concept is curriculum as a field of study is the field of curriculum study. This is a field of study of curriculum experts and education and teaching experts. The purpose of the curriculum as a field of study is to develop knowledge about the curriculum and curriculum system. Those who are steeped in the field of curriculum, learn basic concepts about the curriculum. Through literature studies and various research and experimental activities, they discover new things that can enrich and strengthen the curriculum field of study.

New curriculum focuses on project-based learning which is expected to increase literacy and competence of student. According to (Albar & Southcott, 2021) says that project-based learning stimulates the student creativity process. Furthermore, the results of the study (Shin, 2018) showed that project-based learning has a positive effect on learning motivation and leadership in cooperation or collaboration. In the context of physics learning, (Baran et al., 2018) explained that compared to conventional learning, project-based learning accompanied by games has more success and it is recommended for using in other materials in physics. It is appropriate with (Hanif et al., 2019) who found that STEM project-based learning has an effect on the creativity of learners which the dimensions of creativity studied are dimensions of resolution, elaboration and novelty. Lastly, (Almulla, 2020) found in his research that project-based learning techniques increase students' involvement in sharing and discussing knowledge, because PBL is highly recommended. Therefore, it is important to know deeply how readiness of teacher for facing new curriculum, especially for doing project-based learning and building character of Pancasila.

The project based learning is constructivist approach which student is led to think freely in doing instruction matter and purpose of learning. This model is totally compatible with Kurikulum 2022 which is expected to increase 21<sup>st</sup> century skill. Therefore, it is prominent to know deeply how the response of teacher for facing this new curriculum, especially for IPAS project subject in vocational high school in Indonesia. The research question on the research is "How do natural science teachers think about new curriculum in Indonesia?"

## Method

A research design that the researcher used was a phenomenological philosophical perspective since the main object of the research was to investigate the response of teacher about new curriculum, Kurikulum 2022. The results of this research are more general instead of using of all phenomenological methodologies following their characteristic result. Hence, the overall procedures of the research used qualitative research procedures. The researcher uses phenomenology method because it enables the researcher to reveal various realities that occur in subjects' standpoints. The objective of this study is to describe the subjects' experience and perspective which stand distinctively for the sake of data provision.

### **Subject of Research**

The researcher performed the information ethically, so the researcher maintained the school and the participants name, the participants' confidentiality, privacy, and safety. The samples were homogenous, the researcher used purposive sampling in selecting the participants. It was done in order to get the appropriate sample or subjects in which they were qualified as the research criteria being aimed in this study. Those samples were gotten according to some consideration choices that were suitable with this research need.

In phenomenology, (Creswell, 2013) explained that data are collected from the individuals who have experienced the phenomenon and often data collection in phenomenological studies consists of in-depth and multiple interviews with participants. The number of participants in this research is eight vocational teachers which consist of two vocational teacher from west Indonesia, five vocational teacher from Central Indonesia and one vocational teacher from east Indonesia. This is compatible to (Creswell, 2013) who stated that the exploration of this phenomenon with a group of individuals who have all experienced the phenomenon. Thus, a heterogeneous group is identified that may vary in size from 3 to 4 individuals to 10 to 15. The participants have much experience about natural science learning in vocational school because at least they have three years of experience as vocational teacher for natural science subject.

### **Data Collection**

The data collection was conducted by depth interview. The questions were created by researcher based on main topic in this research. The collection is done by Zoom App, because the condition was pandemic era on April-May 2022.

### **Data Analysis**

Creswell (2007) argues that phenomenology talks about the important thing to recognize how people interpret the world and what the people experience. Furthermore, to analyze the data, the observation field notes and the interview transcriptions were categorized and analyzed into relevant themes by the researcher. In addition, the triangulation strategy was used in this research to contrast and compare the data between the interview result and the observations' findings. To support this strategy, the researcher implemented the field notes and data transcription. To make an effective interview and observation, the use of memo in two-column forms was made and deliberated the notation process (Creswell, 2007). The researcher deliberated the responses and information to clearly interpret, explain, and analyze the teachers' perceptions. Data is analyzed by Atlas.ti 22 software to generate clear interpretation.

In analysis data, (Bogdan & Biklen, 2007) explains that analysis is a process of data reduction. Decisions to limit codes are imperative. Codes categorize information at different levels. Major codes are more general and sweeping, incorporating a wide range of activities, attitudes, and behaviors. Subcodes break these major codes

into smaller categories. (Creswell, 2013) argues that phenomenology talks about the important thing to recognize how people interpret the world and what the people experience. Therefore, to analyze the data, the observation field notes, and the interview transcriptions were categorized and analyzed into relevant themes by the researcher. The initial step to analyze data is to transcribe data of interview for each participant. The transcript was arranged for coding process. The coding process was conducted by ATLAS.ti 22. The process of data analysis generates data reduction and the interview transcriptions were categorized and analyzed into relevant themes. Data reductions are arranged based on the same subtheme to form code group in ATLAS.ti. Relationships or code groups generate conclusion or theme.

Data analysis in this research used thematic analysis as (Braun et al., 2017) explains that thematic analysis has advantages follows: (1) Flexibility. (2) Relatively easy and quick method to learn, and do. (3) Accessible to researchers with little or no experience of qualitative research. (4) Results are generally accessible to educated general public. (5) Useful method for working within participatory research paradigm, with participants as collaborators. (6) Can usefully summarize key features of a large body of data, and/or offer a ‘thick description’ of the data set. (7) Can highlight similarities and differences across the data set. (8) Can generate unanticipated insights. (9) Allows for social as well as psychological interpretations of data. (10) Can be useful for producing qualitative analyses suited to informing policy development.

## Results

The figure 1, figure 2 and figure 3 are the result of data analysis by using ATLAS.ti 22. These figures are reviewed by vocational teacher on three regions in Indonesia, such as West Indonesia, Central Indonesia, and East Indonesia. Figure 1 describes the response of vocational teacher for new curriculum, and figure 2 describes advantages and lack of new curriculum based on vocational teacher’s perspective. Whereas Figure 3 describes how the response of vocational teacher in detail, such as PjBL on natural science project subject, Pancasila profile, preparation, and recommendation.

### Theme 1: General response

The first theme data is showed by Sankey diagram. Sankey is generated by ATLAS.ti 22 by Code-Document Table analysis. The document group of participants is arranged by region, such as West Indonesia, Central Indonesia, and East Indonesia.

In the figure 1, the Sankey Diagram shows that majority of vocational teachers have positive response. Muhammad Yunus expressed “I like this curriculum”, whereas Muhammad Ikbal said ‘The new curriculum is good because student can focus on detail things’. The same response with Hasrianti, Alifiah, Harsina, Suriadi and Nurul Huria. The negative response was expressed by Ayu Sulistiwati, vocational teacher from West Indonesia. who said ‘I haven’t understood about Pancasila profile’ and she continued that ‘Teachers do not



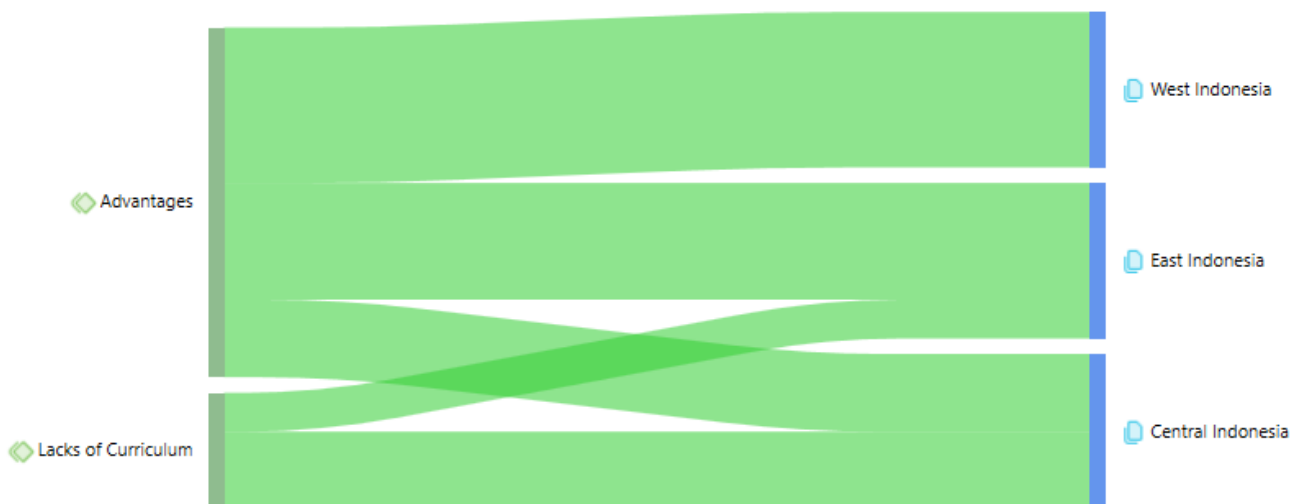
know how to implement the curriculum'. Their perspective about new curriculum gives insight that teachers have positively responded but government should give understanding how the new curriculum is.



**Figure 1.** The response of vocational teacher for new curriculum based on region

**Theme 2: The advantages and the lacks of new curriculum based on response of vocational teachers**

The second theme data is showed by table Sankey diagram. Sankey is generated by ATLAS.ti 22 by Code-Document Table analysis. The document group of participants is arranged by region, such as West Indonesia, Central Indonesia and East Indonesia.



**Figure 2.** The advantages and lack of new curriculum which is reviewed by vocational teacher

In the second theme, vocational teachers were asked to mention what the advantages and lacks of this

curriculum. The Sankey diagram in the figure 2 shows that teachers have much opinion about this theme. Ayu Sulistiwati expressed ‘It’s match to vocational school because this curriculum directs on students’ talent and passion’. The same point of view with Alifiah, vocational teacher from central Indonesia. Harsina, vocational teacher from East Indonesia, added the advantages that Kurikulum 2022 is more flexible and focused on essential thing. ‘The burden of teacher decreased by implementation the curriculum’, Nurul Huria said. Therefore, it creates freedom for teacher.

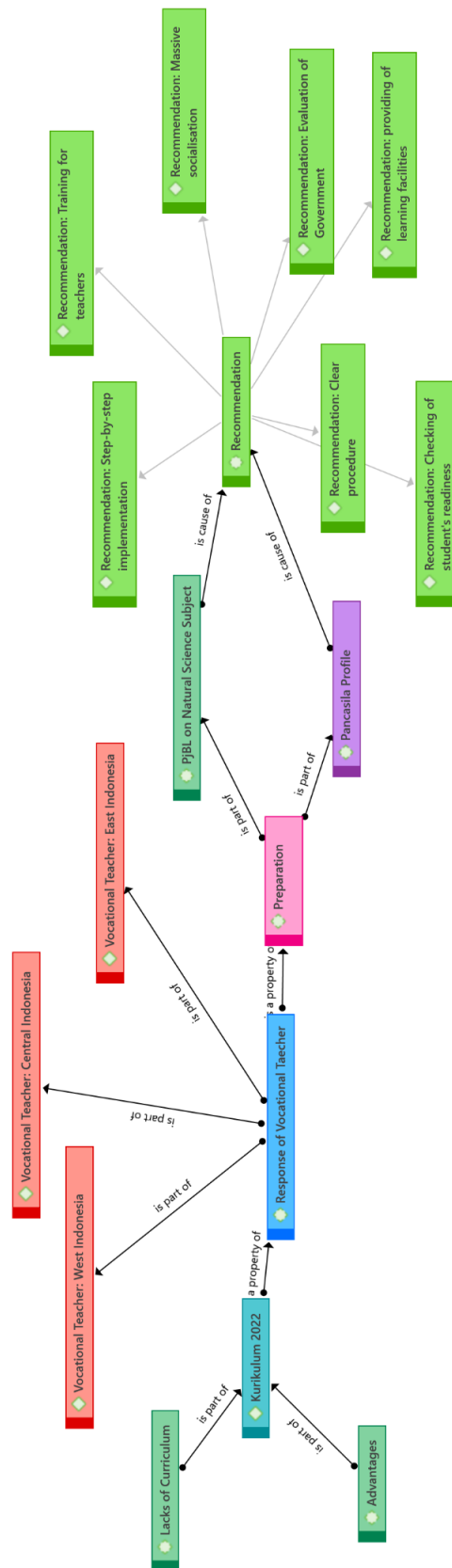
Besides, the lacks of curriculum also were expressed by vocational teacher. Alifiah said “sometimes old teacher is difficult in adaptation for new change”. Some teachers criticize the facilities that it is not complete in the school which it was expressed by Suriadi and Alifiah from Central Indonesia. The main point is less socialization, so the setting of this curriculum is unclearly understood. Harsina emphasized on intensive activities in the industry which take time too long, so student could not be controlled daily and awareness of student is required for conducting the program seriously. Briefly, actually the new curriculum has more advantageous than the lack. government could handle the problems by solving the problem which is expressed by teacher for better implementation in the future. The final goal is to improve quality of education in Indonesia.

**Theme 3: Project-based learning (PjBL), Pancasila profile, preparation and recommendation based on response of vocational teachers**

The third theme data is showed by table Sankey diagram. Sankey is generated by ATLAS.ti 22 by Code-Document Table analysis. The document group of participants is arranged by region, such as West Indonesia, Central Indonesia, and East Indonesia.



**Figure 3.** Response of vocational teacher for PjBL, IPAS, Pancasila profile, preparation and recommendation



Figures 4. The mind mapping of vocational teacher's

The last theme is specific things, such as project-based learning (PjBL) model, Pancasila profile, preparation and recommendation in the future. This curriculum emphasizes on project-based learning (PjBL) model for natural science subject. The teacher's point of view about this model is positive which majority of teacher mentioned the benefit of learning model. 'It's necessary', Suriadi said. Nurul Huria explained 'Project-based learning is good, because it stimulates student to create something new'. The same positive opinion from Ayu Sulistiwati who said 'PjBL accommodates the vocational student's competence'. For the challenge, PjBL requires innovative teacher, because sometimes teachers are confused for determining what kind of the project.

The new thing is Pancasila profile. It's about character of student to follow Pancasila values in their life. Pancasila values were explicitly explained by (Kemendikbud Ristek, 2021) which consisted of six values, such as good attitude, respect difference, independence, collaboration, critical thinking and creative. Vocational teachers have the important role for building character, and their perspective should be heard. Hasrianti appreciated this program because character building for student is more explicit and complex. She said 'maybe Pancasila profile is more specific than before'. The way to connect the learning can be conducted by the experiment, which good attitude, respect difference in one group of experiment, independence, collaboration, critical thinking, and creative can be created by the experiment activities.

Preparation for facing new curriculum was explicitly explained by participants with different ways. Hasrianti said 'preparation was done by updating information of new curriculum. collaborating to student and observing environment of school'. Harsina emphasized on giving motivation to student. Nurul Huria explained that preparation of facilities. Generally, vocational teachers have totally prepared by their own creativity. The recommendation from teachers were expressed as hope to better implementation this curriculum. Ayu Sulistiwati recommended to train vocational teachers because many teachers have not known the clear procedure. Alifiah stated that facilities is the key, and readiness of student should be checked. In the end, Alifiah emphasized that evaluation of government is really required.

## Discussion

This research is qualitative research to explore how vocational teacher to respond new curriculum. This is important to explore how teacher's response, because their perspective is a reflective for this new curriculum. The teacher's point of view should be heard because they are the key subject who deliver materials in the class. The approach to look the experience in the qualitative research is phenomenology. (Creswell, 2013) explained that the approach of research used phenomenology type that the exploration of this phenomenon with a group of individuals who have all experienced the phenomenon. Therefore, to explore vocational teacher's response about the new curriculum utilized phenomenology approach, because the have experience about how to teach natural science in the school.

The new curriculum is offered by Indonesia government to create specialization based on student's passion and

competence. Furthermore, Indonesia government offer Pancasila profile to build the character of student based on Pancasila's value which it became foundation of nation. (Indarta et al., 2022) explained that the new Curriculum will replace learning methods that were originally implemented in the classroom to learning outside the classroom. The 21<sup>st</sup> century learning model also emphasizes students to create their skills independently. Teachers could use the 21<sup>st</sup> century learning model in the application of the independent learning curriculum in schools. Education in this era also emphasizes knowledge and technology in the development of students who will become human resources in the future.

Generally, response of vocational teacher is positive. They argued that this curriculum could improve the quality of education in Indonesia. It is relevant with (Faiz et al., 2022) found that the prototype curriculum is an effort to transform education in Indonesia. The direction of prototype curriculum development has a distinctive feature that supports learning recovery efforts. The prototype curriculum that will be implemented by the Ministry of Education and Culture and Research and Technology in the 2022/2023 academic year has a very good goal, namely wanting more active and adaptive learning by providing flexibility for educators to carry out learning process-oriented to learning projects. To achieve this, the support and hard work of various parties are needed to realize a better and more advanced Indonesian education.

Pancasila profile and project-based learning are new aspects in this curriculum. In the vocational school, natural and social science subject are combined into natural and social science project subject (Projek IPAS). It means that there are two consequences for this change. The first, the teacher of natural and social science have to collaborate to determine direction this subject in the class. The second, the model of learning have to utilize project-based learning (PjBL). In the research, the participant is the natural science teacher in West Indonesia, Central Indonesia and East Indonesia to explore how their response for this change.

Vocational teachers generally have prepared the way to teach for these aspects. They have their own creativity to develop the learning in the class. Rachmawati et al. (2022) found that Pancasila Student Strengthening Project makes a new sense in Education in Indonesia today, which with the allocation of separate time makes teachers more able to innovate planning projects according to the selection of dimensions and characteristics of students. In addition, it provides flexibility for educators to carry out a project-oriented learning process.

New curriculum has more advantageous than the lack. government could handle the problems by solving the problem which is expressed by teacher for better implementation in the future. The final goal is to improve quality of education in Indonesia. Therefore, the thing should be realized by the whole of teacher and principal is how to make a change in school atmosphere. (Rahayu et al., 2022) found that the keys to the success of the implementation of the curriculum are the teachers must think how to make changes. The principal as a leader should change the mindset of human resources in the school to make changes, so the new curriculum could be applied.

## Conclusion and Limitations

Many vocational teachers on natural science subject have positive response for the new curriculum. They have explained that Kurikulum 2022 has more advantageous than the lack. Government could handle the problems by solving the problem which is expressed by teacher for better implementation in the future. The final goal is to improve quality of education in Indonesia. Pancasila profile is well response by teacher because it is more explicit and complex for building the character of student. The vocational teachers have totally prepared by their own creativity. The recommendation from teacher was expressed as the hope for better implementation this curriculum, such as training for teacher, facilities and massive socialization. The limitation of phenomenology relies heavily on the researcher's interpretation of participants' lived experiences. The researcher's preconceived notions, biases, and personal background can influence the analysis and interpretation of data, potentially leading to subjective interpretations. Furthermore, phenomenological research aims to provide a detailed understanding of the subjective experiences of a small group of participants. As a result, the findings may have limited generalizability to larger populations or different contexts. The emphasis was on the uniqueness of individual experiences rather than making broad generalizations. The last, participants were purposefully selected based on their experience of a particular phenomenon. This selection process may inadvertently exclude certain perspectives or experiences, leading to a biased representation of the phenomenon under study.

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## For Every Action in Nature There Is an Equal and Opposite Reaction, What about Education?

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**Abstract:** The paper will try to provide an answer to the question whether there is going to be an opposite reaction to total online teaching during the COVID-19 pandemic. Moving totally online was the only outcome at that time, it was not easy either for teachers or for students, however, eventually many of them did quite well and even benefit from the situation. However, since the return to the traditional, face-to-face, regime of education, there are demands from many stakeholders, including the Ministry of Education, to totally forget the online teaching. The study tried to find out the opinions of students and teachers to what degree this reaction is. It was a qualitative study in the format of interview, which was held with students at Bachelor, Master's and Doctorate level in various majors in Georgia. The conclusion was made that, depending on the majors and the level of studies, the experience of total online teaching, with all its challenges, was a useful one, and its lessons should be further studied and their advantages go on being used.

**Keywords:** total Online Teaching, Face-To-Face Education, Lessons Of COVID-19 Pandemic

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### Introduction

According to Newton's third law of motion, for every action (force) in nature there is an equal and opposite reaction. As total online education was imposed on us by the environment and educational decision-makers, natural, there was a certain (sometimes passive and sometimes active) resistance to it. This paper will try to provide an answer to the question whether there is going to be an opposite reaction to the removal of total online teaching after the COVID-19 pandemic.

In March 2020, 185 countries in Asia, Europe, the Middle East, North America and South America had to shut



down schools and universities due to COVID-19 pandemic (Learning Portal, 2020), which had a dramatic effect on both teachers and students in those countries. The process involved a number of challenges, beginning with the availability of relative equipment and software, through lack of electronic educational materials, ending with teachers' and students' technical skills and awareness of possibilities of online teaching. Student and teacher stress, and decreased quality of education was mostly stated (Lavonen & Salmela-Aro, 2022; Hensley et al., 2021; Vachkova et al., 2022). Although, eventually, they more or less tackled the problem, there were many stakeholders, specialists and non-specialists, who expressed great displeasure with the quality of teaching and learning (Can & Bardakci, 2022; Ng, 2022; Tkacová et al, 2022; UNESCO, 2020a; 2020b). There was action (unplanned sudden transition to total online teaching) and counter-action (teacher, student and even society resistance to it. Therefore, there have been demands from many stakeholders, including even the Ministries of Education, to totally forget the online teaching as soon as the return to offline teaching became possible (Agenda.ge, 2022). The current paper will try to provide an answer to the question whether educators want to totally forget the total online teaching as a bad dream or whether they did benefit from it to a certain degree.

## Method

Although it was an interview, the results could be analyzed both quantitatively and qualitatively. The analysis was done with the help of NVivo software. A survey was conducted among students and lecturers in Georgia. To conduct it, the researcher-made interview questions were developed. To assess their validity three specialists of online teaching were involved. After the recommended amendments were made, the interview was held. Its participants were volunteers. Some interviews were held in person and some online. The interviewers were the researchers.

The participants were 64 students and 31 teachers from Georgia. The students' majors were philology (7), art (18), business (9), medicine (11), tourism (4), and engineering (15). There were 41 Bachelor's, 15 Master's and 8 Doctorate students. Table 1 presents their data.

Table 1. Demographic data of the participants

	<i>Private university</i>	<i>Public university</i>	<i>University in the capital</i>	<i>Regional university</i>	<i>Total number</i>
Student number	28	36	38	26	64
Lecturer number	17	14	11	20	31

Although this is not a representative sample, it does reveal certain trends, as it represents types of universities and their various geographic location, student specialty and the degree they were studying for, giving a wide enough picture due to stratified and cluster sampling.

## Results

The results were analyzed both for various groups separately and for students on the whole and lecturers on the whole. The participants' opinions are presented anonymously, as S1, S2, etc., L1, L2, etc.

*Q1: What is your general assessment of the total online teaching / learning? Was it mostly positive, mostly negative or was it related to some advantages and some disadvantages?*

The general assessment of the total online teaching / learning was positive, 59 students (92%) and 28 lecturers (90%) assessing it as mostly positive. The remaining respondents assessed it as related to both advantages and disadvantages. The students who chose the latter answer were from Bachelor's programs in medicine and engineering from the public universities situated in the capital. The lecturers who chose the latter answer were from public regional universities.

S5: In the beginning it was too hard both for us and teachers, but eventually we even enjoyed the process. We were protected from the virus, staying at home, didn't need to spend time commuting...

S16: Well, it was not as bad as one might have expected, the quality of lectures was fine, but I lacked socialization a lot, although lecturers did their best to provide communication and interaction.

L3: I was very annoyed in the beginning, it was so hard – sleepless nights in order to get ready for lectures, sore eyes due to spending all time in front of the computer... But finally I am glad to have learned to teach online effectively, self-confident and proud of myself.

L19: It wasn't a great difficulty for me, I even enjoyed it, especially with Master's and Doctorate students.

*Q. 2: What advantages (if any) of total online teaching / learning can you name?*

The advantages were classified into 3 large groups (resource management, pedagogical and psychological advantages), including more sub-groups (see Table 2).

Table 2. Classification of advantages of total online management

Themes	Codes/advantages	number of students	number of lecturers	Sub-codes/advantages	number of students	number of lecturers
Resource management	Time management	n/a	n/a	it saves time on commuting	60	30
				it develops time management skills	14	20
				it enables one to spend more time with one's family	12	25
				it enables to combine some house / family routines with	13	21

				learning / teaching		
	Space management	n/a	n/a	large classes do not matter	n/a	31
	Materials management	n/a	n/a	it provides all needed electronic materials	53	n/a
	Financial management: it saves money on:	n/a	n/a	renting a flat/room, as one can study from his native town/village	26	n/a
commuting				17	10	
even clothing and footwear				6	5	
Pedagogical advantages	one can teach/learn even when s/he is ill	60	31	n/a	n/a	n/a
	it may be used both synchronously and asynchronously	33	31	n/a	n/a	n/a
	it develops the skill of using educational technology	17	31	n/a	n/a	n/a
	it enables one to feel comfortable during the class	17	12	n/a	n/a	n/a
	it enables one to learn at a comfortable for him/her rate	14	12	n/a	n/a	n/a
	it provides various ways of interaction during the class	8	9	n/a	n/a	n/a
	it improves communication	7	11	n/a	n/a	n/a

	skills under non-standard conditions					
	it helps avoid disciplinary problems (noise) in the classroom	5	21	n/a	n/a	n/a
Psychological advantages	it decreases stress	45	51	n/a	n/a	n/a
	it ensures safety	41	31	n/a	n/a	n/a
	students become more independent	16	14	n/a	n/a	n/a
	it improves the attitude towards technology in education	15	23	n/a	n/a	n/a
	it is more motivating than learning face-to-face learning	13		n/a	n/a	n/a

While more than 70% of the students thought that total online education reduced stress, few teachers though so (from the next question we will see that for teachers it, in fact, increased stress). As some students' parents and students' income was frozen, while others lost jobs, saving money on rent, commuting and clothes was a very important factor for the majority of students. What is really valuable, was that all students and lecturers, even those who in the pre-COVID-19 period resisted the application of technologies in education, had to master the needed skills. Students and teachers with children especially valued the possibility of looking after their children while learning / teaching – this saved their money for baby-sitter and made children happier. While for many students who are X or Y generation studying via technologies was more motivating than without them, for the teachers it was not so. Master's and doctorate students mentioned that they managed to combine their online / offline work (in the daytime) with the online classes (in the evening), as they didn't need to spend time commuting. Both the students and the lecturers confirmed that students were seldom late for the classes and practically never missed them. Below see some interesting answers.

S17: During the pandemic I stayed with my parents in the village. I could help them with the housework. We didn't feel lonely. And it saved us a lot of money – renting a room, living alone, commuting... I had the Internet, and when the electricity sometimes went off, we had a generator, so it was OK. The classes were recorded, so, when I didn't understand or remember something, I could watch it when and as many times as I needed.

S 26: I didn't have to spend money on books and to "hunt" for them – all educational materials (scanned or e-

books) were provided by the university. I could sit, walk or lie during the class – that was great! I didn't really get tired. The teachers always noticed who "raised hands" and let everybody ask their questions or say what they wanted. We, students, organized our blog, which helped learning a lot, we were more supportive of each other than usually.

S 30: Neither I, nor the teacher ever missed a class, a quiz or a midterm exam, there was no need to compensate anything, which had always been a problem before. Maybe I shouldn't be saying so, but, if the lecture was dull, I could be there and simultaneously do something more pleasant and important. I've learnt to distribute my time so that I couldn't any more say "I didn't have the time to study / do homework."

L 2. I have two kids, one had stayed at home with a nanny and one had attended the kindergarten. They were ill all the time, because the elder one always brought some infection from the kindergarten. I had been torn between the children and my job. During the pandemic it was difficult to explain to them that mum is "at work" and they shouldn't interfere, but it was still easier and more comfortable than before.

L 7: I was among those who didn't lose their job and income during the pandemic, it was great! Of course I had to work much harder than before, practically day and night. But I felt safe financially and I didn't worry much about the family members' health (my son and husband both worked online like me).

L 21: Besides the video-recorded lectures, I uploaded so many resources for students – texts, audios, videos, articles, textbooks. "Autonomous learner" wasn't an empty word from the syllabus any more, the students had to learn autonomy, and many of them benefitted from it a lot.

*Q3. What challenges / disadvantages of total online teaching / learning can you name?*

The following challenges / disadvantages named are given in Table 3.

Table 3. Classification of challenges of total online management

Themes	codes / challenges	number of students	number of lecturers
Technical challenges	internet access and quality, availability of the needed hardware and software	11	17
	lack of IT skills	5	21
	quality of equipment	5	21
Pedagogical challenges	lack of educational e-materials	17	12
	lack of pedagogical knowledge dealing with online teaching	15	15
	lack of feedback	13	27
	difficulties of organization and self-organization	12	15
	need to make urgent changes to syllabi (e.g., assessment modes)	5	31
	cheating and difficulty of assessment		25

Psychological challenges	lack of socialization	61	29
	lack of emotional support	18	27
	demotivation	13	7
	distractions (from family members, internet and books)	12	23
	abnormal work/study/life balance	11	28
	stressfulness, especially in the beginning of the process	7	27
	low quality interpersonal communication (switched-off cameras, eye-contact)	7	18
	too much control by administration / lack of trust	n/a	22

Practically all students and lecturers suffered from the lack of socialization. Many of them lacked emotional support in that situation. Interestingly, none of them mentioned lacking technical support, so it looks like universities did their best to provide technical support (trainings), however, not only did not provide the needed emotional support, but also required from the teachers to be available online almost 24/7 and asked to do additional paper work. Most of them mentioned they were not trusted by the administration to hold the online lectures and were too much controlled (monitoring + paperwork). While for the students the period did not look too stressful, for the lecturers it was rather stressful. The challenges can be divided into three groups: technical (mentioned by the students 28 and by the lecturers 48 times), pedagogical (mentioned by the students 63 times and by the lecturers 148 times) and psychological (mentioned by the students 150 and by the lecturers 158 times). Although the lecturers were fewer in number, they complained more. However, the trend was the same with all the respondents: while the technical problems were least complained of, the psychological ones were the most complained of. Below see some interesting answers.

S1: As I was staying in the village with my family, there were electricity interruptions from time to time and I missed some classes, but it was good that I could watch the video-recordings, which, of course, could not substitute my engagement in the class, but it did help with understanding and not failing behind the group. And for a few first classes lecturers could not provide some educational resources, but with time this problem was solved. Some teachers were very nervous while using the software and sometimes we needed to help them, but finally it was all OK.

S21: All I did days long was study and sit at home, and that was stressful. I wanted to spend more time with friends. I even missed being in the university yard between the lectures. Frankly, I became a bit lazy – no need to wake up as early as usually, I had plenty of time to choose when to do homework...

L9: I do have some IT skills, but they were not enough to teach online efficiently. The first several lectures were extremely stressful. I couldn't even think of the content of the lecture to be delivered, so much I was concentrated on the technical issues. The university held an online meeting, after which it became easier. But I still believe that I could have taught much better had I known both the technologies and the online teaching pedagogy better.

L13: I spent nights scanning the books for students and making up my own e-materials. My eyes were sore. Some moments I thought I would have a nervous breakdown. I missed live communication so much – it energizes you so much, the student photos and even faces in the camera don't help much. Thanks god I knew some groups from the previous semester or year – then it was much easier to maintain the already established rapport.

L22: I didn't have a camera in my computer – I rushed for one – all were sold out! I borrowed one for a while, and finally I managed to buy my own. It was dreadful. No one, not even my family, understood the hard days I had. The lack of moral support and understanding was so devastating!

*Q4. Now that there is no need in total online teaching / learning, would you like to go on teaching / learning totally online? Why (not)?*

The majority (30) of the bachelor's students, all except the medical students (11), answered that they do not want to return to total online teaching, however, their answers were more related to the need to socialize with their peers than to the quality of teaching/learning. On the other hand, many (12) master's and almost all (7) doctorate students mentioned they would rather go on in the online regime – except the practical and laboratory classes.

S2: No, no way! I'd like to have some learning online, I've enjoyed having more freedom, more autonomy than before, but seeing your group mates in class and not only, spending time together, it's great fun! When face-to-face lectures were restored, many students who in the past missed many classes rushed to classes. The environment was so exciting! Really, we now value the cost of face-to-face learning!

S36: I'm a doctorate student and I combine work with study. The online regime made it much more feasible. I even attended some classes at my workplace, immediately after the work, not to be late to them. The online regime is very flexible. I realize lecturers' doubts about exams, but they may be held in class or computer lab, while the classes, even the seminars, can be very efficiently held in class.

L5: In the beginning it was somehow difficult to reorganize, but eventually I got used to it and evaluated its advantages. To my mind, the classes that are theoretical, whether lectures or seminars, can be better held online, while the practical classes need to be held face-to-face. That will balance the advantages and the drawbacks of online teaching. Hybrid mode is fine, especially for master's and doctorate students. Many of them not only work, but also have families, and the hybrid regime is optimal for them.

*Q5. Now that there is no need in total online teaching / learning, would you like to teach / learn totally face-to-face? Why (not)?*

Although the majority of the respondents (45) have realized the advantages of online learning / teaching and would like to benefit from them, however, they prefer some sort of hybrid regime: some classes from home online, some classes face-to-face, but with more application of the Internet and various software, while some classes totally offline. For the students, especially, for the bachelor's ones, face-to-face socialization at the university seems as important as the knowledge and skills gained there. As for homework, it can be delivered to lecturers completely online. No work will be lost or remain without feedback.

The teachers tend to think (27 of them) that bachelor's students should learn face-to-face, while master's and doctorate students can study in a hybrid regime. They believe that high quality of bachelor's study cannot be achieved only through online regime. And, of course, it depends on the specialty – for humanities online

education is more or less acceptable, while for medical and engineering and some other professions it's unacceptable.

*Q6. Now that there is no need in total online teaching / learning, would you like to teach / learn in a way that benefits more from online education than before? Why (not)?*

Almost no students and lecturers deny the eventual usefulness of the experience of total online teaching. Would it happen again, they would be much better prepared to it. They will apply the experience gained in this or that way – give more online homework, apply flipped and blended learning.

## Discussion

It is essential that the attitude towards online teaching is not one-sided: we need to know the benefits and apply them, but we also need to foresee the possible challenges and to take maximum measures to avoid them (Can & Bardakci, 2022; Lavonen & Salmela-Aro, 2022; Maatuk et al., 2022). The obtained in the research conclusions dealing with the advantages (Goldenson et al., 2022; Punjani & Mahadevan, 2022; Stoian et al., 2022;) and challenges (Hensley et al., 2021; Tkacová et al., 2022; Vachkova et al., 2022) of total online education in Georgia were in line with numerous publications.

## Conclusion

Numerous advantages of total online education experience were made by the respondents: Resource (time, space, materials, finances) management, pedagogical (holding / attending all classes, flexible regime, development of IT skills, comfort, adjustable rate, variety, discipline) and psychological (reduced stress, increased safety and autonomy, positive attitude towards IT in education) benefits. Certain challenges, however, were named too: technical (lack of IT skills, internet access and quality, availability and quality of the needed hardware and software), pedagogical (lack of educational e-materials, insufficient knowledge about how to teach / learn online efficiently, lack of feedback, difficulties of self-organization, urgent changes to syllabi, cheating problems) and psychological (lack of socialization and emotional support, demotivation, distractions, abnormal work/study/life balance, stress, quality of interpersonal communication, humiliation due to the lack of trust from administration) challenges. It was mentioned, that many challenges were overcome with time. Therefore, the conclusion was made that, depending on the majors and the level of studies, the experience of total online teaching, with all its challenges, was a useful one, and its lessons should be further studied and their advantages go on being used.

## Recommendations

It can be recommended that the aftermath of total online learning is studied deeper and on a larger scale should be analyzed, to be better prepared for further analogous situations and to improve the quality of the traditional,



face-to-face education. To express gratitude to teachers and students for their insistence to teach and learn is essential, and, if not expressed so far, it is never too late. To apply the benefits of e-learning more actively in face-to-face education is a must, probably, the most important lesson learned from the education in the time of the COVID-19 pandemic.

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## Assessing ESL University Students' Metacognitive Online Reading Strategies

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**Abstract:** Extracting information through online reading has become second nature to ESL students in higher institutions. Although online reading is indispensable among ESL university students, they lack the ability to read effectively. The present study examines students' metacognitive online reading strategies and how those strategies reflect understanding of scientific online reading materials for academic purposes. This was conducted through an online survey and semi-structured interviews. Data was collected among 55 university students enrolled in various Science and Technology courses. Out of the same sample, ten students were selected to participate in the interviews. Data were analyzed using descriptive statistics and thematic analysis with the use of SPSS and NVivo respectively. Thematic analysis was validated using inter-rater reliability analysis through Cohen Kappa analysis that yielded substantial results, indicating that the findings were reliable. Although the findings from the survey revealed that problem-solving strategies were used mainly by students, semi-structured interviews found contradicting results where support reading strategies were believed to reflect understanding by students. Implications that can be drawn are two folds. Students are motivated to use metacognitive online reading strategies depending on the type of texts; two, the need to use different reading strategies to elicit purposeful information based on the subject matter.

**Keywords:** Metacognitive online reading strategies, English for Science and Technology, university students

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## Introduction

The most important skill of all four to master when learning a second language (L2) is reading because it directly relates to academic success at all grade levels. This is because information is obtained through reading. Hence, readers must be familiar with the reading process to understand and adhere to such information. It is important to note that the reading process is multifaceted, and learners who are new to reading and unfamiliar with reading strategies require different reading strategies to increase comprehension (Miller, 2017). There are several strategies that readers should consider before reading. This includes becoming aware of metacognition and metacognitive strategies.

Flavell (1976) described metacognition as someone's conscious ability to understand, control, and regulate cognitive process to reach maximum learning. Metacognition is a term that describes the process of comprehending information and realizing the full potential of your own mind through your own cognition (knowledge). In reading, it is the act of actively analyzing what you are reading to grasp its meaning. We refer to metacognitive awareness as our ability to reflect on what we already know with cognitive control. In other words, metacognition and metacognitive awareness are dependent on one another. In short, knowledge and attention go hand in hand.

The past decade has seen a continual development in research on reading strategies and reading comprehension. This consequently led to a demand for quality second language reading courses offered in schools and universities. Hence, to measure up to the aspirations in the Malaysian Education Blueprint, Higher Education (2015 - 2025), students are expected to have bilingual proficiency in Bahasa Melayu as the national language and English as the international language of communication (Ministry of Education [MOE], 2015). With that in mind, classroom reading instructions can be reassessed to improve students' reading comprehension. In addition, researchers have begun to emphasize reading strategies in studies of second language reading in the last 30 years. The discovery of reading strategies is vital for many reasons. They are believed to disclose the ways of learners' processes between the link with the text and the metacognitive process that they have (Daguay-James & Bulusan, 2020; Flavell, 1979; Newton, Ferris, Goh, Grabe, Stoller, & Vandergrift, 2018). In other words, it enables readers to read the text first, then organize and synthesize the information to reach their cognitive objectives.

There has been a significant increase in the studies of reading strategies employed by ESL university students (Daguay-James & Bulusan, 2020; Aziza M Ali & Abu Bakar Razali, 2019; Nguyen, 2018). Recently, the exponentially emerging online academic reading materials have become a choice of reference for students. However, in a different study conducted by Nazarov & Kovalev (2017) which concerns the transformation of 'new readers', digital materials are not the most preferred choice in reading. They have demonstrated that the reading format most preferred by youths is printed reading material as compared to digital and audio reading material, especially in Russia, the Czech Republic, and the USA. Interestingly, this result ties well with the

previous study by Jeong (2012), wherein students preferred printed reading materials as compared to digital reading material. It is interesting to note that the findings also revealed the reading comprehension of reading printed material is higher compared to digital material.

However, nowadays, online reading has become an integral part of educational practices. In academic settings, online materials have now become the main source of information for students, especially those in universities. Students are now required to read materials online daily, which can be an overwhelming experience if they struggle to understand what they read. For example, reading academic scientific materials may be difficult for students where English is not their first language. Considering the discussion above, the study on the reading strategies employed in reading online materials in the context of ESL STEM university students is yet to be explored. The following research questions were addressed:

1. What are the online reading strategies mostly used by ESL university students in reading online materials?
2. How do online reading strategies reflect students' understanding of online scientific materials?

Although previous studies have concentrated on metacognitive online reading strategies in improving reading comprehension (Miller, 2017; Ostovar-Namaghi & Noghabi, 2014; Sheorey & Mokhtari, 2001), more research is needed in online reading strategies used by university students in reading EST online materials. Therefore, this paper is determined to identify the metacognitive online reading strategies employed by ESL science and technical university students.

## **Literature Review**

### **Reading Strategies**

Reading requires cognitive and metacognitive reading strategies to effectively understand texts. Cognitive strategies involve thought processes that are also known as metacognitive reading strategies. They are self-regulated and self-monitoring thinking processes that are used by readers from various reading strategies based on the objectives and reading context. For example, cognitive strategies are procedures or actions used directly when readers are working with a text such as trying to guess words that they are not familiar with, whereas metacognitive strategies are actions that learners plan to manage reading, such as previewing the length and organization of the text (Sheorey & Mokhtari, 2001). Hence, being aware of reading strategies is important to ensure overall academic success.

Several studies have concentrated on metacognitive reading strategies in EFL and ESL classroom settings to enhance the reading comprehension of online texts. Stronger emphasis has been placed on metacognitive awareness and reading comprehension. Carrell, Devine, and Eskey (1988) and Sheorey and Mokhtari (2001) clearly define metacognitive awareness as reading strategies that readers employ during reading. They further

laborated that metacognitive awareness is the ability of the reader to set his reading goals and their awareness of their own reading process. The use of metacognitive reading strategies will enable readers to overcome problems they face when reading and ultimately help achieve reading comprehension. Research on metacognitive reading strategies has categorized these strategies into three subgroups: global, problem-solving and support strategies.

Global strategies are when readers plan their reading by previewing the text or having a purpose in mind whereas, problem-solving strategies refer to the actions of readers reading a text, such as guessing the meaning of words or rereading. Support reading strategies are those that readers use to assist in reading, such as looking up words in dictionaries or highlighting (Sheorey & Mokhtari, 2001). All these sub-categories fall under metacognitive reading strategies. When readers use metacognitive reading strategies, it enables them to overcome any problems they encounter and ultimately achieve comprehension. As stated in many studies, learners who are proficient readers utilize more metacognitive strategies than those who are less proficient (Magogwe, 2013; Miller, 2017), and they appear to monitor their reading process (Wu, 2014). This allows for better reading ability and proficiency. To become proficient readers, students should pay attention to metacognition and metacognitive strategies.

### **Metacognitive Online Reading Strategies**

Studies have indicated that metacognitive awareness is an essential reading strategy for successful comprehension. Similarly, various studies have explored the use of metacognitive online reading strategies among students at the university level. In a local study by Zailani Jusoh and Liza Abdullah (2015), OSORS was used to identify online reading strategies among 155 students. The study compared two academic disciplines to identify differences in strategy use among the two groups. The study concluded that there was no significant difference in the strategy used among the two groups. However, problem-solving strategies were most favoured. This contradicts Nor Fazlin Saaduyah and Nadzrah (2011) that found support strategies to be most favoured. Similarly, in another local study by Ruhil Amal, Nor Fariza and Afendi (2017) most students used metacognitive reading strategies when reading academic texts online. The study was conducted among 55 Science and Technology students in a public university. Data was collected through OSORS among students. The data revealed that the mean score for each sub-category was 3.79, 3.51 and 3.22 for problem-solving, global and support reading strategies respectively. Hence, this indicates that problem-solving strategies were mostly used by university students.

In recent years, various studies have focused on metacognitive awareness as a reading strategy at the university level. For example, Zaidatul Akmal Abd Hamid et al. (2020) conducted a study on 495 students in the Centre of Foundation Studies of a local public university using OSORS to find out their metacognitive online reading strategy awareness. The study revealed that the students mostly used problem-solving strategies when dealing with online reading materials, followed by support strategies, and the least used strategy was global reading strategies. In relation to that, it was also reported that the top three most used problem-solving strategies by the

students were re-reading the text, paying closer attention to what they read and reading slowly and carefully to understand the text. In another study done by Heri Mudra (2018), aimed to explore the metacognitive online reading strategies used by 65 pre-service EFL teachers at a state college in Indonesia and to describe their experiences implementing those strategies. Data were collected both quantitatively and qualitatively using OSORS and semi-structured interviews, respectively. His study revealed that global reading strategies were the most frequently used strategy by his respondents, followed by problem-solving strategies and the last was support strategies. Surprisingly, the results do not seem to correlate with the findings of other studies which reported problem-solving strategies as the most favoured strategy (Zailani Jusoh & Liza Abdullah, 2015; Ruhil Amal et al., 2017; Zaidatul Akmal Abd Hamid, Ismail Sheikh Ahmad, Mohd Shukri Nordin & Zainurin Abdul Rahman, 2020). Meanwhile, the results from the semi-structured interviews indicated that there were various strategies employed to comprehend the online texts - focusing on simplified and colourful texts, translating texts into their mother tongue, which is Indonesian, reading for fun and utilising schemata or previous knowledge. Overall, these studies highlight the need for the application of metacognitive reading strategies to become successful online readers.

### **Reading strategies and reading comprehension**

Newton et al. (2018) proposed interrelating skills and knowledge resources that affect reading comprehension among ESL students. Among the skills mentioned is the ability to apply reading strategies when dealing with difficult academic reading texts and observe reading comprehension with reading goals. However, the extent to which reading strategies employment's relation to reading comprehension is mixed (Gatcho & Hajan, 2019; Rastegar, Mehrabi Kermani & Khabir, 2017; Zuriyani Md Yasin & Mohamed Ismail Ahamad Shah, 2019). Gatcho and Hajan (2019) reported a significant increase in comprehension after explicit metacognitive reading strategies among ESL school students. A similar conclusion was reached by Rastegar et al. (2017), whereby a significant and positive relationship is found between metacognitive reading strategies and comprehension among ESL Iranian university students. This does not seem to be the case in the local Malaysian setting as Zuriyani Md Yasin and Mohamed Ismail Ahamad Shah (2019) pointed out that no correlation exists between reading strategies and reading comprehension. However, to become a proficient reader, students should pay attention to metacognition and metacognitive strategies.

## **Theoretical Discussion**

### **Metacognitive Theory**

The process of achieving reading comprehension requires a few factors related to metacognitive theory. Flavell (1979) posits that the mind perceives and monitors the cognitive process by determining the goals set for the task, strategies and actions employed to achieve the desired goals based on interactions between metacognitive experiences and metacognitive knowledge. Both metacognitive experiences and metacognitive knowledge are introduced as metacognitive strategies that relate to metacognitive theory. Metacognitive theory was expanded

into a metacognition model by Anderson (2002). This was then adapted to relate to the current study that focused more on reading strategies as opposed to Anderson (2002) that focused on mechanisms for learning strategies through metacognition. Both Flavell (1979) and Anderson (2002) theories and models were chosen for the current study because they depict principles that are useful for examining metacognitive reading strategies. Based on these principles, Anderson (2003) created an Online Survey of Reading Strategies (OSORS) that was very similar to Survey of Reading Strategies (SORS) created by Sheorey and Mokhtari (2001). However, OSORS and SORS differ in terms of some of the elements linked to reading online that cannot be used for reading printed texts such as 'search' activities. These instruments are widely used in SL reading research that included reading habits in an online environment, which SORS lacked.

## Methodology

The aim of the study was two-fold. Firstly, it attempts to identify metacognitive strategies frequently used by ESL learners while reading EST online materials. Secondly, it purports to assess the influence of these strategies in understanding the online materials. To achieve this, a mixed-method research design was adopted for this study. In doing so, semi-structured interviews were conducted to support the data gained from OSORS.

## Participants

Data were collected among students ( $n=55$ ) that were enrolled in English for Technical Communication (ETC) course undertaken in their second-year study from the various undergraduate Science and Technology programs at the university. The participants consisted of 39 (71%) male and 16 (29%) female students between the ages of 20-22 years old. From this sample ( $n=55$ ), ten students were purposely selected to take part in the semi-structured interviews. To elaborate further, opportunistic sampling was undertaken when selecting these ten volunteer participants as it can lead to novel ideas and surprising findings (Creswell, 2008). Pseudonyms were then used for each participating student ( $n=10$ ) to conform to anonymity.

## Instruments

Data was collected using a web-based survey platform. The survey consisted of a demographic profile and five-point Likert-scale statements. The statements were based on the Online Survey of Reading Strategies (OSORS) adapted and adopted from Anderson (2003). The survey measured metacognitive online reading strategies for academic purposes. It is made up of 36-items that measures: global reading strategies (16 items), problem-solving strategies (11 items) and support reading strategies (9 items) (Appendix A). The reliability for the Global Reading Strategies, Problem Solving Strategies and Support Strategies were 0.77, 0.64 and 0.69, respectively. The Cronbach alpha for the overall survey is 0.92. Hence, making the survey a reliable instrument. The semi-structured interview protocol was used to support the data gathered from OSORS. A set of questions was designed by the researcher that was guided by a study by Chen (2009) on a similar topic. Chen (2009)



explored students' online knowledge of reading strategies and their thinking processes as they read texts on the internet. Similarly, the current study also explored these elements of online reading strategies and measured strategy applications before, during and after reading materials on the internet. Ultimately, the questions used by Chen (2009) were restructured and used for the current study that explored tertiary level students' online reading strategies when reading academic EST online materials.

### Data Collection

Data was collected twice (in week two and week four) during a 14-week academic calendar. In Week 2, the students (n=55) answered OSORS through an online survey. Students took approximately 15 minutes to complete the survey that was conducted through Survey Monkey after class time. From the sample, ten students were selected to be involved in the semi-structured interviews. In Week 4, the interviews were conducted at the participants' preferred time and location. All 10 participants agreed to be a part of the research and filled up consent forms. It was also agreed that pseudonyms would be used throughout the study to conform to anonymity.

### Data Analysis

To obtain the frequency of each sub-category from OSORS, quantitative data analysis was determined through mean, median, standard deviation mode, which was computed through Statistical Package for Social Science (SPSS) software. However, qualitative data analysis was analysed and cross-checked by two raters. This form of verification was crucial to determine the level of agreement among the raters towards the themes created by the researcher. These raters are considered 'outside' experts who can confirm the themes and act as neutral individuals toward the data analysis (Cohen, 1960). The rating process was conducted separately and the rater's agreement on the codes, their definitions and comments were noted. Then, the researcher discussed any disagreements and feedback. Next, modifications were made based on their suggestions. The numbers of agreed and disagreed items from each rater were then gathered and calculated to obtain the Kappa value. The Kappa value was pulled from the interview data.

To validate the themes, Cohen Kappa inter-rater reliability analysis was used in the SPSS software. Cohen's Kappa was used to calculate the probability of similarity between the raters. The following formula was used to calculate the Kappa value of the developed themes.

$$k = \frac{fa - fc}{N - fc}$$

Inter rater one:

$$k = \frac{18 - 10}{20 - 10} = \frac{8}{10} = 0.8$$

Inter rater two:

$$k = \frac{16 - 10}{20 - 10} = \frac{6}{10} = 0.6$$

Mean score  $.8 + .6 \div 2 = 0.7$

The calculation yielded a K value of 0.7 for the interviews. The K value for the interviews indicated there was substantial agreement thus, showing that the data analysis had high reliability. Another method for enhancing data trustworthiness and credibility is through triangulation. Denzin (1978) as cited in Merriam (2009) addressed four triangulation types, where this study applied multiple methods of data collection to triangulate the data. For this, data collected from OSORS was checked against what students answered in the semi-structured interviews. The purpose was to also identify how OSRS reflect students understanding of reading online materials. In addition, for the semi-structured interviews, the themes that were derived from the interview transcripts were matched with the OSORS statements alongside the descriptive statistics.

## Results

This study explored the metacognitive online reading strategies mostly used by students in reading EST online materials. In doing so, a survey was conducted online using the Online Survey of Online Reading Strategies (OSORS), which consists of three parts: Problem Solving strategies, Global Reading strategies and Support Reading Strategies. In addition, semi-structured interviews were conducted to support the data gained from the OSORS, which were then matched against the statements in OSORS and reported. Each subpart is described statistically in the following sections.

### Problem-Solving Strategies

The three most frequent problem-solving strategies used were P26 (When an online text becomes difficult, I reread it to increase my understanding), P14 (When an online text becomes difficult, I pay closer attention to what I am reading) and P9 (I try to get back on track when I lose concentration) with the mean score  $M = 4.40$ , 4.26 and 4.13, respectively. For P26, out of 55 participants, 29% answered “4” *usually* and 56% answered “5” *always*. This showed that a total of 47 students chose to reread an online text which is difficult to comprehend.

The second highest strategy number P14, with a total of 47% answered “4” *usually* and 40% answered “5” *always* equating to a total of 48 students who concentrate on their online reading materials when the text becomes difficult. While the third highest statement under problem-solving strategies was P9 where, 45% answered “4” *usually* while 36% answered “5” *always* indicating that 45 students believe they would get back on track when they lose concentration. Similarly, these three statements were also listed in the top 5 problem-solving strategies frequently used by the participants in the study conducted by Zaidatul Akmal Abd Hamid et al. (2020) and generally, most of the statements under this strategy received high mean scores. Overall, data on OSORS indicated that students used problem-solving strategies the most in reading online materials for academic purposes. Figure 1 shows the strategies most employed under problem-solving strategies.

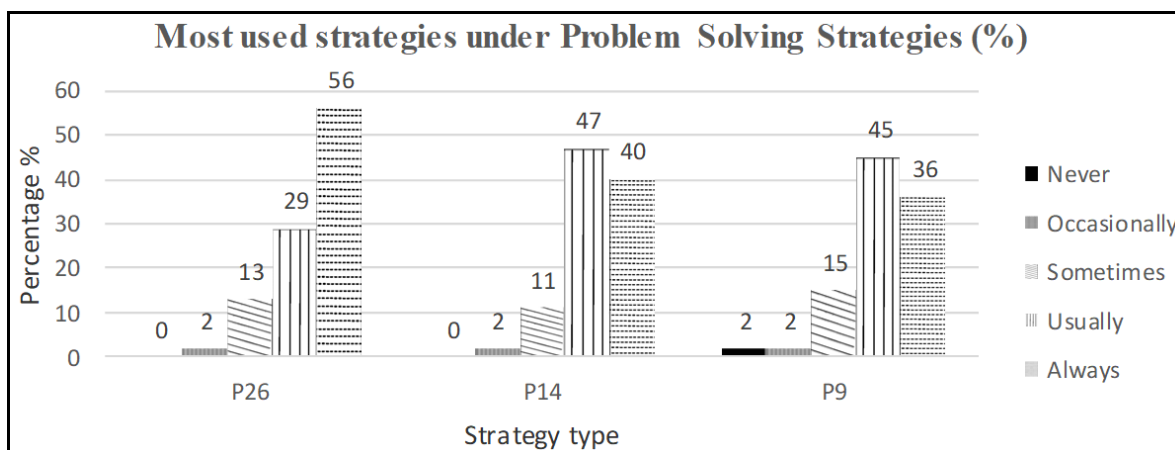


Figure 1. Problem-Solving Strategies

In addition to the data obtained from OSORS on problem-solving strategies, identification of problem-solving strategies was also obtained through semi-structured interviews. For example, three students mentioned the need to evaluate online reading texts by rereading the materials. This was problem-solving strategy No 26; *when an online text becomes difficult, I reread it to increase my understanding*. The extracts below depict this point:

- “Because just now I got write down the important points, then I will *go through the text again* so as to make sure I understand the context.” (Will)
- “I will print out the article and *read it again*.” (Fatin)
- “After reading, I will usually *look at my points* that I have jot down then I *look whether it is complete* or incomplete and if it is nothing much information that I get, then I will go to another text.” (Ida)

All three students above believe that rereading an online text would assist them to understand the texts better. This proves that online reading strategies were significant in understanding online scientific materials. For example, a study in a local context found students used problem-solving strategies the most in reading an English text to understand what they read (Abdul Rahim Hamdan, Mohamed Najib Ghaffar & Ahmad Johari Sihes, 2010). The study was conducted among a group of 57 students in a tertiary level institution in Malaysia. The study found that students put more attention to difficult texts by rereading them to increase understanding. Hence, problem-solving strategies such as rereading difficult texts are important for ESL learners. Meanwhile, two students reported using problem-solving strategies by evaluating the texts while reading online. The extracts below reflected strategy No 32; *I critically evaluate the online text before choosing to use information I read online*.

- “I try to find more sources and *analyse each source whether it is reliable* or not reliable. I try to collect more information, then only I categorise the information.” (Omar)
- “I try to *evaluate* the text. Do I need it?” (Amin)

Based on the excerpts above, two students admitted the need to evaluate online reading materials. This shows that students set their reading goals by evaluating the online reading text. Analysing the text critically helped the readers to decide whether to adapt the content or not (Heri Mudra, 2018). To summarize, Table 1 illustrates the themes identified in the interview responses that were matched with problem-solving strategies items in OSORS.

Table 1. Semi-Structured Interview Themes Matching Problem-Solving Reading Strategy Statements

Themes	Statement No.	Problem-Solving Strategy (in OSORS)
Reread online materials ( $n = 3$ )	26	When an online text becomes difficult, I reread it to increase my understanding.
Evaluate online text ( $n = 2$ )	32	I critically evaluate the online text before choosing to use information I read online.

Referring to Table 1, data gained from OSORS was supported through the analysis from the semi-structured interviews. The themes derived from the semi-structured interviews matched strategy No 26 ( $n=3$ ) and 32 ( $n=2$ ) in OSORS. Similarly, a study that looked at types of metacognitive online reading strategies and frequency in the use of these strategies found that less proficient learners used problem-solving strategies the most while proficient learners were found to use global strategies the most (Eghlidi, Abdorrahimzadeh, & Sorahi, 2014). A probable explanation for this is that students needed to take actions while working with online texts to achieve comprehension. They believed this is dealt with rereading when encountering difficult texts, paying closer attention to the difficult text they are reading and critically thinking about what they are reading, all of which are important components of problem-solving strategies.

### Global Reading Strategies

The highest mean score for global reading strategies was for strategy number G3 (I think about what I know to help me understand what I read online) with 4.02, followed by strategy number G18 (I use context clues (i.e. look at other words) to help me better understand what I am reading online) with a mean score of 3.82 and 3.71 for strategy number G24 (I check my understanding when I come across new information). Both G24 and G25 (I try to guess what the content of the online text is about when I read) have the same mean of 3.71, and hence, the standard deviation is considered. The standard deviation for G24 is 0.78 while standard deviation for G25 is 1.04. G24 is chosen as the most-used global reading strategy instead of G25 because of its smaller standard deviation. A smaller standard deviation indicates that the data has small variation, and the data is less dispersed. Smaller standard deviation also means that the data is more consistent and, therefore, more precise.

Based on global reading strategy number G3, 58% answered “4” *usually*, while 23% answered “5” *usually*. This indicates that 45 participants (81%) think about what they know to help them understand what they read online. Based on Schema Theory, recall and comprehension are dependent on the reader’s background

knowledge and how it is matched to textual data (Carrell et al., 1988). This shows that background knowledge plays a significant role in online reading comprehension. With 53% answering “4” *usually* and 20% “5” *always* for strategy number G18, this clearly illustrates that students ( $n=40$ ) used contextual clues to help them have a better understanding of what they read online. In addition, more than half (66%) ( $n=36$ ) of the participants checked their understanding when they came across new information while reading online. This contributes to 53% of students that answered “4” *usually* while 13% answered “5” *always*. Figure 2 depicts the most global reading strategies used by students.

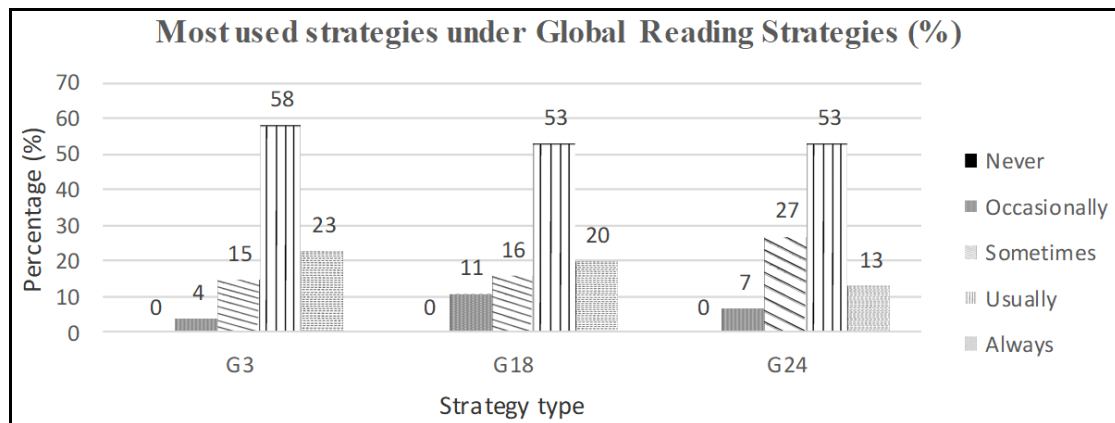


Figure 2. Global Reading Strategies

Based on the semi-structured interviews, having a purpose in mind before reading EST online materials is important. This theme matched OSORS strategy No. 1 *I have a purpose in mind when I read online*. The extracts below described this further:

- “I think I will clear my mind and *focus on what I am reading*.” (Seth)
- “Before I start reading, *I am going to plan* what am I going to search and *what is it about* before I look for the text.” (Kaden)
- “I read the title and then I try to understand, *if it’s interesting I will read everything if it’s not I am going to stop*.” (Omar)

Two of the students (Seth and Kaden) claimed they used this strategy before reading EST online materials. Another student (Omar) will determine what to read and what to ignore. This finding echoed an earlier study on online reading among 54 ESL university students where global strategies were found to be used more for reading online materials (Ostovar-Namaghi & Noghabi, 2014). The study concluded that when students can plan their reading, it implied that they were clear about the objectives of reading. This becomes a determining factor for successful learning. As Sheorey and Mokhtari (2001) hypothesize, metacognitive awareness encompasses the ability to set reading goals and awareness of the reading process. Based on the interview excerpts, it can be concluded that all three students utilize metacognitive knowledge. This contributes to successful reading of

online materials.

Scanning through the text before reading was one of the most preferred global strategies students used. This was like OSORS strategy No 30; *I scan the online text to get a basic idea of whether it will serve my purposes before choosing to read it*. The interview transcripts below illustrate that students scanned the text before reading.

- “Basically, when I am just reading the Science and Technology hypertext, I am just *scanning through* the lines and paragraph.” (Ida)
- “Before I read the text from the online and because the text is very long right, *I will go through some points* from the text *to see what the points are* in the first paragraph, second paragraph, and third paragraph so on. So, *I can easily understand* about the content inside later on.” (Will)
- “Normally I will *scan through* the article first rather than reading the entire text.” (Tini)
- “Normally I will *scan through* the article first la”. (Fatin)

Four students employed scanning strategy before reading to gain a general idea of the passage. It is considered a global reading strategy that provides students with an overview of the text. Clearly, students believe scanning through the online material is a much-needed reading strategy. This strategy transferred from paper-based reading was also found in a study that investigated online reading (Park & Kim, 2017). The study found that students adjust their reading strategies based on different reading environments and purposes. Overall, these results corroborate the notion that students transferred paper-based reading strategies to online reading.

Another feature of Global reading strategy that was identified in students' reading process was strategy No. 16; *I use tables, figures, and pictures in the online text to increase my understanding*. This is an important reading strategy as it allows readers to predict the text. In doing so, students would be able to activate their background knowledge when they apply this strategy before reading. This form of global reading strategy includes noting the length of the text, number of paragraphs or number of words. Interview excerpts below support this finding.

- “Normally I will read the title first and then *see whether it contains the graphics or photos* and then I will direct to the contents.” (Cindy)
- “I will see the *title first*. Mostly I’ll see the title first.” (Qay)
- “First, before I read an article I will *look for the title of the article* about what and then I will *open several article* and *read overall*.” (Fatin)
- “Before I read, I will skip through to the end and *count as how many paragraph* it has.” (Amin)

The excerpts above highlight four examples of students reading strategy in noting text features such as graphics or photos and number of paragraphs. This reading strategy may provide students with beneficial information about the text to increase their understanding of the reading text. Identifying text features before reading is important because it prepares students for what to expect in the reading texts. The students admitted that they

would scan the text, look at the title, and note text features before reading. According to Heri Mudra (2018), students preferred reading simplified and colourful texts which can help them to visualize the information to better understand the texts. Hence, it is important for students to utilize appropriate reading strategies before reading to activate their background knowledge of the reading materials. Table 2 illustrates global reading strategy statements matching the themes derived from the semi-structured interviews.

Table 2. Semi-Structured Interview Themes Matching Global Reading Strategy Statements

Themes	Statement No.	Global Reading Strategy Statement
Having a purpose ( $n=3$ )	1	I have a purpose in mind when I read online.
Scanning ( $n=4$ )	30	I scan the online text to get a basic idea of whether it will serve my purposes before choosing to read it.
Using text features and noting text characteristics ( $n=4$ )	16	I use tables, figures, and pictures in the online text to increase my understanding

As shown in Table 2, the themes identified in the semi-structured interviews that matched the global reading strategies obtained from the OSORS are strategy No. 1 ( $n=3$ ), strategy No. 30 ( $n=4$ ) and strategy No. 6 ( $n=4$ ). It is apparent from this table that students used global reading strategies when reading online materials. Hence, reflects the use of online reading strategies in understanding online reading materials.

### Support Strategies

The three most frequently used strategies under support strategies were strategies number S13 (I use reference materials (e.g. an online dictionary) to help me understand what I read online), S23 (I go back and forth in the online text to find relationships among ideas in it) and S36 (When reading online, I think about information in both English and my mother tongue). The lowest among the three most used support strategies is strategy S36 with the mean score of 3.71. 19 students answered “4” *usually* and 15 “5” *always* indicated that students do think about what they read in the language that they were familiar with to ease their understanding when reading online materials.

Strategy number S23, received the second most mean,  $M = 3.76$  among the three most used support reading strategies. This shows that students try to find relationships among ideas when they read online materials to increase their understanding. On the other hand, strategy number S13 gave the highest mean,  $M = 3.93$ . Strategy number S13 indicates that participants use reference materials to guide them in understanding the text they read with 38 students stating that they *usually* and *always* do this. Figure 3 shows the most strategies used under support reading strategies in percentages.

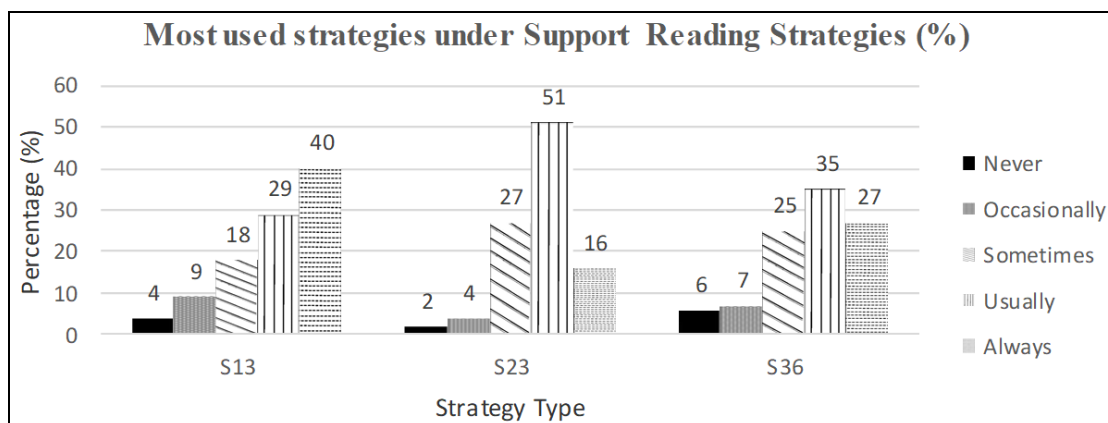


Figure 3. Support Reading Strategies

It is believed that support strategy No 2 *I take notes while reading online to help me understand what I read* are reflected the most in the semi-structured interviews. Most students have a preference to use this reading strategy while reading EST online materials. As displayed in the excerpts below, eight students reflected this reading strategy:

- “I will *take note the important information* that I wanted. I will *jot down the points* that I get from the text and I will try to understand from the elaboration.” (Ida)
- “I will find the main point and *make some writing on the paper* about the main point. That is all”. (Amin)
- “Maybe *I can jot down in the notebook* and somewhere then *next time I can use* it when I want to find out”. (Cindy)
- “I usually will *jot down the important points* from what I read. For future reference I guess”. (Tini)
- “After I read something like note means something that related to academic, I will make some *note in a piece of paper* so that I will know what the main point of the text I read.” (Kaden)
- “I will prepare a paper or prepare the note inside the laptop, then I will go through the points and *write it down the notes and maybe highlight* it. Or *I’ll underline certain words* that I don’t understand.” (Will)
- “While reading, I will *underline the main points and important messages* that being delivered from the text or *I will do a mind-map* in simpler form so that I can roughly get what it meant by just referring to the mind-map.” (Seth)

The interview transcripts above reflect the strategies students used when they read EST online materials by writing down important information, underlining main points and even doing a mind-map. They believe that these strategies are important because the notes that are written down may be used in the future or can be used as a reference and shared with others. This indicated that the students do invoke conscious strategies and utilize metacognitive knowledge in reading. Flavell (1979) posits that metacognitive knowledge allows a person to prioritize tasks and use various strategies to achieve the desired goals.



After reading EST online materials, some students summarize and paraphrase the ideas to understand and remember the texts better. This is support strategy No. 19 in OSORS *I paraphrase (restate ideas in my own words) to better understand what I read online* as depicted in the excerpts below:

- “I will *summarize my ideas and rewrite it* in full sentences so that it is complete and can understand better.” (Seth)
- “Because just now I got write down the important points, then *I will go through the text again and paraphrasing* it so as to make sure I understand the context.” (Will)
- “I will *summarize the point of article* and rephrase it a little”. (Fatin)
- “I just *review it again* and *make it simpler*.” (Ida)
- “I usually *make a conclusion* about it. I bear in mind what I understand from the paragraph.” (Kaden)

The excerpts above illustrate various forms of support reading strategies that students use. This includes summarizing, paraphrasing, and reviewing. According to the students, these strategies enable them to understand and remember the texts better. Another common support strategy used by students was to use reference materials such as online dictionaries and Google Translate to understand what they are reading online. This is support strategy No 13 *I use reference materials (e.g. an online dictionary) to help me understand what I read online*. This can be seen in the interview excerpts below.

- “I always read the text first. Later if I do not know the words, some vocabularies, so I will *check the dictionary*”. (Qay)
- “I *check the dictionary online*. So, that later on I can go through the text easily. Also, I will go *google search* the words. Other than google search, like wikipedia and so on”. (Will)
- “Sometimes when I found the problem I just *google* actually or I *look for dictionary* to find the meanings”. (Tini)
- “For phrases, I just basically ‘*google*’ it and then try the different webs that give the *meaning for that terminologies*.” (Ida)
- “I will *refer to the dictionary* or internet...Try to *search for the meaning of the phrases*”. (Kaden)
- “I will *refer to dictionary* to search for the words and its meaning online. I also *look for example of sentences and the way of using that words in a sentence*...I will search online maybe other websites maybe google translate for the meaning of the phrases.” (Seth)

As the interview excerpts depict, students relied heavily on using online dictionaries and Google Translate when they face reading difficulties such as incomprehensible words or sentences during reading. This indicated that students monitor their reading process by making the effort to comprehend the text they are reading. Students comfortably resort to these online resources when they face decoding problems. Using online support resources to compensate for the lack of word knowledge is found to be common among learners in online reading environments (Huang, Chern, & Lin, 2009) because decoding is crucially important for reading comprehension

(Grabe & Stoller, 2013). To summarize, Table 3 illustrates OSORS statements that matched the themes derived from the semi-structured interviews.

Table 3. Semi-Structured Interview Themes Matching Support Reading Strategy Statements

Themes	Statement No	Support Reading Strategy Statement
Taking down notes ( <i>n</i> =7)	2	I take notes while reading online to help me understand what I read
Paraphrasing & summarizing ( <i>n</i> =5)	19	I paraphrase (restate ideas in my own words) to better understand what I read online
Using reference materials ( <i>n</i> =6)	13	I use reference materials (e.g. an online dictionary) to help me understand what I read online

It appears that strategy No 13 (*n*=7), is an important global reading strategy for the students. Students believe they need to use reference materials such as online dictionaries and google translate to help them understand difficult online reading materials. They also needed to ask friends or lecturers to understand some difficult reading texts they encountered.

## Discussion

Results from OSORS indicated that students perceived problem-solving strategies to be more useful than global and support strategies. However, there is an inconsistency of data in OSORS to that of the semi-structured interviews. The interviews found problem-solving strategies to be the least used and support reading strategies were used the most by students. For example, 8 students admitted to taking notes while reading online, another 5 admitted to paraphrasing and summarizing ideas read online, while another 8 used reference materials to assist reading of online materials. In contrast to problem-solving strategies, only 3 students reread and 2 evaluate online materials. In total, there were 21 counts of using support reading strategies compared to only 5 students using problem-solving strategies. As reported by Zailani Jusoh and Liza Abdullah (2015), students in Information Technology course were generally more familiar with the Internet features such as online dictionaries and references, which could be a probable explanation why they employed more support reading strategies compared to other students in different field of studies. This is similar in the current context as students in this study. As all participants were from Science and Technology background, they might be applying support strategies more frequently than the other strategies due to the nature of the reading materials that they are dealing with throughout their studies. In addition, Zaidatul Akmal Abd Hamid et al. (2020) also reported that the use of reference materials to aid reading of online materials had the highest mean score of 4.17 in their study and none of the statements under support strategies fell under the low level of mean score. This shows that students are quite familiar with the use of support strategies when reading online.

Based on semi-structured interviews, most of the students reported that they are quite capable of using various

strategies in reading online materials. Four students (Will, Fatin, Ida, and Kaden) use all the strategies (problem-solving, global and support strategies) when reading online. However, there is some evidence to suggest that students lack other important reading strategies such as guessing contextual clues, visualizing information, and deciding what to read and whether content of online text fits reading purposes. These strategies are important to equip learners with online reading skills for them to effectively learn in an online environment (Magogwe, 2013). As past studies show, many students still need guidance at all levels and in most content areas (Green 2013; Lai et al 2014 and Wise 2009 as cited in Armbrecht (2018). Lessons should be executed to show or demonstrate how to use these strategies successfully. Therefore, there is a need to continue applying online reading strategies such as problem-solving strategies efficiently at all levels, including university and in all subject areas with multiple modalities.

The data also revealed that the metacognitive online reading strategies chosen were interrelated and led to one objective that is to improve student's understanding towards the text they read online. This is especially important for ESL students who are reading EST online materials at a higher level. Students in higher education need to use higher order thinking skills when reading academic online materials such as EST. Based on the statements selected by the students, it is believed that students need to apply these strategies in reading online materials at tertiary level.

## **Conclusion**

The aim of this study was to explore the metacognitive online reading strategies used by university students in reading EST online materials. The contrasting data from two research instruments found a mismatch in the application of metacognitive online reading strategies among the students. The mismatch of data describing the students' familiarity to reading strategies may depend on the type of texts, need and the nature of texts (Daguay-James & Bulusan, 2020). Although students are prone to unconsciously reverting to metacognitive reading strategies, Ruhil Amal et al. (2017) asserts the need for students to be guided in the process of applying metacognitive reading strategies to promote effective understanding of texts. The employment of online metacognitive reading strategies emphasised the need for students to be aware of their reading objectives. The participants are ESL science and technology undergraduate students who are confronted with technical reading materials that require problem-solving strategies more than global and support strategies. The focus and interaction with a reading text will differ uniquely from field to field. It is imperative to note that the popularity of metacognitive online reading strategies found in this study is not conclusive to all technical fields.

## **Recommendations**

There are several emerging research directions in the study that call for further action. The most prevalent research direction is the need to draw comparisons between different datasets. The engagement of focus groups with students from other fields of study can provide a comprehensive input on the effectiveness of online

metacognitive reading strategies. In addition to obtaining insights on the effectiveness by comparing the two datasets, the inclusion of a bigger sample in a study could provide a better representation of students' online metacognitive reading performance. Secondly, the underpinning of this study focused solely on online reading strategies in the academic settings. Future research could focus on the integration of technological tools and learning management systems in achieving comprehension regardless of texts. Another potential research strand is studying students' experience whilst applying online reading strategies. By investigating students' experiences in applying online reading strategies, not only will it provide insights into students' motivation but will also aid future research in understanding why certain reading strategies are preferred by students. This research is hoped to be a source for future contributions in studying metacognitive reading strategies.

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## Flipped Language Learning for Arts Students

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**Abstract:** Flipped learning is a teaching methodology which holds most theoretical learning in asynchronous regime online, after which practical classes are conducted face-to-face. This constructivist methodology became especially valuable during and after the total online learning during the COVID-19 pandemic. The greatest academic benefits of this methodology have been found in language, technology, and health-science (i.e., skills-based) courses. Among the English for Specific Purposes (ESP) directions, teaching arts students offers considerable advantages, as it enables the teachers to pre-teach the ESP language (terminology), as well as lets the students participate in virtual excursions to museums, view other videos related to the topic under study at the pace most comfortable for them, so that they are well prepared to the discussion and other communicative activities in class. A survey was conducted among students of an art university in Georgia. The conclusion was made that the majority of students like the methodology, especially if the homework part provides enough support in language (vocabulary, grammar) needed for the comprehension of the video materials.

**Keywords:** Flipped learning, Asynchronous regime, Face-to-face learning, English for specific purposes, English for arts students

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### Introduction

Flipped learning is a teaching methodology which holds most theoretical learning in asynchronous regime online, after which practical classes are conducted face-to-face. The idea of ‘flipped’ (or opposite to traditional) chemistry lessons was first suggested by Bergmann and Sams (2012):”Basically the concept of a flipped class is this: that which is traditionally done in class is now done at home, and that which is traditionally done as homework is now completed in class” (p.13). First, they found that using recorded classes helps students who miss classes to catch up with the class. Further, their students decided to apply the pre-recordings as homework – they watched them, and did their best to understand. The explanation in the classroom was based on students’ questions and helped them understand better what they had watched, so the educational process was student (and not teacher or coursebook)-centered. This enabled the researchers to personalize the face-to-face classes, as every student had a chance to ask questions and receive answers. The flipped class was more authentic than a regular one, as it moved out of classroom (videos could show processes in a lab or in a factory, etc.). The students could record their projects and share them with other students, while the discussion would take place in

class. As theoretical learning was done at home while listening to the ‘lectures’, in class students could develop (in case of language teaching, communicative) skills and gain practical experience. Teachers in flipped classrooms are not necessarily the material presenters: they are rather tutorial authors and/or selectors.

With time, the ideas of flipped classroom spread from science classes to language classes. Contemporary foreign/second language teaching is focused on communication and not learning about the language (Ellis, 2012; Loewen, 2014). However, students to some degree need to learn about language (e.g., vocabulary meaning, grammar rules in order to do admission and language level defining tests) and culture (to use the language appropriately) as well, and this can efficiently be done via the videos given to students as homework. As videos are watched individually, the language teacher can adjust the selected materials to the students’ language levels (e.g., videos on the same topic, but of different difficulty level) and interests (e.g., on sports topic winter and summer, male and female, athletic and artistic sports can be offered). In Brown and Lee (2015), Nation’s (2007) ten principles were interpreted for flipped language classes: comprehensible input through listening and reading, using activities raising consciousness (pre-listening or pre-reading tasks), variety, collaborative activities, deliberate learning of grammar, pronunciation and vocabulary in authentic context, developing language learning strategies (offering relevant videos), extensive listening/reading, focus on meaning, re-using the materials when/if needed, continuous assessment.

Of course, flipped language learning was characterized not only by the advantages discussed above, but also by some challenges. Cunningham (2017), for example, mentions that it is not easy to find reading/listening and video materials that exactly fit the syllabus and meet the students’ needs and language level. The search of relevant materials, due to it, is time-consuming. Students who did not apply this sort of pre-teaching materials would come to class, unable to participate in the activities. Then the teacher might need to present the materials to his/her students quickly. However, a more communicative outcome may be found – a brief small group activity can be organized in which students who did the homework have their peers quickly informed about it.

### **ESP and Flipped Learning**

“In comparison with teaching EGP (English for general purpose), teaching ESP usually faces a lot more challenges. Focusing on the specific needs of the learners based on the need analysis, concentrating more on language in context and on the students’ need to acquire a set of professional skills and particular job-related to each function, ESP remains a major testing experience for every teacher in charge of it” (Fălăuș, 2017, p. 6). As teaching and learning ESP entails additional difficulties compared to teaching English for General Purposes, special approaches are needed to teach it efficiently. Flipped learning is one of such possible approaches.

According to Lee (2017), while applying flipped learning in English for Specific Purposes (ESP) classes “the impact on the student experience is significantly positive and with a higher level of satisfaction by students especially for those students who have TOEIC test experience before” (p. 4995). Parvaneh, Zoghi and Asadi (2020) found a significant positive effect of flipped classroom method on autonomy, which also reduced the



anxiety of Iranian language learners.

Hsiao (2021) held a quasi-experimental study with students who did not major in English, but studied it for Specific Purposes (ESP). The results of his study revealed that the experimental group students developed significantly higher self-efficacy and received higher course grades both for English and specialty courses than the control group. Moreover, the students' higher-order cognitive skills (critical thinking) improved. The students became able to make numerous associations between ideas. Fard et al. (2022) study demonstrated the positive influence of the flipped classroom on the students' task engagement and their critical thinking skills. Ebadi et al. (2022) studied the effects of flipped vocabulary learning via an online dictionary on EFL learners' listening comprehension. The students had to learn new vocabulary (the list of 20 vocabulary units per lesson offered to the students) via online dictionaries. They had to pay attention to the definition, antonyms, synonyms and the part of speech the words belonged to. The findings of the study suggested that flipped vocabulary learning can be applied as an effective instructional tool for the development of listening skills.

Therefore, flipped learning can benefit ESP (arts) students in the following ways:

- it enables the students who missed the class to catch up with their peers;
- it provides a comfortable learning environment (anxiety-devoid, timing and speed, number of repetitions);
- it is student-centered;
- it is authentic (language, activities);
- it enhances the communication in class;
- it enhances collaboration and cooperation;
- it helps develop their vocabulary (terminology) skills (especially, through electronic dictionaries and encyclopedias);
- it develops their reading and listening skills (increases the volume);
- it increases students' motivation, engagement and satisfaction.

### **Flipped ESP Teaching during the Pandemic**

This constructivist methodology became especially valuable during and after the total online learning during the COVID-19 pandemic. While flipped learning before the pandemic involved online homework and offline classes, during the pandemic both stages were realized online: online homework done by the students asynchronously and online classes in the synchronous regime. For those students who were already accustomed to flipped learning, getting adjusted to fully online learning was less painful. Montaner-Villalba (2021) assessed the students' perception of the development of academic writing skills through flipped learning during the COVID-19 pandemic; the results of their study revealed that the students assessed the importance of general English writing skills with a mean of 4.4 on a 5-point Likert scale, while they assessed their own general English writing skills at 2.8 level and Business English writing skills at 2.81. In students' assessment, their

competence in Business English writing through flipped learning increased a lot – to 4.7. Mundir et al. (2022) compared face-to-face, flipped (homework online and classwork face-to-face) and completely online learning of vocabulary and found that both online and flipped groups outperformed the face-to-face group, while the flipped group had the highest results.

## Method

A survey was conducted among students of an art university in Georgia. The tool used was a researcher-made questionnaire in a 5-point Likert scale format. The questionnaire was assessed for content validity by three professors in the relevant field and by a test-retest procedure for internal consistency (reliability) with 10 students who further were not involved in the study. R was found to be equal to 0.92, which is quite high.

Four flipped classes were held to a mixed-specialty group student (totally 18 students) during one month. The researcher selected the reading / watching materials and made up the tasks. For the first class, the teacher shared with the students a text selected online dealing with their specialty. There was a list of vocabulary with definitions, translations and examples. The students had to fulfil gap-filling and multiple-choice tasks on the vocabulary online at home. For the second class, the students were asked to find online a text about his/her favourite artist, to make up a list of key terms (minimum 20) used in the text, with definitions, translations and examples. The results of their work had to be uploaded to the group created for the purposes of the research. In class they had to present a short abstract of the text and answer their peers' questions on it. For the third class, the teacher chose a short video "What art museums are for?" (<https://www.youtube.com/watch?v=ThyY7efQJP0>). Several sentences from the video were grammatically analyzed for the students. The students had to fulfil gap-filling and multiple-choice tasks on the grammar emphasized in the teacher's materials online at home. And the final class, the teacher asked the students to find a short video about a museum of art and to upload the links to the group. During the face-to-face class 2-3 students chosen at random during the class demonstrated the videos and answered their peers' questions on it.

The structure of the classes was defined by the fact that flipped teaching arts students offers considerable advantages, such as it enables the teachers to pre-teach the ESP language (terminology), as well as lets the students participate in virtual excursions to museums, view other videos related to the topic under study at the pace most comfortable for them, so that they are well prepared to the discussion and other communicative activities in class. The questionnaire was held online.

## Results

The students mentioned to the teacher that they were especially pleased with the classes when it was the teacher who provided the vocabulary included in the reading and in particular in listening texts. The questionnaire was online for one week and then closed. The obtained results are presented below.

Table 1. Questionnaire results

Item / descriptive statistics	1	2	3	4	5	M	SD
1. Have you ever before experienced the flipped learning?	18 (100%)	0	0	0	0	1	.00
2. Were the four classes held as flipped learning difficult for you?	5 (28%)	8 (44%)	2 (11%)	1 (6%)	2 (11%)	2.28	1.27
3. Did these classes help you more than usually to learn the vocabulary / terminology?	0	2 (11%)	1 (6%)	7 (39%)	8 (44%)	4.17	.99
4. Was this way of dealing with grammar comfortable for you?	1 (6%)	2 (11%)	3 (17%)	5 (28%)	7 (39%)	3.83	1.24
5. Do you think that the flipped classes contributed to the development of your reading skills?	0	1 (6%)	1 (6%)	7 (39%)	9 (50%)	4.33	.84
6. Do you think that the flipped classes contributed to the development of your listening skills?	0	0	0	8 (44%)	10 (56%)	4.56	.51
7. Did you enjoy the flipped classes?	0	0	2 (11%)	9 (50%)	7 (39%)	4.28	.67
8. Would you like to go on learning in this way?	0	1 (6%)	1 (6%)	6 (33%)	10 (56%)	4.39	.85

The standard deviation for items 2 and 4 is higher than 1, which reveals that on these issues the opinions of the respondents differed significantly, on other items their opinions are quite unanimous. All students have never experienced flipped classes before ( $M=1$ ). The majority of them (83%) did not view the approach as a difficult one ( $M=2.28$ ). They confirmed that the flipped classes helped them improve their vocabulary ( $M=4.17$ ), grammar ( $M=3.83$ ), reading ( $M=4.33$ ) and listening ( $M=4.56$ ) skills. The majority of them (89%;  $M=4.28$ ) enjoyed the flipped classes and would like to go on learning in this way (89%,  $M=4.39$ ).

## Discussion

The lack of Georgian students' awareness about flipped classes in the current research is in line with that of

Korean students (Kim et al. 2015). Concerning the difficulties of flipped learning, Farrah and Qawasmeh (2018) mention only the technical ones (availability of the necessary technologies in class and at home), otherwise “the participants considered the flipped classroom exciting, motivating, and engaging” (p. 275), which is in line with the findings of the current research. The current study stated the positive impact of flipped language learning on the development of vocabulary skills. Likewise, Kirmizi and Kömeç (2019) found a positive impact of flipped classes on their students’ vocabulary skills. Pudín (2017) found that the students benefitted from flipped learning of grammar, which is in line with the given study. Karimi and Hamzavi (2017) found a beneficial effect of flipped learning on reading schools, while Amiryousefi (2019) revealed its positive impact on listening and speaking skills, as well as engagement in the class activities. This is relevant to the findings of the current study.

## Conclusion

Flipped language learning is beneficial for arts students, as it improved their vocabulary, grammar, listening and learning skills more than the traditional classes with no online pre-teaching provided as their homework. Although students have not earlier experienced flipped classes, they did not find them difficult, on the opposite, they enjoyed them and would like to continue such learning. Their attitude was especially positive when the homework part provided pre-teaching of vocabulary and grammar needed for the comprehension of the video materials.

## Recommendations

Using virtual excursions to museums and other videos as homework is highly recommended for teaching English to arts students. Flipped classes in which sometimes the teacher does the preliminary explanation and sometimes the learners themselves develop the language materials as homework, and then a big part of the face-to-face class can be dedicated to communicative activities will be both enjoyable and effective.

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## Moodle System for Preparation Surgery Medical Students during the War

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**Abstract:** Martial law has been introduced in Ukraine since February 24, 2022. Which other sectors, the education sector has been affected by this dire situation: educational institutions have started distance learning. Initially, a forced vacation was organized for the students, it was closed all educational institutions, teaching and learning are suspended activity. Subsequently, the training was continued in an online format for domestic and foreign citizens of all forms of education. Taking to attention, that the proper teaching of surgery in the whole complex of others discipline creates conditions for quality medical practice in the future, it became necessary to optimally use the modern one's information resources and technologies. Learning should be active the process is giving students tasks to use the received information in practical situations, while different ones are offered forms of communication: game, joint work, exchange of ideas when students can develop knowledge and skills using various cognitive and operational means and tools. At the same time, students are studying record and display their activities. This study aims to examine the effectiveness of remote of e-learning among medical students during study disciplines "Surgery" - module 1 "Emergency abdominal surgery and proctology" and identify possible problems, limitations, satisfaction as well as prospects for this learning approach in extreme conditions, especially learning practical skills in the context of distance learning of surgery. Practical skills include several categories of material, intended for assimilation and reproduction by students.

**Keywords:** Medical, Students, Moodle, Surgery, Education

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## Introduction

- 1) The technique of performing physical and additional research methods.
- 2) Results obtained using additional methods research.
- 3) Comparison of the clinical picture and the data of additional studies.

For the implementation of the tasks, the most acceptable are tools included in the Moodle educational platform. We have 3 categories of tests that can be used for implementation training and control practical skills, the most effective they turned out to be tests for the selection of missing words, where there are missing words in the text, the questions are filled in using the ones added to the menu. Instructions for performing each test are provided (example): control of practical skills is built on the principle of a test with five questions each on a separate screen, four of which contain lists answers from which the student, using his knowledge of this topic, must choose the correct ones, put a check mark opposite them. Number correct answers are not regulated. One question need choose a certain sequence of actions in the algorithm by selecting from identical lists given to each number in the algorithm. After that, the student must complete the attempt by clicking on the appropriate one button and then confirm the action or return to the questionable answer and review the questions, and reconfirm the completion of the test and sending results.

## Moodle

Moodle allows you to create interactive mini-programs that can contain text, sound, video information, as well as any images. Using branched the script allows simulate diagnostic, treatment process with registration of the correct choice and erroneous actions of the student. In addition, scenarios may include the above tests that makes this module basic in solving the task of practical learning skills both in surgery and in other fields of medicine.

On the one hand, the advantages of distance education are the possibility of learning simultaneously a large number of students, facilitating the educational process, in the case of education of people with disabilities, adaptability - training using modern software and technical equipment then makes e-education more accessible. Also, usually distance learning is cheaper than regular education, first of all, for due to the reduction of expenses for moving, living in another city, reducing the costs of organizing the courses themselves. (*Moore et al., 2011*).

Opponents the use of distance education in medicine is considered as such it is impossible to master practical skills, which are the main ones a component in the training of future medical workers. However, on our opinion, the use of this form of education in medical educational institutions not only possible, but in wartime safe and necessary. It is certainly necessary to train a doctor in practical skills of traditional face-to-face contact, but all theoretical training and solving debatable issues of tactical decision-making issues in the treatment of the patient can be done remotely.

### *Principles of higher medical education*

Taking into account that the level of qualification of the doctor is in the first place in various gradation system of educational societies it's understood the necessity to improve the quality of the doctor in institutes of higher education, in which directed implementation of the credit-module system to the educational process. Preparation of doctors of the general practice is the principal task of the medical institution of higher education, and therefore the proper teaching of surgery in the whole complex of other disciplines will create conditions for quality medical practice doctor in the future, especially for those professionals who plan to work as surgeons. The doctors of the general medical practice tasks determinations basic requirements of scope of knowledge and practical skills for graduating student of institute of higher education of IV level of accreditation: goal-directed methodical algorithm of questioning of the patient (getting anamnesis), physical examination, substantiation of provisional diagnosis, determinate algorithm of additional methods of investigations with analysis of received results, differential diagnosis, forming clinical diagnosis, substantiation of treatment program and its implementation.

And for the intern surgeon it's important to mastering of surgical manipulation and stages of surgical interventions in treating the most common surgical diseases or providing an emergency assistance in case of emergency conditions. Development of modern surgery is impossible without modern techniques, including laparoscopic technology, so it's necessary to prepare medical interns to work on equipment that meets the time. This requires to reconstruct the process of teaching surgery both students and medical interns towards a positive effect - mastering the full range of theoretical knowledge and practical skills with the help of modern equipment.

### **Method**

Our study included a survey of 1058 students dents who are currently studying in 4-6 courses with clinical disciplines. At the beginning of the questionnaire, all participating students were explained the purpose of the survey and the obtained consent to participate in the study.

This study aims to examine the effectiveness of remote of e-learning among medical students during study disciplines "Surgery" - module 1 "Emergency abdominal surgery and proctology" and identify possible problems, limitations, satisfaction as well as prospects for this learning approach in extreme conditions, especially learning practical skills in the context of distance learning of surgery.

During 4 – 6 courses basic direction of educational process is mastering of theoretical knowledges and practical skills which must provide a young doctor possibility of independent supervision after a patient, forming of previous diagnosis, program of inspection and differentiation of basic socially meaningful diseases.

Mastering of this algorithm in-process doctor in a present tense acquires yet greater actuality in connection with



changes in priorities of grant of Medicare from stationary to primary ambulatory link, embodiment in work of surgeon's permanent establishment-deputy and mini-invasion technologies, introduction in practical activity of health protection institute of general practitioner.

Educational technologies among which acquire development and incarnated credit-module system of studies change, organization of educational process by system of his quality management. All of it needs new organizational and methodical approaches in studies, new textbooks in which from modern positions it is structured and compatible all educational material must be expounded. Important is and mastering of algorithm of diagnostic thought students at establishment previous, differential and clinical diagnosis.

The in addition, changed paradigm of grouping of material is from a nosology form depending on the organ of defeat, to distributing of diseases after a basic clinical syndrome. To our opinion, such approach must provide more quick mastering of material and approaches thought of student and young doctor to basic principles of work of doctor, when on principles of symptoms of disease, a basic clinical syndrome is formed, previous diagnosis and on their basis his clarification is conducted, differentiation and the program of treatment is formed. One of major factors of perfection treatment diagnostic there is an analysis of quality of clinical diagnostics a process. It is very important for this purpose, that doctors in medical establishments of different level communicated between itself one language and adhered to the unique principles of estimation of the state sick. In the first turn it touches recognition and construction of clinical diagnosis.

It costs to consider such after which the expediently directed follow and complete a correct clinical diagnosis, after these circumstances, medical and prophylactic measures. Coming from it, a necessity is a diagnosis timely (early) and complete (unfolded), logically faithful, nosology, etiologic and nootropics. Forming a diagnosis, a doctor determines the imagination about illness and patient. Thus, a doctor builds appearance exactness of which depends on his logic, ability of connection diagnostic value of symptoms of illness, conclusions about essence of disease and about being of patient in this stage. The correctly formed diagnosis allows being determined with the prognosis of disease and presence of complications.

The correctly recognized and formulated diagnosis creates pre-conditions for the choice of adequate medical tactic. Except for it, estimation of plenitude of the formed diagnosis, the correctly recognized disease creates terms for the analysis of quality of diagnostics and treatment, exposure of medical errors, and also increases of authenticity of medical statistics. Unfortunately, among doctors, especially youths, widespread idea, that quality of recognition of illnesses can be well-to-do, mainly, due to the difficult and exact methods of research. But more frequent all numerous researches, analyses, consultations, do not allow quickly and exactly to diagnose. Far rarer, especially young doctors, reflect above a problem that to the increase of efficiency of diagnostic process can lead optimization of thought of doctor. And more frequent all it shows up in the lack of ability to discover and define a leading clinical syndrome, and also symptoms, that he is made, the symptoms of disease are expressly and rationally interpreted not enough. It can be explained that nosology principle of diagnostics dominates in educational and monograph literature, when opinion of doctor is sent from the already set

diagnosis to remember those or other symptoms, characteristic for this nosology unit. (*Letterie, 2003*).

Professional activity of doctor hankers after from him a very opposite situation – syndrome thought. In practical work a doctor finds out some initial symptoms and must move from symptoms through leading syndromes to the previous diagnosis. It is formed the above-mentioned nosology principle of diagnostics of thought of doctor more frequent all it appears unable to reform on syndrome principle and correctly to interpret found out symptoms. All of it results in appearance of uneconomical and inefficient mechanisms of clinical thought which results more frequent all in an incorrect diagnosis or absence of diagnosis in general. Avoiding these failings is possible at the orientation of intellect at forming of clinical diagnosis on directions, which include syndrome principle of diagnostics, diagnostic algorithm and principle of optimum diagnostic expedience. The mortgage of progress of recognition of clinical diagnosis is a correct exposure of every symptom of disease and him distinctive criteria. It is a key moment of diagnostics, because if found out symptoms wrong or incompletely, no instrumental and laboratory diagnostics will not result in a correct diagnosis. For achievement of top quality of mastering of clinical surgery general practitioners in our program of studies are present the private questions of surgery, different nosology states, co-operation on groups, by basis each which a major clinical syndrome is of. A main difference and primary purpose of our studies is a concentration of attention on the processes of forming of previous diagnosis, ground of troubleshooting routine, with the purpose of clarification of diagnosis lead through of differential diagnosis.

To implement the system of planning, monitoring and evaluation of the education quality for a real degree of assimilation of students with specific components of the program during the academic year of surgery training and discipline for module “Emergency abdominal surgery and proctology” in general based on the cumulative number of ranking points for the European Credit Transfer System (ECTS).

This will improve the quality of learning discipline among the four-year students of enrolled this year, and develop common indicators for professionally-oriented exam after 6 years of study to get a general level of theoretical and practical knowledge and skills of physician’s interns of surgery.

The Department of Surgery № 1 of the Dnipro State Medical University was conduct structured, multiple planning of the study process and the use of different forms of the staging control. Taking into account the Standard program of the discipline, curriculum, working program for the department was create the specific actions by teachers, students and interns of surgery to achieve theoretical and practical knowledge, necessary resources and sequence of technological operations with the use of credit-modular system. Thus, there were additionally created classes for training with medical mannequin and simulators to master the practical skills of students in educational time and time for self-preparation on products firm “3B Scientific”. Nosologically principle of training that exists in most clinical departments, unfortunately, does not meet the practical work of a doctor, so we came to forming the curriculum by the syndrome principle: a practical training combines several pathological conditions, with oriental features, such as the module “Emergency abdominal surgery and proctology”, consists of two modules of content (substantial modules): “Urgent abdominal surgery” and “Urgent

Proctology”.

Thus, the substantial module “Urgent Proctology” includes “Syndrome of an acute pain in perianal area”, “Syndrome of rectal prolapses” and “Diarrhea-inflammatory syndrome”, combining similar diseases or their complications in the form of so-called educational elements, where, for example, a practice training for “Syndrome acute pain in perianal region” contains “Acute hemorrhoids”, “Acute anal fissures”, “Acute proctitis” and “Inflammation of the epithelial coccygeal passage”.

This approach is appropriate to expediently use the time of practical training, examine patients according to pathological syndrome, mastering the skills in classes with medical simulators, perform differential diagnosis with the definition of a rational treatment program.

To support the learning process developed by the principles of credit-modular system using multimedia lectures, the textbook “Surgery” in 3 volumes (5 books), methodological guide of development for students, methodological guide of development for teachers, hand book and individual plans for students, journal of the teacher.

For the practical training used division’s computer class (10 computers) - for computer testing of students, two classes of medical mannequins and simulators (products firm “3B Scientific”) - for acquiring and mastering practical skills, supervision of patients in the surgical department, supervised and theoretical survey in training rooms. For the interns besides the basic work in the surgical department with patients it’s necessary to mastery of the operational equipment in operation and manipulation rooms, as well as mastering of mini invasive surgery technology in the learning center “Endoscopic technologies in medicine”.

**The algorithm of training and preparation on surgery of students of 4th course on practical studies (2 hours 40 minutes):**

1. Muster, the announcement of a theme and the purpose of practical studies - 5 minutes;
2. Carrying out of theoretical computer testing on an studies theme in a computer class of chair (30 tests for 30 seconds on everyone students) - to 15 minutes;
3. Control of the mastered two concrete practical skills on an studies theme on simulators and firm training apparatus “3B Scientific” - to 50 minutes;
4. Investigation the thematic patient in surgical division of clinic after development of practical skills on simulators and firm training apparatus “3B Scientific” – to 30 minutes;
5. Theoretical analysis of results investigation the thematic patient and a theme of study with poll of each student - to 50 minutes;
6. Analysis of the basic errors admitted by students - 5 minutes;
7. The information on the task on preparation for following practical studies - 5 minutes.

After each study to student’s time for independent development of practical skills by preparation for following study is allocated.

## Results

According to 867 (81.9%) students were satisfied with the quality of the survey distance learning according to the above methods. According to our data and the data of modern studies on the quality of education programs have proven that distance e-learning is very effective way of learning, but requires self-motivation of students as well the teacher's ability to constantly improve distance learning tools of education and strive to meet the needs of the applicants as much as possible.

These questions were mainly about student's demographics (age, gender, academic years and medical school), prior and current experience with distance learning, available technologies, distance learning benefits, drawbacks, their instructors' influence, challenges, attitudes towards the effectiveness of distance learning in medical education, and their perceptions about the future of distance learning in medical education.

Accordingly, this study included a convenient sample of 1058 students who are currently enrolled in their clinical years. Objectives and goals were explained at the beginning of the questionnaire to all participating students, and their enrollment was after they consent to participate in the study. Students must be active participants in the educational process, is in a learning center with a teacher acting as an advisor and supports interest in learning.

## Discussion

The Bologna Declaration founded of June 1999 put in motion a series of reforms needed to make European Higher Education more compatible and comparable, more competitive and more attractive for Europeans and for students and scholars from other continents. Reform of Higher Education was needed then and reform is still needed today if Europe is to match the performance of the best performing systems in the world. (*Declaration, 1999*), Initiated by the European Commission (EC) special the Erasmus project was founded in 1987. After two years the European Commission felt that, whilst it was successful in terms of physical mobility of students, the Erasmus scheme was not working as well as it should because frequently the period of study of the student was not recognized by the student's own university. (*Chartia, 1988*). This meant that often study had to be repeated and examinations retaken.

Ways were considered of making improvements and the idea was put forward of a European Credit Transfer System (ECTS). A pilot scheme was launched for the 1989/90 academic year in five subject areas: History, Chemistry, Business Sciences, Mechanical Engineering and Medicine. Initially about 20 institutions per subject took part, but this increased to around 30 per subject by the end of the pilot phase (1995-1996). The pilot phase was designed to test the European potential of credit transfer as an effective means of academic recognition. It was based on mutual trust and confidence between institutions in terms of the quality of the educational experience enjoyed by the students. The pilot institutions were chosen for their general academic

compatibility of standards.

The scheme proved successful and was opened out in 1995 to all Higher Education Institutions in the European Union who wished to make use of it as a standard system for recognizing and transferring academic credits. It has now become the standard for all student exchange agreements where academic recognition of the study period abroad is required by the home institution. A breakthrough for ECTS was created with the Bologna Declaration (1999), after which ECTS became part of the Bologna process.

The European Universities Association (EUA), which represents and supports universities across Europe, approved of the ECTS Key Features in its annual conference in Zurich (2002). The Key Features are a concise document in which the essentials and principals of ECTS are stated. ECTS was further developed by the TUNING project (2004).

The aim of this project is to standardize and tune the educational structures in Europe. The European Commission in finally supported the development of ECTS by appointing a group of experts, the so-called ECTS Counselors. This group of experts designed an ECTS Users' Guide which can be found on the EC website. The three overarching objectives of the Bologna process have been from the start: introduction of the three-cycle system (bachelor/master/doctorate), quality assurance and recognition of qualifications and periods of study. In the Bucharest Communiqué (April 2012), identified three key priorities - mobility, employability and quality, and emphasized the importance of higher education for Europe's capacity to deal with the economic crisis and to contribute to growth and jobs. Ministers of Education also committed to making automatic recognition of comparable academic degrees a long-term goal of the European Higher Education Area.

Such statement of a question, the higher medical education of independent Ukraine to return to the solution of a difficult pedagogical task - urgently and systemically to pass from classical methods of teaching of subject matters to post-classical that would allow at catastrophically accruing volume of medical information various organizations' and administrative and medical (preventive, diagnostic, medical, rehabilitation), and also scientific genesis to turn it into knowledge of the student, and the theoretical knowledge received by the same student, to transform to his professional skills and abilities.

The Bucharest Communiqué builds on the Leuven Communiqué of 2009, which established priorities for 2010-2020:

1. Ensuring a quality higher education system
2. Adopting a two- or three-cycle system of study (bachelor, master, doctorate)
3. Promoting the mobility of students and academic and administrative staff
4. Introducing a credit system (ECTS) for the assessment of study performance
5. The Recognition of levels: adopting a system of easily identifiable and comparable levels
6. The Active involvement of higher education institutions, teachers and students in the Bologna Process and student participation in the management of higher education

7. Promoting a European dimension in higher education
8. Promoting the attractiveness of the European higher education area
9. Lifelong learning
10. A European higher education area and a European research area – two pillars of a society based on knowledge.

Covid-19 has been declared as a pandemic disease by the WHO on March 11th, 2020. The disease started in Wuhan province in China in late December 2019. Since that time, the global incidence of Covid-19 disease has increased dramatically. Distance learning of students in conditions quarantine Covid-19. The question of the use of this form of education in medical educational institutions remains controversial. On the one hand, the advantages of distance education are the possibility of teaching a large number of students at once, facilitating the educational process, in the case of teaching people with disabilities, adaptability - learning using modern software and hardware makes e-education more effective, also, usually, distance learning is cheaper than regular education. first of all, by reducing the cost of moving, living in another city, reducing the cost of organizing the courses themselves.

Opponents of the use of distance education in medicine believe that mastering practical skills, which are the main component in training future medical workers, is impossible in this way. However, in our opinion, the use of this form of education in medical schools is not only possible, but necessary.

On February 24, 2022, the Russian army started a war and invaded Ukraine, disrupting the usual life, work and education of millions of people, leading to suffering, injury and death. Many Ukrainian medical students, and especially foreign students, have been forced to switch to distance learning, to which they partially adapted during the Covid-19 quarantine.

Distance E-learning in medical education may represent a suitable alternative to traditional learning to deliver high-quality education. The availability of essential infrastructures and efficient institutional strategies represent a major challenge for integrating distance learning in medical education. Even blended education (i.e. distance and on-campus) is well adopted in different word countries, the effect of distance electronic learning is likely to be revolutionary especially in low-middle income countries.

Distance E-Learning is defined as using computer technology to deliver training, including technology-supported learning either online, offline, or both. It is aimed at the effective construction of knowledge regarding individual experience, practice, and knowledge of the learners and students. Internet-based learning, computer-based learning, virtual classrooms, and digital collaboration all represent different types of e-learning.

The structured, multifactor planning of the educational process and implementation of various forms of staging control were conducted. Based on the standard curriculum and learning plan was created the Working program

that regulates specific activities by teachers and students to achieve as a theoretical and practical knowledge required for this sequence of technological resources and action items using the credit-module system. The calculated threshold standards levels of education (sum of estimates after the module translates the 200-point scale ECTS) and communicated to students to stimulate their enthusiasm for learning to the maximum level.

Main objective of this passive method of training – lectures, is formation of an orientation basis for further assimilation by students of a training material, then when a source in this method of training is the word of the teacher that directly reflects its language of culture pedagogical professionalism. Besides, today lecture - as the passive method of study strengthened by such methods of presentation as an illustration (tables, schemes, presentations and so forth) and demonstration (slides, video movies). (*Rotimi et al., 2017*).

## Conclusion

Amid the war period, the majority of the student have participated in distance learning in their medical schools. Further analysis of the non-participating students showed that 6th-year students were the least to be involved in distance learning as the majority of them have completed their academic courses before the war period curfew. Among the 538 students, smartphones were the most commonly used single device in e-learning (35.9%) followed by computers either laptops or desktops (14.5%). Two hundred and sixty seven students (49.6%) utilized multiple devices to access their learning sessions. With advances in technologies and social media, distance learning is a new and rapidly growing approach for undergraduate, postgraduate, and health care providers. Regardless of reported benefits, medical students preferred the blended approach in teaching as distance learning represented a major challenge to acquire adequate clinical medical skills. Satisfaction in distance learning is strongly linked to students' prior experience in distance learning as well as instructors' experiences and interactions. (*Shanahan, 2008*).

Distance E-learning has been proved as an efficient modality of learning in different educational and governmental studies. Data from the Institute of Educational Studies showed that learners revealed a more active attitude in learning when various methods such as electronic books and on-line articles were implemented in the teaching process. Technical and infrastructural resources reported as a major challenge for implementing distance learning, so understanding technological, financial, institutional, educators, and student barriers are essential for the successful implementation of distance learning in medical education on period war.

## Recommendations

We recommend using the proposed technologies in the training of medical students for distance on-line surgery education.

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## The Importance of Education for Democracy

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**Abstract:** A democratic government, whose power belongs to the people, serves all its citizens equally and protects their natural rights. Its highest priority is to treat and serve its citizens properly and fulfill their interests. In democratic regimes, conflicts and other social issues can be resolved through dialogue, compromise, and consensus between the government and people of a given country to have a better future. In a democratic society, civic education plays an important role in shaping people's values and behaviors, and it cannot be achieved without a stable and developed economy. However, the interest of the human society in education dates back to the dawn of civilization in ancient Greece, when Plato spoke about the importance of education in the development of the state. And, based on his initiative, he wrote at the entrance of the Academy, "*Do not go inside unless you are a geometer.*" Plato's concept of geometry is used to understand a man with a high cultural and scientific level. Thus, the European Enlightenment based on Platonic concepts of education gave it the role and place it deserves among all the professions that develop and civilize people. In ancient Greece, education was not valued as a luxury for a small number of people in the society, but as a right of all citizens. However, in order to achieve the practical goals of education, human society needs to regard it as the most important tool for its development. Therefore, this paper discusses the significance of education in the development of society by enriching it with modern philosophical concepts. The following issues will be addressed: The philosophical essence of education, Education for democracy as a social requirement, The importance of intercultural and multicultural education.

**Keywords:** Education, School, Democracy, Society, Philosophy.

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### Introduction

Deep economic and political transformations require the establishment of a developed democracy. However, the development of a democratic society is closely linked to the expansion of its well-being. Social foundations are built on two pillars: the rights and duties of each member of a given society. Every citizen becomes familiar with the protection and implementation of his/her rights and duties because of the deep and sustainable knowledge he/she has about them through education. Furthermore, the "rights and duties" of citizens converge with the protection of their social well-being. The concept of "well-being" encompasses all aspects of citizens'

social lives as well as the path that leads to their social improvement. Thus, social well-being is the only thing that can bring together all of society's individual tendencies, abilities, and interests. However, the achievement of social development is the result of the implementation of human ideas and works of great philosophers such as Socrates, Plato, and Aristotle.

A democratic system embodies many different elements that work together to nurture and sustain a truly developed society. However, these elements are related to the ability of individuals to dialogue, express convictions, make compromises, adapt to new social situations, evaluate actions for the benefit of the common interest, make decisions, and solve social issues. The ability of people to cooperate with one another and find solutions for different issues that may arise in a given society is an important part of the social life of people.

Throughout history, democratic societies have applied and followed new ideas and theories such as those of Rousseau, Montesquieu, Kant, and other philosophers. There can be no social community in the absence of a democratic climate and educational values. These values include both the fundamental and individual norms of society. From the top to the bottom of the social pyramid, everyone is interested in implementing and defending educational values. The most important task of the state is to educate its citizens, particularly the younger generations.

The school intends to standardize some aspects of civic and intellectual education for the members of the society. Thus, it expects students to learn and reflect on their own attitudes and opinions, even if they disagree on a particular issue. Moreover, civic education is a distinct front and a priority for schools, teachers and other social institutions such as family, religion, radio, television, media and government.

Furthermore, the feature that distinguishes a democratic society is that the process of education and civic values are not imposed by force on people. Their transmission and inculcation in young people are closely linked to the selection of the most appropriate remaining means: persuasion and reasoning. Simultaneously, the values of reasoning and logic in education constitute their intellectual synthesis. These values are promoted by both the individual and the society as a whole. Personal values are the result of an individual's intellectual level, which is based on his perception, thought, and idea processing abilities. While, social values are presented as "levels" of representation of an entire society.

## **A Literature Review**

This research paper is the result of extensive reading and familiarization with relevant literature. Besides reading of relevant literature, I also used the reasoning and interpretation methods of existing information on education, taken from various sources. Also, these concepts were analyzed as the only trend for the development of the human society.

## The Philosophical Essence of Education

Education remains one of the most important pillars of a society. Generally, education is a form of learning in which the knowledge, skills and habits of a group of people are inherited and passed on from generation to generation through teaching, training and research. Education takes place under the supervision of educators, such as teachers, lecturers, and so on. It can also be done through self-learning. However, any experience that has a formative effect on the path of thinking is valued and considered as educational. Thus, the ideas of Socrates, Plato, and Aristotle were influential in the development of educational concepts and methods, as well as their practical application. They began with the goal of educating a well-prepared and highly valued citizen. Socrates regarded education as a tool for discovering the truth, interpreting knowledge, combating ignorance and becoming acquainted with oneself and others. Socrates used a method of learning that became known throughout history as the *"Socratic method"*. According to this methodology, the teacher asks the students various questions and leaves room for them to judge before giving the answers. Moreover, it is also about fostering debates; it entails testing human knowledge and discovering the truth. Socrates urged young people to think deeply about philosophical and social issues.

In his writings, Plato, a disciple of Socrates, underlined the importance of social education by considering it as essential for the development of humanity. Moreover, He writes in his book entitled "The Republic": *"The aim of education is to illuminate what the child has in his soul. Not just bringing knowledge into the soul, but extracting what is hidden there and directing it towards the soul. Education is the most important social life scheme"* (Plato, 1999, p. 82). Plato believes that education is important for both justice and the state. According to him, education should be divided into stages in which young people are trained in various subjects and prepared to defend the state. Plato's educational scheme is designed to last until the age of 50. This is analogous to the modern concept of "lifelong learning". According to Aristotle, the concepts of education, human nature, habits, and reasoning are powerful forces that must be cultivated by the entire society through education. Aristotle emphasized the importance of education by arguing that knowledge is gained through scientific research and by nurturing individuals' experience and skills.

The views of Plato about education are still relevant today. His ideas aimed at forming the individual as a human being so that he or she could be educated as a worthy citizen of the society. Plato used metal values to support his point, by saying: *"When God created man, He put different metals in his composition. For example, in some people he placed gold, in others he placed silver, and in others, he placed bronze and copper"* (Plato, 1999, p. 109). His idea is clear, and the concept of "metal" refers to the gift of talent, which, according to him, is education that allows people to manifest these talents.

In the Platonic views on education, it is stated that the educational aspect of man is to be a worthy citizen of the state, society and the instruments that make his education possible. Based on Plato's and Aristotle's philosophical points of view, the school is considered as an important institution in the function of the individual and society. It operates through certain rules and norms, and its mission is to:

Educate citizens as members of the state.

Provide professional training.

Introduce an individual's values to the society and emphasize his or her skills.

Make an individual to be aware of his/her individual values.

Train people professionally and provide them with employment opportunities.

However, educational institutions are different from family and religious ones. The school as an institution brings together and works with students from a variety of social, religious, cultural, ethnic and economic backgrounds. Same as any other institution, the school as an institution has its own set of rules and procedures. It allows young citizens to advance to a higher level of education once they have correctly followed the rules and mastered the specified requirements. Thus, the school is a place where children can learn about facts, culture, national history, and patriotism. School educators teach students common languages and communication methods, as well as critical perspectives and thoughts for facing life challenges.

The process of education is realized during our daily life. Through action and experience, we as human beings may create our own level of culture and knowledge. It is about a culture that has the necessary tools to comprehend life and its processes. Active participation in society becomes possible by using these types of tools freely and efficiently. The result of the process of education is the development of a continuous cultural level both personally and collectively. Although the role of the school and the works of various philosophers are quite important in human education, the criterion of truth is found in everyday life. That is why this postulation is passed on through the generations: *"All life is a real school"*. During his early existence, man learned to read and write and was able to pass on inherited knowledge to future generations. With the expansion of knowledge came the need to have an institution of education and knowledge, which became a school. The keys to this education are found in our daily life and practice.

The mission of philosophy continues to be the illuminate life when there is darkness and to resolve social conflicts. Its mission is to end violence and provide solutions, as well as to uphold the rule of law and the truth. As a result, it is never outdated or obsolete to acquire Plato's and Aristotle's philosophical ideas on the need for education and upbringing of the younger generations prior to their coming of age and in running the affairs of the state; it is more important than ever today. The ancient Sophists as teachers promised to provide students with the knowledge and skills necessary for the development of Greek city-states. The primary goal of education, according to Aristotelian philosophy, is to contribute to the discovery, transmission, and application of knowledge. Moreover, Immanuel Kant emphasized: *"Education is the only way to become a man"* (Kant, 2004. P. 14). According to him, human beings as a unique existence can be real humans only through education. For Kant, education, in essence, is the process by which a society passes on accumulated knowledge from one generation to the next. Therefore, in essence, education is the process by which a society develops. Its mission is to dismantle social violence and provide solutions, as well as to understand and implement the rule of law.

Human education is essential in recognizing the values of society, the state, and the culture of people. The real

purpose of education is to guide young people on the right path of knowledge, to give them the opportunity to discover the present in order to prepare for the future, to get them acquainted with the institutions and the responsibility they carry in the service of their state, their national policies, as well as the relations of citizens themselves in the society where they live. Education is the battle of a society that runs on the path of knowing its rules, on the path of knowledge and values, as well as society-state relations, citizen-state relations, and state education.

Education is one of the most important fields in a society and in any social-political system because, through it, developmental values are transmitted to future generations. However, in all historical differences, a primary role is played by the education of society, especially that of the leading elites, which has sometimes accelerated the integration processes and sometimes slowed them down. In this respect, the education of the ruling elites continues to be a priority, which has both accelerated and slowed the integration process. Thus, the integration and strengthening of Albania's political, economic, and military relations are the "propellers" that push the "ship" towards Euro-Atlantic processes. Albanian institutions have a genuine desire and effort to integrate into the European Union, but it is also true that we do not go to Europe to "melt" or lose our national identity. Today, Albanian society offers the world the coexistence of different religious faiths, to which almost all of Europe is vulnerable, while Albania appears to have the golden key. This means that the next generation of Albanians must be well-versed in the culture and all that our people have inherited from generation to generation in the material and spiritual realms in order to pass it on to the next mosaic of European culture. Therefore, education is a process of constant change and reorganization, and its goal is to educate. The educational process should result in the ability to form a continuous formation, both social and personal.

### **Education for Democracy as Social Requirement**

Education for democracy is the ability of a society to recognize and protect its freedom and democratic institutions. It (Education for democracy) should not be just a slogan, but a vital part of the life of people and the whole society. Education is the basis, the foundation of the overall development and future of a democratic and modern society. Thus, a comprehensive education in general, and democratic education in particular, are essential to society and the state because society and the state are governed by the same laws. Through education for democracy, the society is taught to love the state, the nation, to know itself, its responsibilities, etc. In democracy, the society and the institutions that make it up are tools of education and social formation. Therefore, education is still one of the most important aspects of any political and social system because it transmits developmental values to future generations. Moreover, it is about pursuing higher education from the comfort of one's own home, using technological advances such as the internet and the publication of electronic books. Of course, these phenomena of perspective not only represent the cutting edge of modern education but are also expected to play a progressive role in the phenomena of school attendance and its quality in the future. Considering higher education as the top of the pyramid and lower education as its base, we would emphasize the importance of maintaining the interactive relationship between the base and the top of this pyramid.

The purpose of education for democracy is to acquaint young people and the society in general with the principles and values of democracy. Thus, education for democracy is the essence of society; it is the promotion of the values of democracy and their implementation. Education is the foundation on which all moral, family, cultural, political institutions are developed. Democratic principles are the laws of life in a society and a democratic state. They are the pillars and values of that society. A democratic society is a free society, that is based on the principles of equality and justice. Freedom becomes possible when it is protected by laws. Only in this way can all citizens of a democratic decision be guaranteed equal protection and freedom. Therefore, freedom that knows no laws is debauchery; it is degeneration, and false illusion.

The basis of a democratic society is built on the premise that no power, including political ideologies and their leaders, has a monopoly of right. The philosophy of democracy moves and progresses along pragmatist rails. Even the values of theories surrounding them are primarily evaluated by the changes they bring to the society. Elections done in a given state in one period may be free and fair, reflecting the will of the sovereign and the people; whereas in another period and under different circumstances, these same elections may be manipulated or stolen by those in power. However, democratic systems educate citizens about democratic culture. The conduct of free elections becomes a fundamental criterion of their own freedom for them. For citizens of a democratic society, the rotation of powers is one of the essential gears by which democracy and society progress. The development of alternative and developmental ways of thinking is an undeniable value of democracy. Democracy creates equal opportunities for all members of a society.

There can be no social community without shared democratic values. These values emerge as the fundamental norms of a society and the individuals who inhabit it. Leaders and ordinary citizens are both concerned with the implementation and protection of these values. According to Ralph Dahrendorf, "*citizenship is a set of rights and obligations... citizenship is a concrete social function*" (Dahrendorf. 1997, p. 48). The essence of the rule of law is to establish a state in which the rule of law must prevail and all its citizens enjoy guaranteed rights as a result of these laws. Only members of a society who are equal before the law can create a prosperous democracy and society for themselves and their children.

The ethics and culture of democracy are of interest to the entire society. Therefore, the most important duty of the state is to educate members of the society, particularly the younger generations, about democratic values. However, in all aspects of social life, justice must be present and dominant. A democratic society is built on the fundamental concept of justice. Judgment is healthy when it is able to judge and evaluate the truth independently. We all require independent and impartial justice to discover and protect everyone's legal rights. Everyone seeks and desires justice. The desire for justice is an excellent starting point for the study of democratic values in schools and other institutions. The pursuit of justice for all is an unmistakable democratic value. Justice or "the first virtue of social institutions" is the basis of a democratic society. It governs how people behave in their relationships with others. Every individual in different communities has the right to be different and pursue his or her goals to the extent possible, as long as this is done without violating the basic laws and values of the society. The principles of justice require that each individual should have equal

opportunities to be happy and to enjoy other natural rights. This is the way to achieve equality. It must be remembered, however, that no one should pursue happiness to the exclusion of equal opportunities for others. In a democratic society, the government has the right to intervene and protect the rights of everyone to equal opportunities.

However, it is still the duty of every citizen, government agency, and educational institution to strengthen the pluralistic democratic system for the benefit of the present and upcoming generations. Despite the fact that civic education is implemented in all spheres of Albanian society, it is not by chance that we identified the role of intelligence and our country's educational system as a guarantee of accelerating the necessary developments within the integration processes. Thus, a sustainable economy is required for civic education in a democratic society. It is essential, especially in a democratic regime for all citizens to participate in the economic life of their society, but only within the context of freedom. The production, distribution, and exchange of goods and services between people constitute economic activity. Participation in this or that business is determined by market requirements. This is why democratic economic systems are frequently referred to as "market economies". Profit is the driving force behind this economy. Economic freedom or free initiative determines the effectiveness of a market economy. Economic freedom manifests itself in a variety of ways, including the ability to obtain a legitimate profit, the ability to buy and sell, the ability to compete, and the ability to innovate.

### **The Importance of Intercultural and Multicultural Education**

The differences in people's worldviews make us aware of the existence of being different. The advancement of social democracy is one of the primary goals of modern education. The intercultural education system works to overcome differences in a multicultural society's daily life and shared relationships. Thus, this process can be achieved through mutual understanding, respect, and dialogue between groups from different cultures, as well as by providing equal opportunities and fighting discrimination. The essence of intercultural education among different people includes sensitive cultural areas that transmit and nurture friendly feelings between them, such as film screenings, theater performances, the organization of festivals, sporting events, scientific, philosophical, and political conferences, as well as visits to mutual and tourist attractions.

Education is at the heart of social cohesion's identity. It is closely linked to the system of factors that comprise it, particularly distinguishing the world views that nurture the way of thinking, as well as the feelings and actions of its members. It is the semantic differences between people that make us aware of the existence of being different. The educational system must take into account the multicultural nature of the society into which we want to integrate and contribute to the peaceful coexistence of people with different cultural backgrounds. From this point of view, there has traditionally been multicultural education, which allows for the recognition and acquisition of other cultures. It is the duty of every citizen, of state bodies, and of the structures of education and upbringing of generations to strengthen the system of pluralistic democracy.

The foundation of a democratic society is based on free and fair elections. The primary task of educating citizens and other state and social structures should focus on recognizing the democratic principles and norms for setting European standards. It aims at a more significant contribution from the education system to education and youths. Therefore, in dealing with the individual and his character, Lock came to the conclusion that: *"people are equal and independent, and no one should harm another's life, health, liberty, or property"* (Lock, 2005, p. 81). According to Lock, people, on the other hand, are aware of their inherent rights as well as their protection. However, in order to improve their rights and survive, they require an agreement or contract, which they entrust to a sovereign state. Contemporary democracy is representative of the values that free and liberal societies place on the relationship between politics and human rights. However, democracy is a form of government and a way for citizens, particularly young people, to participate in policymaking. Therefore, in everyday life, the most important front remains the education of citizens with a contemporary mentality. This important issue is almost left on the periphery of the work of state and social bodies, or better put, "in a free flow" and spontaneity, which is remembered only in special cases when pressure is exerted by European organizations.

The role of education is also to protect and develop the highest human values, especially equality and the right to live in dignity. Understanding the cultural traditions of different people, their intellectual and spiritual perspectives, their art, music, literature, way of life, value system, traditions, and religious beliefs are all examples of education. Friedrich von Hayek, a well-known political economist, used the phrase *"constitution of freedom"* instead of *"social democracy"*. He meant a set of elements that allowed the individual to coexist with society. Hayek highlights three of the most important aspects of this process. However, Jefferson, Locke, and Rousseau, based on a number of treaties, have been devoted to the individual's and society's freedom, rights, and duties. Thus, as stated in the Declaration of Independence of the American Revolution in 1776, all men are created equal, and further, the Creator (God) endows them with certain inalienable rights: *"There is no happiness without freedom; freedom without self-government; self-government without constitutionality; constitutionality without morals; and there are no such great goods without stability and order"* (Dhamo, 1999, p.24.).

In a pluralistic society, the consequences of globalization may aim to flatten the values and characteristics inherited from popular culture. It is an obvious reality that in our time there is need to outline and formulate theoretical-practical views on the causes of the failure of communist ideology and one of the most powerful philosophical currents of the last century, which had significant consequences and changes in today's human history. However, we cannot avoid the dangers that arise from the use of force and violence to solve problems and conflicts. This is because there is no greater paradox than the development of wars in the name of peace, even if only in the sense of an individual's life or that of the entire people of a nation. The phenomenon of globalization cannot exclude either the format of global culture, both in technological and sociological fields, without excluding philosophy, which can never be closed in the ivory tower but always stands at the forefront of socio-political developments. The imposition of global culture, particularly by the most developed capitalist countries with a consolidated democracy, may not find the right ground and bedrock due to the interdependence



of a number of developments in other fields of science, culture, and production. Every new phenomenon in human society immediately generates groups for and against it. This is because it does not occur immediately, but gradually replaces inherited values. This is the phenomenon of globalization. Therefore, the above issues lead to the conclusion that the mosaic of cultural pluralism should be treated and nurtured as the greatest asset of human society; it only does not endanger any people or nation but also enriches them and raises the demands of democracy to a greater degree.

Ethnocentrism makes intercultural communication and understanding difficult, if not impossible. To overcome these, it is necessary to work in a variety of areas, particularly through the intercultural integration of components in school curricula. This does not mean that we should not work on recognizing our cultural heritage at the same time, or that we should overestimate other cultures in comparison to our own. The Albanian people that live and work overseas develop new concepts and models for the development of small and large businesses, private initiatives, the free market, and the benefits of the democratic system. They return to their homeland to bring their lofty individual and social goals to life. But, from the start, they are confronted with the "mountain" of corruption obstacles that have gripped the public administration and state institutions, making their dreams and plans shrink or appear to fail.

In a democratic society, diversity is a current value. It is influenced by the population's diversity in terms of race, ethnicity, culture, and religious beliefs. At all levels, strata, and powers that exist in a democratic society, diversity remains the most important indicator. Ethnic and multicultural diversity simultaneously improve the quality of a society's democracy by respecting change for the sake of cultural and intellectual enrichment. Respect for diversity should not be regarded as a source of national disruption or a diverse population. In the presence of such a country, state, and population, commitment to universal democratic values remains their common honor, the vital cohesive factor that determines the present and future of this society with vital common interests. Only a truly democratic society is capable of preserving, defending, harmonizing, and respecting internal change and diversity, whether political, ethnic, religious, or multicultural in nature. This harmony is the foundation of this very democratic society.

## **Conclusion**

Education remains one of the most important fields in any society and system, as it is through it that the most valuable knowledge, culture, and values are transmitted. As a result, education and society have a relationship that resembles a communication vessel with mutual influence. However, recently, education has been incoherent not only with countries' social changes, but also with their rapid technological and global developments.

The development of individual human resources and capacities remains the goal of education. Humans are engrossed in the process of the work that they perform on a daily basis. Democracy embodies moral, ideal, and political principles based on social coexistence. Culture is transformed into a means of free and full participation

in joint activities. In this way, it manages to foster social efficiency. The ethical value of democracy is achieving the benefits of social education. The goal of education is to form a reflective thought in order to formulate a hypothesis that will result in a specific attitude. To accomplish this goal, an individual must put his ideas into action and have the opportunity to testify about them. Intelligent learning, which implements the ability to think, is the only way to improve human theories and experiences

The laws of life in a democratic society and state are based on democratic principles. They are the foundations and values of a society. A democratic society is one that is free and founded on the principles of equality and justice. Only by legally protecting liberty can all citizens of a democratic society be equal and free. Democratic systems instill a democratic culture in citizens. The holding of free elections has become a fundamental criterion of their own liberty. For citizens of a democratic society, the rotation of powers is one of the essential gears by which democracy and society progress. The development of alternative and developmental ideas of thinking differently is undeniably a democratic value. Democracy creates equal opportunities for all members of a society.

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## Artificial Intelligence and Business Ethics: An Integrated Course-Design Framework

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**Abstract:** The last few years have witnessed significant integration of technology, particularly Information and Communication Technology (ICT) in both content as well as delivery of business courses in higher education. On the one side, the contents related to technological applications are increasingly expanding the space in business education curriculum while on the other hand the mode of delivery has also been significantly influenced. The teaching of business ethics involves a number of distinct issues, often challenging the educators to plan and deliver the course effectively. The current chapter, which is based on review of literature as well as authors' own experiences in teaching business ethics in university courses, critically examines the role of technology as enabler of business ethics course delivery. The Chapter also provides a framework of how the technology can be used to link the teaching, research and participative community action in enhancing the relevance of business ethics teaching in a given context. The chapter provides conclusions for deans, course leaders and faculty members in order to manage change smoothly.

**Keywords:** Technology, Business Ethics, Action-Learning, AI, Pedagogy, Education

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### Introduction

The Arm 2020 Global AI Survey (AGS, 2020) reports a number of benefits of AI, as expected by customers in different areas like automated automobile, healthcare or smart homes, etc. This implies the significant growth in AI-based products and solutions for consumers. Already, we can see the rapidly increasingly penetration of AI-driven solutions in our daily lives. Business application of AI is also increasing sharply in different business

functions and business processes ranging from logistics and manufacturing to customer relationship management and automated complaint handling. However, despite the increasing use of AI, the research on ethical implications of AI does not appear to be at the same pace as its' applications and thus, resulting into many unanswered ethical questions.

The ethical issues related to use of AI in business can be broadly classified in two categories in terms of time horizon: first, the short-term of immediate impact; and second, the long-term impact. These issues must be examined and clearly analyzed by the executives and decision-makers who recommend or decide upon of AI integration in the products, services or in-house business processes. For example, in recent years, many countries have witnessed increasing application of AI-based algorithm in social-media data analytics in influencing the electoral process through customized promotional messages. While the sophisticated technological algorithms have created good results for successful political groups or their respective consulting companies, its' long-term implication is yet to be tested with the time. Similarly, how the increasing use of technology will result into physiological, psychological or behavioural changes is yet another area, which will require significant long-term research and analysis by interdisciplinary research teams and scholars.

In this chapter, we focus on business ethics education in the age of AI. We mainly explores the main ethical issues relating to AI integration that a graduate or executive education participation must be sensitized about. We also propose a framework for effective and contextually relevant business ethics teaching framework that will address the issue of selecting the content as well as the pedagogy in business ethics teaching and research at the time of AI. While developing the chapters, in addition to secondary source reviews, we draw insights based on more than 45 years of combined learning in teaching ethics and moral values to the graduate and executive education students.

## **2.0 Ethical Issues Linked to AI Applications in Business**

The application of AI has both short-term and long-term implications. From the perspective of business, the fundamental assumption in integration of AI is that it will help in enhancing value for business in one way or another. This may help in cost-reduction or enhancing some other benefits for example; precision in quality, speed or efficient customer relationship management. However, the long-term impact of AI on different stakeholders as well as on society and economy, appears to be often ignored.

LaPlante (2019) identifies two main risk areas in context of AI applications which include:

- i. Issues related to the model: Interpretability of the results and transparency in terms of how the results are generated, as this may lead unintentional biases.
- ii. Issues related to the data: Issues related to non-traditional data sources like social media and IoT (Internet of Things) technologies as it may involve data like race, disability status, and religious affiliation, etc.

which may be seen as unethical as well as raises issues related to customer's data usage and privacy rights.

In addition to other wider ethical issues related to impact of AI like job-loss or wealth-inequality, a Kambria (2019) blog article highlights the issues including: Errors and mistakes caused by AI; Self-Learning and updating of algorithm; and Ethical issues in treatment of AI (roboethics).

The ethical issues related to the AI can be classified in three broader categories

- A. AI Interface and Response, which includes the data use, algorithm transparency and consequent undesired and unintentional consequences emerging from application of AI.
- B. Long-Term AI Impact, which may include long-term economic and social consequence due to likely imbalance produced by the increase application of AI like job-loss, wealth inequality, etc.
- C. Limit for Responsible Use of AI, which includes policy making and ethical control on how the AI should be used and for what purpose.

In an interesting article, Jonathan Tarud (2018) observes: "... technologies like this often begin with good intentions. Nuclear technology was developed as a cheap power source, with implications toward people and the environment discovered later. AI represents many great commercial opportunities, but what will be the longer-term effects?"

Therefore, in context of business ethics, the first and foremost issue is to sensitize the managers and leaders about the contextual implication of the AI. One must understand both short-term and long-term issues relating to the use of AI not only related to the business results but also in terms of wider stakeholder considerations and long-term social-economic impact.

### **Business Ethics – AI Issues Interface from Teaching Perspective**

It remains a major question how should the practically relevant and contextualized ethics teaching be planned and delivered. Tripathi (2013) in context of applied ethics teaching summarized the following attributes for an effective ethics course:

- a. Value-Linkage Focus: Should be able to condition the learners' values by harmonizing the desired core managerial values and ethical values.
- b. Holistic Approach: While delivering the anti-corruption issues, the method should be able to relate to the existing functional area knowledge and provide the total picture of the corruption

causes and solutions.

- c. Participatory: Should encourage learners' involvement in the process of teaching-learning.
- d. Context-Specific: Should offer flexibility to customize the contents as per the local demand and need without diluting the fundamental purpose of the course.
- e. Real-Time Knowledge Creation: Should provide opportunity for creating the knowledge contents by synchronizing the teaching and research function during the course delivery.
- f. Internalization: Should facilitate the internalization of the values that would provide foundation for bringing anti-corruption perspective required for managerial decision-making ethical behavior.

Developing and delivering a course with the above suggested attributes require careful planning in terms of desired course outcome, contents and delivery methods. How to decide about the course learning outcome of an ethics course, particularly with focus on degree of AI related content integration is the starting point of a purposeful ethics course in any given context. CTE (n.d., a) suggests that while designing of a course, one should address questions relating to context, desired learning goals, content, methods and assessment. Based on CTE (ibid.), here are some of the suggested questions for consideration in ethics course design:

- What knowledge regarding AI and ethics we want our students to develop?
- Are the intended learning outcomes in terms of knowledge, skills and attitudes relating to ethical considerations of AI are reasonable in the given context?
- How best we can align the content and methods to ensure that the students accomplish the desired learning goals?
- Are learning outcomes linked to theory or skill or both i.e. knowledge about ethical issues linked to AI as well as decision making ability in relation to responsible integration of AI.
- Are the learning outcomes specific, achievable, and measurable?
- The understanding of the context of the course would involve the analysis regarding target learning group as well as the positioning in the programme in which the course is planned to be offered. Some of the important issues regarding contextual issues could be summarized as under:
- Who are my students i.e., executive with experience or fresh graduates admitted to MBA or other Masters' level course?
- Why do they need knowledge about AI and ethics?
- What skills do they need in terms of analyzing and deciding about the ethical implications of AI in the businesses where they may work in future?
- What are the differences within my class in terms of culture, gender and age?
- Do they need to have any pre-requisite skill for learning AI and ethics course?
- What should be level of coverage regarding AI related content i.e., a complete ethics course or a module in the course?

The Taxonomy of Educational Objectives, also popularly referred as Bloom's Taxonomy (Bloom, 1956) provides a framework which educators often use to create learning outcomes, as it not only helps in adequate

coverage of the subject matter but also focuses on in-depth learning which a students should achieve (Anderson & Krathwohl, 2001).

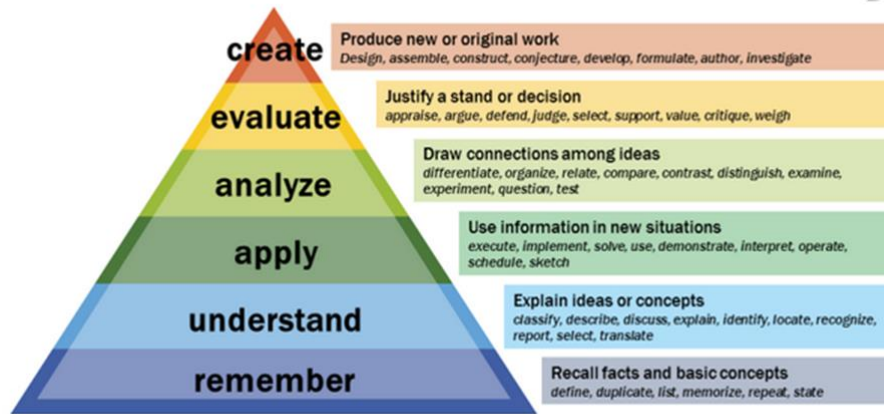


Figure 1. A Conceptual Framework for AI-Ethics Course in Graduate Level Management Programmes

Source: CTEUF (n.d.)

Based on the Bloom’s Taxonomy, the learning outcome for AI and ethics related course can be planned. Depending on the contextual factors, as discussed in preceding paragraphs, the different knowledge, skill and attitude related outcomes can be conceptualized. Some of the suggested outcomes as per the different levels in Bloom’s Taxonomy, and with special emphasis on AI and Business ethics, are presented in Table 1.0. The AI related ethical analysis involves both the theoretical foundations in ethics as well the analytical, decision-making skills in application of ethical theories in the given context. The student, at advanced level of learning, should also be able to create the solutions for ethical and responsible integration of AI in the given context.

Table 1. Examples of learning outcomes related to AI and Ethics

Bloom’s Taxonomy Level	Example of AI and Ethics Learning Outcome
Remember	Ability to display foundation level knowledge related to ethics theory
Understand	Understanding of ethical issues involved in integration of AI
Apply	Ability to apply the different ethical approaches to identify possible consequences of AI integration in the given context.
Analyze	Skills in analyzing ethical implications (using different ethical approaches) of AI integration in the given context.
Evaluate	Ability to critically examine the different types/ levels of AI integration in the given context
Create	Develop a solution for responsible AI integration in the given business context.

Reeves (1990) links the Cognitive and Affective domains of Bloom's Taxonomy (Bloom, 1956, op. cit.; CTE, n.d.,b) to teaching of business ethics. The article (Reeves, 1990, op. cit.) explains the six levels of the cognitive domain and illustrate how the six cognitive levels might be used and tested in the classroom using six-steps case method. Upon deciding the course outcome, the content of the course as well as the pedagogy can be decided in view of the target learning group characteristics, course positioning and other contextual factors.

### **A Framework for Business Ethics Education with AI Perspective**

The business ethics course development requires a holistic perspective in terms of understanding the contextual issues. The ethical implications of relatively new innovations like AI are yet to be tested over time, which will set the direction for slow evolutionary changes. Constant adaptations will be key.

The immediate effect of the AI integration on the different stakeholders must be analyzed carefully. This is quite evident that the AI integration will influence the different constituencies and stakeholders with varying intensity. The varying influence on stakeholder groups remain one of the main issues in analyzing ethical impact of the AI. If one stakeholder group is benefitted at the cost of another stakeholders' loss, how to balance or optimize the benefits? This is particularly challenging when we apply ethical approaches that suggest 'zero tolerance' on ethical compromise. It is not always the situation of 'utilitarian' consideration and, therefore, the ethical analysis of AI application becomes a very important as well as sensitive issue. In view of the importance the first major decision regarding ethics and AI course is linked to the broader purpose of the course, which will eventually be influenced by the contextual factors as discussed in the preceding section.

Once the purpose of the course is agreed, its' positioning within the programme needs to be decided. One can integrate the ethical issues in every course of subject of study or one may design a complete stand-alone course on ethics and AI integration. Based on the positioning and preferred format, the course learning outcomes as well as other related decisions can be made. One important issue related to the AI and ethics is the lack of research-based information regarding the ethical implications of AI, however, this can also be considered as an opportunity in course design with active action-learning and research components. The integration of research will not only help in developing better understanding about the ethical issues in AI use but will also support the knowledge creation on the issue. A suggested framework for AI and ethics course development in business programmes is conceptualized in Figure 2.0 below.

The research component can be integrated as a part of learning methodology and can be linked to coursework assessment. Making the research as a continuous formative assessment component will help in enhancing the action-learning. This will also help in creation of evidence-based contents related to the course topics and the same can be used in classroom. The integration of the research as an embedded process will help in co-creation i.e. students will be participating in building the knowledge while at the same time learning for the desired course outcomes.



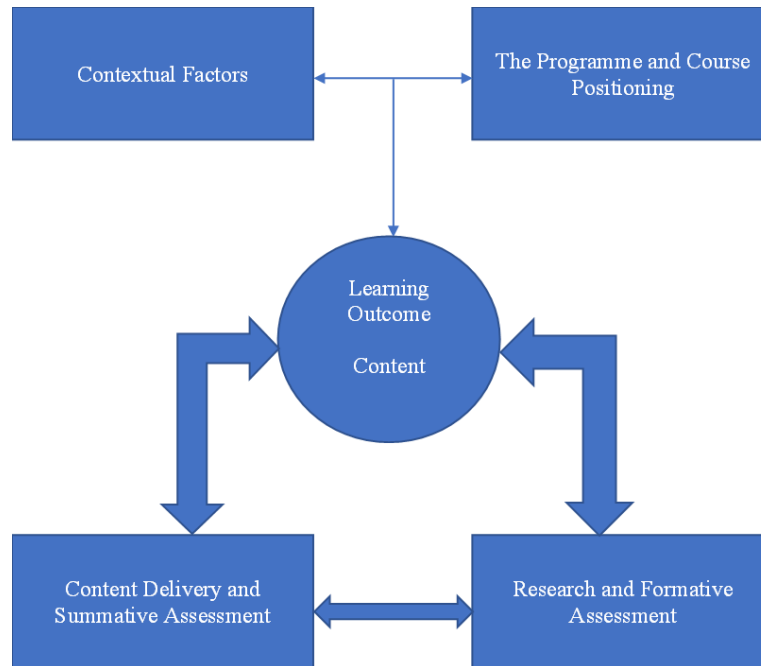


Figure 2. A Conceptual Framework for AI-Ethics Course in Graduate Level Management Programmes

The class-room delivery of the course, which can be linked to the course-end assessment or summative assessment, also needs to be planned carefully. While integration of teaching with the research through action and experiential learning will make the learning quite innovative, the class-room delivery methods should also be participative and as well as engaging. For example, the students can be given group tasks and projects involving ethical reasoning and decision-making related to different AI integration situations.

The stakeholder impact analysis part could be covered through field research or secondary research. Given the increasing use of technology in research activities, the participants can be effectively engaged in stakeholder research even without visiting the stakeholders and organizations physically. /use of innovative and tailored pedagogy would be critical in the success of the course in terms of the level of learning outcome accomplishment by the students.

This is important that course should be revised every time with the new group of students. The students are major influencing contextual factor. Given the highly research-intensive nature of the proposed ethics course, the tailoring of the course to the participating student characteristics will help in enhancing the course impact significantly. The suggested framework is conceptual in nature. The framework is neither prescriptive nor it is sequential, i.e., many activities related to course planning can be undertaken simultaneously.

## Conclusions

The increasing use of AI is giving rise to many ethical concerns in the society and economy in general. It has been observed that the AI can be integrated both with the product/ service or in the process of the business. Irrespective of where and how it is used, the integration of AI triggers many ethical issues. In addition to other factors, the ethical issues related to AI can be due to algorithm, patterned learning by the machine or the use of private data. Depending on the degree and context of AI integration, the impact would be varying on different stakeholders and, therefore, optimization of positive stakeholder impact is one of the primary concerns in the ethical analysis of the AI integration.

Due to the importance of the theme, it is proposed that AI and Ethics course should be integrated with graduate level management programmes. Although, the content and pedagogy of the course would change according to context and programme positioning, a conceptual framework has been proposed to systematically design and deliver a contextualized ethics course in the given context. The framework suggests application of Bloom's Taxonomy in course learning outcome design. Also, the research and teaching is proposed to be aligned to foster the knowledge co-creation on the subject theme.

There is an additional layer of implications and conclusions. It raises the question to what extent faculty members and their institutions have the skills to readily master such course design and curricula adaptation processes? Two further considerations matter. First, is a course design or redesign also used as an opportunity to create an innovation which is merely me-too or cutting-edge? The process of designing and redesigning courses should, therefore, be linked to the overall strategic positioning of the school as either a thought and quality leader or an efficiency-focused, reactive institution. The latter may well differentiate in either dimensions or focus on an operational model which lower ambitions. Yet, there is a need to for any course designer to understand the bigger organizational context.

If there is ambiguity in this regard, faculty members and program directors have unique opportunity to create 'pocket of excellence', i.e., an area which may well be ahead of other departments or teams in the organization. A fresh course design could inspire others to uplift the quality of their offerings, which in turn could foster a culture of innovation and constant and never-ending improvements. In this context, it helps if faculty members and course leaders are fully aware of their own strengths and aspirations.

Organizations should not keep them too busy to notice what aspirations and talents exist. Mere busyness does not productivity as it could also signal a mere lack of capacity. What applies to course participants and graduates in terms of the obligation to develop self-awareness, also holds for faculty members and course leaders. They have agency to not only understand themselves better but to carry out a certain job crafting to shape the workplace, at least to some extent, in a way that is most conducive for them.

This has implications for business school and higher education governance. Deans should ensure the institutions

have a clear winning recipe in place, i.e., a solid understanding what the unique contribution of the institution is and how to win in a marketplace relevant to them. This includes idea on how graduates and researchers can win, too. Next to ensuring an institutional strategy exists, organizational governance must add value. The helm of the business school, or more generally put the helm of the higher education institution, must add value. Key questions for reflections include the following. What is currently at stake and is the current organizational leadership and institution overall effective in mitigating any threats while securing opportunities?

If this is not the case, deans ought to adapt their roles dynamically. In terms of AI, there are tremendous upsides and downsides. If we merely advance technological capabilities in societies without clarifying responsibilities, we miss opportunities to construct a better future. Deans should equally explore to what extent there are talents on board which need empowerment and decentralization to not only stay motivated but also add their own value and self-actualize. Talent management is not just a key responsibility for leaders in the corporate world. Also business schools and management education are fields in which talent attraction, motivation and retention matters significantly.

COVID-19 represents a period for many countries and institutions, which may well have been without precedence. Digitalization efforts often saw boosts, while internationalization of student bodies slowed down. International travel and face-to-face networking possibly catalyzing research got inhibited. COVID-19 was a critical event in the development of institutions. Naturally, past approaches to operational models had to be revisited. It is in those moments of critical events, during which institutions could trigger change more easily. Therefore, from a change management point of view, institutional leaders should reflect on their own change management acumen and monitor what the best conditions for organizational change are.

In the context of AI, a special summit, a social media-friendly dialogue between powerful CEOs arguing about AI, a breakthrough innovation, or a scandal in the news could ensure the relevant attention and awareness to bring about change. Change leaders then merely need to ensure the necessary sense of urgency in their organizations and units in order to trigger effective change with a lasting impact. In other words, critical events can represent unique opportunities to orchestrate change. Once more, the self-awareness of a change agent's transformation skills should be identified proactively and within business schools or higher education institutions, such change acumen should equally be built proactively.

In addition, it is essential to clarify how emerging ethics courses link to the other parts of programs. Pure ethics programs as a stand-alone offering may well entail limited commercial success and would not allow for a truly holistic education. Ethics courses should not be isolated in a program. They should not be perceived as an artificial ad-on. In turn, ethics courses should be fully integrated into a curriculum. It should be a natural element of a high-quality program to reflect upon not only knowledge but the skills needed in order to bring management and AI solutions to life. It should make sense intuitively that beyond knowledge and skills, courses address the being and becoming level.

Being allows for discussions on what type of leader or manager someone aspires to be. Nowadays, a number of psychometric tests exist to find out more about essential values in life and what genuine strengths exist amongst diverse talents. Case studies, YouTube videos, exercises, and simulations can equally help clarify one's values and skill levels already in place to deal with ethical dilemmas. Academic networks, such as the Academy of Management, offer a plethora of experts and resources on how to construct relevant, high-impact learning interventions. Faculty development workshops exist in different parts of the world as well. There is no excuse for not embarking on a learning journey on how to construct unique learning journeys – at reasonably low cost.

Moreover, the becoming level of learning fosters a dialogue about the growth trajectories over time. Like organizations and other organism in nature, course participants must understand how to evolve further over time in order to best cope with environmental complexity. Not everyone is likely to be born with the sufficient skills to direct AI projects with mitigated ethical dilemmas. There are project management skills to be mastered, communication skills to be added, and complexity skills to be honed. If participants of courses and graduates know how to be a role model team member, team leader and project director, they can add the right value at the right point in time.

Finally, the core point of our conclusion is the link of opportunities to change with the responsibility to trigger them. It is in business schools and higher education facilities where current and future leaders are educated. This is where their normative programming takes place. Once working on AI strategies in their companies, they might not have the time for deep reflections on ethics. Gaining clarity about what business must accomplish and who drives positive change must be discussed and clarified in the formative years. This helps avoid that the complexity of ethical discussions across value, process, and outcome ethics does not overwhelm when in frantic action.

This does not mean that learning stops with the end of a course or program as life-long learning will be inevitable. Yet clarity on what and how to develop as for the next skills can offer value. Institutions must understand in this context that not all learners are equal. Some learners like and even insist they drive their own learning from a control and decision-making perspective. Others are more open to others influencing their journey. Faculty members must move beyond a one-size-fits-all approach to managing learners and programs.

There is substantial potential in simplifying ethical discussions by deciding to have humanism as a North Star. Humanism in business simply inquires if a solution and an individual foster human dignity as an outcome of action? Of course, any solution should contribute to efficiency and effectiveness but should do so with an eye on protecting and furthering humanism in business. Human dignity has somewhat of a local connotation and, therefore, must be interpreted in each context individually. Yet doing so improves the quality of decisions and actions.

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# Anti-Corruption Education in Management Programmes: Learning Style Versatility and Artificial Intelligence (AI) Applications in Course Development and Delivery

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**Abstract:** The effective anti-corruption education requires careful understanding of the teaching-learning context. At the different stages of the designing an anti-corruption focuses course, we need to consider factors related to target learning group as well as the respective context in which they are. Learning style versatility is an important factor that needs to be analyzed for an effective and outcome linked course in Anti-Corruption. The emergence of artificial intelligence provides significant opportunities in improving the outcome-focused course design. Automating the identification of learning style versatility of target learning group can simplify the process of customizing the course contents, pedagogy and assessment framework for the given learning group. The article is conceptual in nature and provides a generic framework for applying artificial intelligence (AI) in developing the anti-corruption course, tailored to the target learning group characteristics. The suggested framework can be adapted under the different teaching-learnings contexts, as per the need. The anti-corruption is an extended and applied area of ethics and, therefore, the framework can also be extended in developing course modules related to other similar themes.

**Keywords:** Anti-corruption; Artificial Intelligence (AI), Ethics, Learning Style Versatility, Course Design

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## Introduction

The main tasks in any course curriculum design includes the three broader stages: defining the course learning

outcomes; identifying the content sources; and setting the pedagogy. All these three stages require careful analysis of the target learning groups and a number of other context related variables. The analysis of learning style is one among the important factors that play important role in the curriculum development. The same steps are applied in the curriculum design and development in any of the courses in higher education, however, the focus on a particular stage could vary depending on the nature of subject, level and purpose of the course.

The course delivery and assessment are the part of implementation and once the designed course is ready for delivery, a number of contextual as well as target learning group related factors also becomes important for effective implementation. With the help of AI, many of the tasks related to course design and delivery can be simplified. While proposing the AI applications, we mainly aim to develop the mechanism where AI can complement the faculty/expert efforts and simplify the selection, analysis and feedback with right kind of data use. In next sections, we will be more specifically exploring the following dimensions in relation to anti-corruption education:

- a. Identification of different factors that influence the course design and delivery
- b. Analyzing the role of Learning Style Versatility (LSV) in effective curriculum design and delivery.
- c. Identification of possible AI application areas in course development and delivery.
- d. Suggesting a generic framework for AI enabled course development and delivery framework.

The analysis undertaken in the chapter is purely based on the secondary data sources. Most of the insights have been drawn from the published literature by experts or credible agencies. The application areas for AI has been suggested to improve the process, however, the chapter does not provide any technical details for designing the AI applications, as it is beyond the scope.

### **Factors Influencing Curriculum Design and Delivery**

There is no universally acceptable model for standardized course development. Universities and institutions of education have suggested different frameworks which are often adapted in the process of curriculum development under any given situation. It is important to note that broadly the steps suggested in different frameworks are similar or quite related. For example; The Centre for Teaching and Learning, University of North Carolina, Charlotte suggests seven stepped approach for curriculum development. Adapting these steps in context of anti-corruption education, the following are the steps (UNCC, n.d.):

- A. Deciding expected learning goals for target group (Goals)
- B. Identification of best teaching approaches for anti-corruption (Methods/ Approaches)
- C. Identification of assessment for learning/ testing the progress (Assessment Tools)
- D. Availability of Time and Space (Duration)
- E. Availability of Technological Tools (Technology)
- F. Learning Sequence Planning (Order)

#### G. Experience based reflections for improvement (Reflection)

There are different considerations in designing an effective course curriculum. The analysis of learning styles of the target learning group is considered to be an important consideration in curriculum design. However, in addition to the learning styles of the target learning groups, there are other variables also that must be taken into account while developing an effective ethics teaching plan (Sims and Felton, Jr., 2005). Teaching anti-corruption is a part of applied ethics education, the following factors can be considered in designing effective teaching strategy:

F1: The learning styles of the members in target group (Learning Style)

F2: The nature of the ethics learning task (Nature)

F3: Target group's level of readiness for learning ethical concepts (Preparedness)

F4: Previous experience and knowledge in area of Anti-Corruption/ ethics (Relevant Knowledge/ Experience.

F5: The personality related factors of both students and teachers (Personality)

F6: The personality of other learners in the target group (Peer)

F7: The political ethos of the institution, including department/ school where the anti-corruption course is to be taught (Institutional Ethos)

F8: Dominant values and traditions of the culture, which the students belong to (Cultural Context)

F9: Balance between the active engagements of students with issues in real-life situations (Relevance);

The steps for curriculum development (A to G) and the important factors/ considerations in the curriculum development (F1 to F9) are the two main dimensions for developing the initial course map. Combining these two dimensions will help in developing the initial check-list for identification of the relevant issues. The process has been described in the following section.

#### **Developing Initial Course Framework**

The Exhibit 1.0 presents a 7 X 9 matrix which can be used as a check list for development of an effective anti-corruption curriculum. The specific requirements for each combination of the matrix could be highlighted. However, before mapping it as the larger matrix, as suggested, the specific combinations of the relevant factor-steps can be identified in the given context. Once, the check-list is confirmed, the requirements of the curriculum can be analysed in consultation with the different relevant experts and other stakeholder groups like target learning group, industry and organizations including NGOs, sponsors (mainly in case of customized executive programmes), regulatory bodies, etc.

Wherever, the secondary sources benchmarks are available, the same can be considered unless there are specific contextualization needs relating to the design and delivery of the curriculum. This is important to note that use of the term matrix here is in general sense to present a two-dimensional analytical table, not exactly the matrix comprising numbers. Based on the above the two main steps for anti-corruption course development would



comprise of: First, the checking of relevant Step-Factor map combination; and second, the detailed analysis of the specific requirements for given combination of the Step-Factor. Based on the analysis, the following elements of the desired course can be presented in the given template (Exhibit 2.0).

Exhibit 1.0: Initial Course Mapping Checklist

Steps in Course Development	Considerations in Course Development								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
Goals									
Teaching Approaches									
Assessment Tools									
Duration									
Technology									
Order									
Reflection									

Exhibit 2.0: Initial Course Design Template

Course Design Elements	Check-List/ Description
Course Description	<ul style="list-style-type: none"> <li>Does it provide specific description of what the course intends to achieve?</li> </ul>
Course Learning Outcomes (COs)	<ul style="list-style-type: none"> <li>Do the COs provide the different combination of knowledge, skill and attitude related to anti-corruption/ ethical situation handling?</li> </ul>
Course Contents (Duration)	<ul style="list-style-type: none"> <li>Are the contents/ modules aligned to the COs?</li> <li>Have we adequately defined the distribution of contents to the time available?</li> </ul>
Assessment Tools and Duration	<ul style="list-style-type: none"> <li>Do the assessment methods match with the requirements of module learning as the COs?</li> </ul>
Technological Support	<ul style="list-style-type: none"> <li>What are the technological tools available to enhance the effectiveness of learning, delivery and assessment?</li> </ul>
Innovative Pedagogical Methods	<ul style="list-style-type: none"> <li>Are we using any innovative pedagogical method which is aligned to the target learning group characteristics?</li> </ul>
References/ Support Material	<ul style="list-style-type: none"> <li>Are available reading/ learning materials adequate and relevant?</li> </ul>
CO Achievement Methodology	<ul style="list-style-type: none"> <li>Have we defined how we are going to measure the accomplishment of the COs for the proposed course?</li> </ul>

### **Learning Style Versatility (LSV) and Anti-Corruption Curriculum**

The recent research shows the importance of Learning Style Versatility (LSV) in effecting teaching and learning. Learning style versatility (LSV) can not only help in better learning performance but also helps institutions in innovating, making education relevant and ensuring better return on education (Amann, 2021). LSV can be used for effective customization of contents and course-delivery.

The concept of LSV is based on the learning styles suggested by Peter Honey and Alan Mumford who suggested four distinct learning styles i.e. Activist, Theorist; Pragmatist and Reflector (Honey and Mumford, 1982). These different learning styles reflect the different individual preferences or approaches for the learning. The authors suggest that in order to effectively learn, one must know what is one's preferred learning style. However, they also suggest to have versatility in learning styles for effective learning i.e. one should try to be open to other learning preferences as well in order to maximize one's learning outcome (UOL, n.d.).

Extending and testing the concept in context of business and management education, it was found that the learning style versatility can add significantly to learning effectiveness of the target learning groups (Amann, 2021). Therefore, it becomes quite important for the learner and educator both that they try to align the teaching-learning in such a ways that it also creates interest for the learner to expand one's learning style and thus, contributing to enhancing the learning effectiveness at optimum level of efforts. Extending the concept in context of anti-corruption course development and delivery, we can address a number of issues related to the course planning (Exhibit 2.0) and its' delivery.

It is quite evident that under the limited time and scope of any course curriculum, we can not change the learning style of any target group, however, we can try to design the course (content, pedagogy and assessment) in such a way that: fits to the Learning Style Versatility (LSV) of the given target group; and contributes to enhance the LSV of the group through balanced design. We understand that the learning-journey in any course includes variety of different experiences which may be planned or spontaneous, direct or indirect and formal or informal. Understanding the LSV also helps in improving the learning skills of the group as well as the planned learning processes. The Learning Style Versatility (LSV) of the target learning group can be profiled to ensure that the pedagogy, content and assessment strategies for the course is relevant and attractive to the group we are designing for. The use of LSV not only helps in making learning easier but it also makes the learning more enjoyable and effective. Once we understand how the target group broadly learns, the learning opportunities i.e. content, pedagogy and assessment tools can be matched accordingly. Therefore, at the next stage, which would be third step of the process, the learning style versatility of the target learning group can be measured analysed. The next step can be alignment of the content, pedagogy and assessment in view of the existing group LSV. However, it is important to note that before aligning the content, pedagogy and assessment tools, it would be important to subjectively analyse the LSV characteristics of the target group, as the target group may require interventions to enhance LSV for improving the learning experience.

Therefore, the LSV should not only be interpreted and analysed for the entire LSV score rather the trends within the peer-group i.e. understanding the ‘learning style (s) which are more dominating in a group than others’. This is quite important as role of peer interaction and peer-group learning is quite important in any higher education course. Anti-corruption is such a highly contextual theme, which makes the peer-group learning extremely important for the overall course effectiveness. Therefore, it would be important to match the content, pedagogy and assessment with the group characteristics by matching with the LSV as well as the dominant peer-group learning style (s) in the given context. This task can be effectively done with the application of AI, as it can be helpful in eliminating the complexities, improving the accuracy and saving the time in analysis.

**Developing Anti-Corruption Course: A Generic Framework for AI Application**

The Artificial Intelligence (AI) can be very useful in the curriculum design. The AI technology provides opportunity to learn from the previous experiences. Systematic learning from the prior experience can help in continuous improvement of any course.

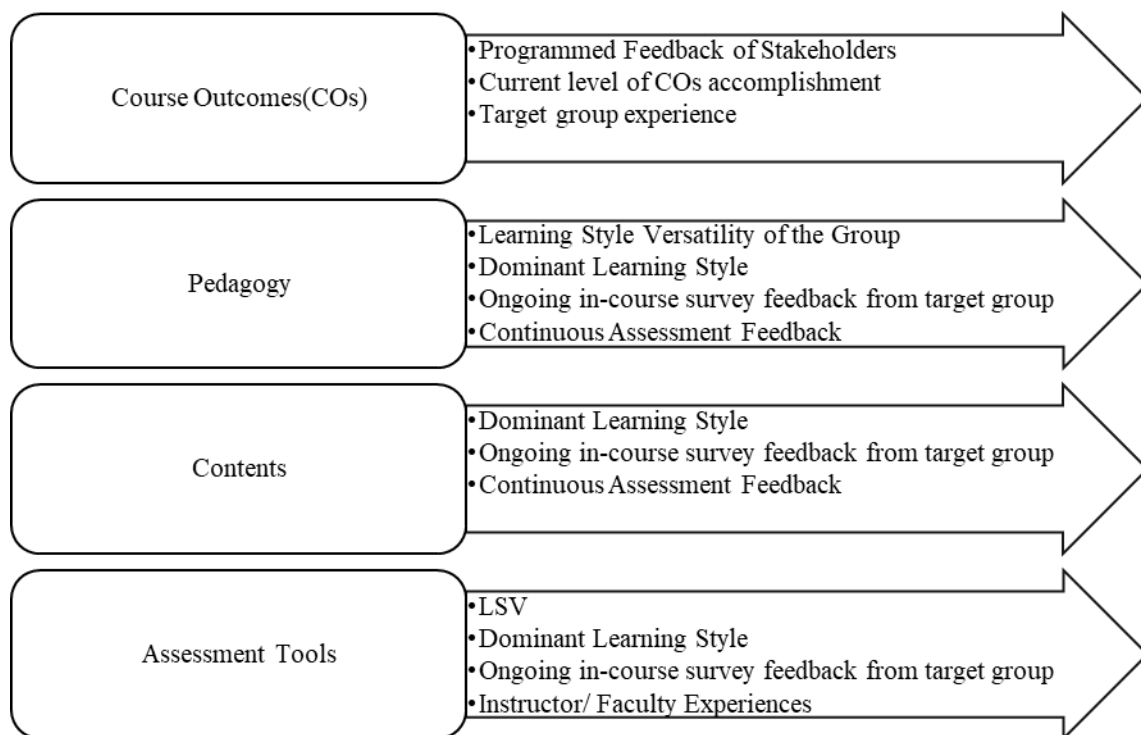


Figure 1.0: Specific Inputs for AI Applications in Different Areas of Course Development

The AI based curriculum development can facilitate improvements across the different areas ranging from course learning outcome to pedagogy selection and assessment design. However, it is important to understand that for specific AI application area, the inputs and sources must be defined carefully in developing the algorithm. Figure 1.0 shows the important areas of AI applications with required inputs and sources. This is an indicative and as per the need, it can be further customized.

Therefore, at the next stage, the input requirements for AI programme development must be specified. The effective application of AI would require interface with the different processes during and after course. This will help in collecting data from the different sources, and suggesting improvements as per the defined algorithm. However, in order to develop an AI programme for continuous improvement in the Anti-Corruption courses, it would be important to define the types of the input information requirements for the different aspects of the curriculum (Figure 1.0). Using the information, the desired improvements in the curriculum can be realized on the real-time basis. Also, it can help in predicting the LSV improvement potential in future cohorts based on the cumulative ongoing and previous cohort experiences in Anti-Corruption teaching.

Combining the previous stages, a generic framework for AI-enabled Anti-Corruption Course Development is suggested in Figure 2.0. The proposed framework for AI-enabled Anti-Corruption course development includes five steps. Each of these steps have been discussed earlier in the Chapter.

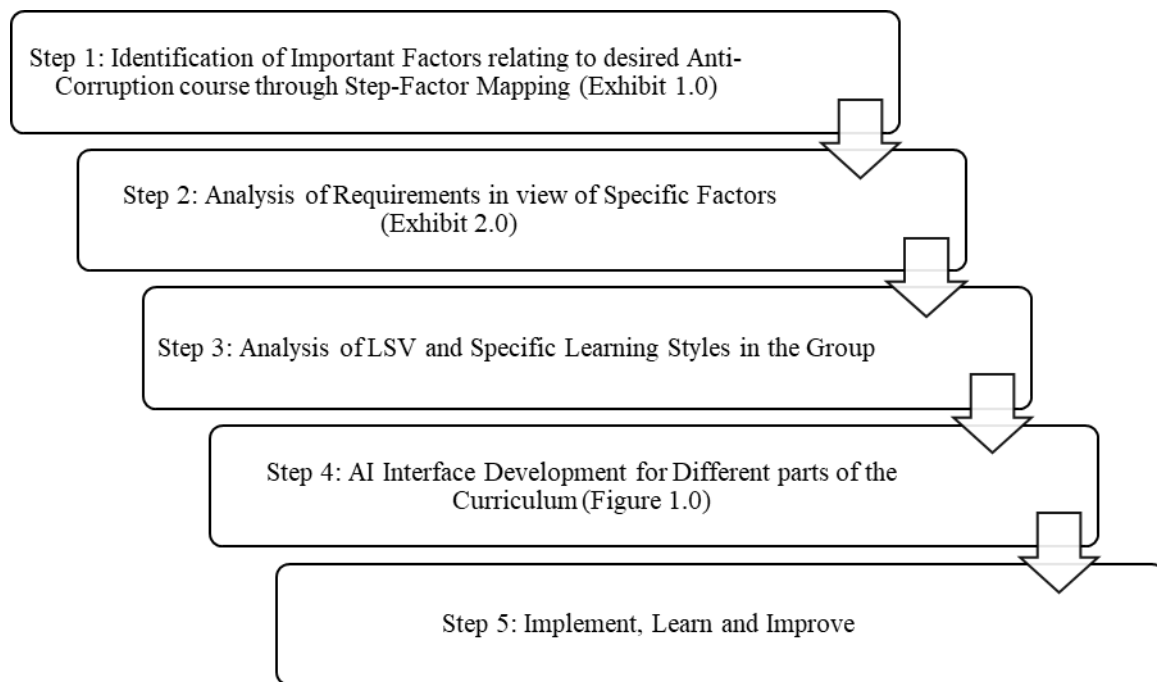


Figure 2.0: Generic Framework for AI Enabled Anti-Corruption Course Development

The AI interface can be planned for both Step 4.0 i.e. the aspects related to Anti-corruption curriculum as well as for entire process (Figure 2.0). The AI applications can also be deployed for the analysis of the specific steps in the framework. Like any other AI system, the effectiveness of the application would depend on the volume of the data and accuracy in defining the input-output relationship. However, the main advantage of the framework would be in terms of its’ potential to offer contextually relevant curriculum with real-time improvement, which is in-built in the process.

The technical aspects of the AI interface are to be developed by the experts in consultation with the concerned

faculty and target learning groups. Once the system is functional, it will provide opportunities for improvements based on accumulative experience of the cohorts. After initial fine-tuning and improvements in the framework, the standardized AI-enabled curriculum development for Anti-Corruption can be developed.

The suggested framework is primarily for the design and delivery of Anti-Corruption course in view of the highly contextual nature of the course. The framework is generic and with little customization, it could be applied to the different courses. The above framework can be very useful for courses, which require high degree of contextual alignment in course outcome, pedagogy, content and assessment.

### **Consideration in AI-Enabled Course Development**

Application of AI in course development requires a number of issues to be addressed. The AI-enabled system complements the conventional course development process by simplifying the data identification and analysis, required for effective design and delivery of the course. The following factors should be considered while developing and delivering the AI-enabled course:

1. The technological support system i.e. AI programme development and its' interface with course process must be closely monitored by the faculty member/ instructor facilitating the course.
2. As far as possible, the real-time improvements should be encouraged, as that is one of the major advantages of using the technology.
3. Profiling of LSV and specific LS should also be done using AI and the output of the system can be integrated with the broader curriculum development system.
4. Regular monitoring of outcomes, contents, and pedagogy and assessment tools is required during the initial phases of the AI-enabled course development system.
5. All the participants and other stakeholders must be sensitized about the technological aspects of the entire process so that the desired feedback and improvements can be realized smoothly.
6. As far as possible, during the initial application phase, the automated results should also be supplemented with manual change option so that in case of an undesired deviation, the corrective action can be introduced by the faculty concerned.
7. The improvements in the curriculum planning and delivery should be based on cumulative learning from the system and, therefore, this aspect requires consideration at the stage of system design.

The faculty members, course planners and AI developments should work closely to develop system for value addition in the teaching-learning experience and the process. In previous sections, we have discussed the main

areas for AI application in Anti-Corruption course design. Some illustrations of how AI can be used across the different dimensions of the course design and delivery process is summarised in the D3 Approach below (Exhibit 3.0).

Exhibit 3.0: Dynamic Course Improvement using D3 Approach

#### D1: Dynamic Content Selection

Identifying the type of content (case, article, Chapter, etc.) from the already identified pool of resources (Example: PRME Anti-Corruption Toolkit, PRME 2013) and dynamically improving the course contents based on learner's learning style and demiostrated progress in the course. This implies that the course outcome and outline to be defined in the beginning but the process of selecting the contents will depend on the selected variables.

#### D2: Dynamic Pedagogy Update

This can be an used as real-time feedback driven system. The course facilitator can first select a set of pedagogical tools based on the initial analysis. Based on the learner's performance and need of the topic/theme in focus. the technology interface can be used for integrating the inputs in improving the pedagogy as per the need and context. Application of AI is particularly useful in view of accuracy enhancement with the increasing number of participants.

#### D3: Dynamic Assessment Improvement

The improvement in the assessment process can also be realized using the technology. So far, the feedback obtained through the initial course assessment mainly contributes to performance assessment of the learners, however, using the technology the assessment performance of once cycle can be used as an input for improving the right assessment methods duding the next cycle.

Assessment, pedagogy and contents are deeply integrated in designing and delivering any outcome-focused course. It can be seen that the use of technology, particularly AI, can be very effective in integrating these three dimensions for improved learning experience as well as better learning outcome. The integrated D3 approach to dynamic updates can be used and applied for design and delivery of context focused Anti-corruption course. It is important to note that the distinct feature of this approach lies in its' ability to track and utilize the real-time changes for making the learning effective and interesting.

## Conclusions

The AI application can improve the relevance and effectiveness of the Anti-Corruption course planning and delivery. The experience shows that the Anti-corruption course, which can be considered as a part of applied

ethics education, is highly contextual in nature. The contextual relevance of the course can be enhanced by providing real-time inputs regarding the requirements in the given context during the course development process. Similarly, the participants experiences can be recorded for real-time improvement during the course delivery.

The Learning Style Versatility (LSV) can be very useful in developing an effective course for Anti-Corruption education. The suggested generic framework for AI – enabled course development and delivery can bring significant improvements not only in enhancing the user experiences but also in making the course contextually relevant and effective. The important feature of AI-enabled course development lies in its' unmatched potential for real-time improvement, which facilitates the continuous interaction of the different stakeholders on ongoing basis with aim of continuous improvement and impact.

Let us be ready for the innovation in the course development though integration of LSV with power of Artificial Intelligence. The framework is generic and, therefore, with some customization can be adapted in different courses, which requires high degree of contextual relevance. However, for developing the concept to practical model, the further consultation of experts in technology and educational instruction design will be desirable.

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# Is the UAE ready for the Fourth Industrial Revolution in the age Artificial Intelligence? Development of Artificial Intelligence in the United Arab Emirates


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**Abstract:** Artificial Intelligence (AI) is now part of the daily lexicon given the widespread adoption of devices based on AI and related capabilities. Several studies suggest that AI has heralded the Fourth Industrial Revolution. The birth of the concept of AI can be traced back to the workshop held in 1956 at Dartmouth College in the United States based on the premise that machines would be invented that would be as intelligent as human beings. Several studies have been conducted to examine the development of AI since the 1956 inaugural workshop. The focus of this paper is to review the development of AI with particular reference to the United Arab Emirates (UAE) given the strategic intent of the government to transform the economy from oil dependency with the deployment of AI initiatives across the Emirates in a variety of industries including the transformation of the governance process in the UAE. The UAE's Ministry of Artificial Intelligence overall strategy is to provide assistance to support various future service, sectors and Emirates-wide infrastructure projects. The ultimate goal is to enhance government performance at every level through the integration of smart digital systems to boost efficiency and effectiveness of administrative, economic and social services.

**Keywords:** Artificial Intelligence, Fourth Industrial Revolution, Governance transformation, United Arab Emirates

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## Introduction

Given that the concept of Artificial Intelligence (AI) is based on numerous disciplines, there is no singular



definition of AI. The origin of AI can be traced back to contributions from classical philosophers with their attempt to understand how human thinking operates based on mechanical utilization of symbols. Some philosophical contributions include syllogism by Aristotle and Al-Khwarizmi with algorithm (Berlinksi, 2000). Lull developing several logical machines (Bonner, 2007). Other contributors include Leibniz, Hobbes, Descartes and others (McCorduck,2004). Thereafter contributions from the field of computer science building upon the work of several mathematicians. The initial effort focused on programmable computers and code breaking computers (Russell & Norvig, 2003). This phase was followed by the synthesis of various fields such as mathematics, psychology, engineering, economics and political science with the aim of exploring the possibility of developing an artificial brain (Cordeschi, 2002).

There were many stages of development that has led to the current state-of the art in terms of AI. A few definitions given the lack of consensus include: “. . . The ability of a system to act appropriately in an uncertain environment, where appropriate action is that which increases the probability of success, and success is the achievement of behavioral subgoals that support the system’s ultimate goal” (Albus 1991); “Any system . . . that generates adaptive behavior to meet goals in a range of environments can be said to be intelligent.” (Fogel 1995); “Intelligent systems are expected to work, and work well, in many different environments. Their property of intelligence allows them to maximize the probability of success even if full knowledge of the situation is not available. Functioning of intelligent systems cannot be considered separately from the environment and the concrete situation including the goal” (Gudwin 2000); “. . . The essential, domain-independent skills necessary for acquiring a wide range of domain-specific knowledge – the ability to learn anything. Achieving this with ‘artificial general intelligence’ (AGI) requires a highly adaptive, general-purpose system that can autonomously acquire an extremely wide range of specific knowledge and skills and can improve its own cognitive ability through self-directed learning” (Voss 2005); “that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment” (Nilsson 2010).

Kumar (2018) offers the following as possible definitions of AI: “The ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings;” “a machine completing the tasks which involve a certain degree of intelligence which was previously deemed only to be done by humans;” “is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning, reasoning, and self-correction;” “the capability of a machine to imitate the intelligent human behaviour.” In addition to the various definitions proposed, Kumar (2018) further classifies AI into two categories: Weak or Narrow AI and Strong AI. Narrow AI applies to machines with limited intelligence but assembled in such a manner as to appear smart. Strong AI on the other hand applies to systems that are capable of thinking and can execute tasks similar to humans.

Alzaidi (2018) suggests that AI represents a field of science that deals with competing possibilities of the modern computer systems in order to solve problems by applying complex human abilities of self-correction, learning, and reasoning. Floridi (2019), posits that AI are artificial agents that can be autonomous, smart,

informed and capable of performing morally significant actions without continuous input by the programmers. In our opinion AI can be simply defined as the system by which machines are capable to perform complex tasks associated with intelligent human behaviors.

## **AI in the UAE**

From an historical perspective, the Smart City (composed of Smart Life, Smart Economy & Smart Tourism) initiative by the Dubai government in 2014 paved the way for the rapid adoption of AI in the UAE (Kressner, 2017). One definition of a smart city is “a community in which citizens, business firms, knowledge institutions, and municipal agencies collaborate with one another to achieve systems integration and efficiency, citizen engagement, and a continually improving quality of life.” Snow et al. (2016). Neirotti et al (2014) suggest that a smart city represents an ecosystem which is largely developed via the effective utilization of technology with the goal of enhancing the quality of life of the citizens by the efficient integration of systems and services. The foundation for a successful smart city include: well-designed information and communications technology (ICT), linked platforms to engage various stakeholders from idea formulation to implementation stage, efficient utilization of data gathered from interfaces with the key stake holders in addition to analysis of big data (Berron et al., 2016).

The UAE embarked on the road to full deployment of AI in 2011 as stated by Sheikh bin Rashid, the Vice President and Prime Minister of the UAE and Ruler of Dubai “we began providing e-government services 16 years ago. Today, we embark on a new phase, embracing AI in the public and private sectors” when the UAE Centennial Plan 2071 was launched in October of 2017. The Sheikh further stated that “we want the UAE to become the world’s most prepared country for artificial intelligence.....the new phase of governing in the UAE will focus on future skills, future sciences and future technology, as we prepare for the centenary to ensure a better future for our generations” (Stepfeed, 2019).

In addition to the UAE Centennial Plan 2071, the stated goal and plan for the UAE is to be recognized as the world leader in the field of AI by 2031. As such, in October 2017, the UAE Government launched ‘UAE Strategy for Artificial Intelligence (AI).’ This essentially signals a new era of governance which will be based on novel delivery of services, sectors and infrastructure projects. This is the first globally expressed strategy pertaining to AI with the aim of:

- achieving the stated objectives outlined in the UAE Centennial 2071 plan
- boosting government performance at all levels
- utilizing an integrated smart digital system capable of overcoming challenges and providing quick efficient solutions.
- Making the UAE the first in the field of AI investments in various sectors.
- Create new vital market with high economic value to boost the gross domestic as well as the gross national product of the UAE.

The UAE 2031 Strategy (About the UAE, May 2019) is directed at the following sectors:

- transport – to reduce accidents and cut operational costs
- health – to minimize chronic and dangerous diseases
- space – to help conduct accurate experiments, reduce rate of costly mistakes
- renewable energy – to manage facilities
- water – to conduct analysis and studies to provide water sources
- technology – to increase productivity and help with general spending
- education – to cut costs and enhance desire for education
- environment – to increase forestation rate
- traffic – to reduce accidents and traffic jams and draw more effective traffic policies.

The AI strategy will be guided by the following five themes:

- the formation of the UAE AI Council
- workshops, programs, initiatives and field visits to government bodies
- develop capabilities and skills of all staff operating in the field of technology and organize training courses for government officials
- provide all services via AI and the full integration of AI into medical and security services
- launch leadership strategy and issue a government law on the safe use of AI.

Another substantial addition to support the AI initiative is the creation of a Ministry for Artificial Intelligence and the appointment of His Excellency Omar Bin Sultan Al Olama as the Minister of State for Artificial Intelligence further showing the commitment of the UAE to comprehensive deployment of AI. Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the U.A.E and Ruler of Dubai stated that “we want the U.A.E. to become the world’s most prepared country for artificial intelligence,” said in a press release. He added that the new phase of governing in the U.A.E. will focus on “future skills, future sciences and future technology, as we prepare for the centenary to ensure a better future for our generations” Forbes Middle East (October 2017).

The UAE in furtherance of AI deployment/development has opened the first of a kind university – The Mohammad Bin Zayed University of Artificial Intelligence in Abu Dhabi which will be ready to receive students by September 2020. The university will only offer AI graduate programs at the Masters and PhD level in a variety of AI subfields such as machine learning, Computer vision and natural language processing. The UAE is in the process of introducing Project Oyoon based of thousands of interconnected surveillance cameras utilizing AI and machine learning to track criminals. There are also plans to deploy a variant of the technology to airports which will result in the phasing out of immigration officers (The National, 2018).

In October 2019, Dubai launched the world’s first Artificial Intelligence fatwa service. The platform will issue fatwas (Islamic rulings on religious matters). This service will replace the need for Islamic scholars answering questions over the phone. Table 1 below present a summary of AI milestone in the UAE.

Table 1. United Arab Emirates (UAE) Artificial Intelligence (AI) Milestones

DATE	INITIATIVE	PURPOSE
<b>Dubai (2011)</b>	<b>Artificial Intelligence Deployment</b>	Providing E-Government Services
<b>Dubai 2014</b>	<b>Dubai Smart City</b>	1. Employ AI capabilities to make Dubai more efficient by revolutionizing the way its residents and visitors live, work and play as it strives to become the world's smartest <b>city</b> by 2021. 2. Eliminate all applicable paper transaction by 2021.
<b>UAE 2017</b>	<b>UAE National Artificial Intelligence Strategy 2031</b>	For UAE to be recognized as the global leader in the field of AI by 2031 based on novel delivery of services, sectors
<b>UAE 2017</b>	<b>UAE Centennial Plan 2071</b>	The goal is for the UAE to be the best country in the world by 2071. The vision's objectives also include the development of education, with a focus on advanced technology and engineering, and instilling an Emirati moral values system in future generations" according to Shaikh Mohammad Bin Zayed Al Nahyan, Abu Dhabi Crown Prince and Deputy Supreme Commander of the UAE Armed Forces
<b>UAE 2017</b>	<b>Ministry of Artificial Intelligence</b>	Co-ordinate AI efforts in the UAE. The Ministry will invest in advanced technologies and AI tools that will be deployed in all fields of work and ensure the government's overall performance in terms of efficiency and effectiveness. The Ministry will also implement laws and legislation to govern AI in the UAE. The Ministry of Education and the Ministry of Higher Education will also work as partners in the areas of Scientific Research, National Curriculum and training people for the AI environment
<b>UAE 2018</b>	<b>UAE Project Oyoon</b>	The UAE is in the process of introducing Project Oyoon based of thousands of interconnected surveillance cameras utilizing AI and machine learning to track criminals. There are also plans to deploy a variant of the technology to airports which will result in the phasing out of immigration officers.
<b>UAE 2019</b>	<b>UAE Citizenship</b>	Official grant of UAE citizenship to an AI powered ROBOT named "Sophia." Sophia is capable of humanoid thinking that can communicate through human speech with real life facial expressions.
<b>UAE 2019</b>	<b>University of Artificial Intelligence- Abu Dhabi</b>	The UAE in furtherance of AI deployment/development has opened the first of a kind university – The Mohammad Bin Zayed University of Artificial Intelligence in Abu Dhabi which will be ready to receive students by September 2020. The university will only offer AI graduate programs at the Masters and PhD level in a variety of AI

		subfields such as machine learning, Computer vision and natural language processing.
<b>Dubai 2019</b>	<b>Dubai AI Fatwa Service</b>	Dubai launched the world's first Artificial Intelligence fatwa service. The platform will issue fatwas (Islamic rulings on religious matters). This service will replace the need for Islamic scholars answering questions over the phone.
<b>UAE 2019</b>	<b>UAE Council for Artificial Intelligence</b>	The Council was established to oversee AI integration initiatives in government departments and the education sector. The council is charged with proposing policies to create an AI-friendly ecosystem encourage advanced research in the sector and promote collaboration between the public and private sectors, including international institutions to accelerate the adoption of AI.
	<b>UAE Building a Responsive Artificial Intelligence Nation (BRAIN)</b>	The UAE National Program for Artificial Intelligence – BRAIN – is a comprehensive and consolidated compilation of resources that highlight the advances in AI and Robotics, with special emphasis on the UAE's policy objective to become a leading participant in the responsible use of AI and its tools, globally.
	<b>UAE AI CAMP</b>	The intent of the camp is to empower the next generation to be in the forefront of AI advances in order to support the UAE economy as well as boost UAE's position globally in all fields in collaboration with leading national and international technology and education companies in both the public and private sectors

## Transitioning to the Age of Artificial Intelligence

The advent and deployment of AI has triggered the Fourth Industrial Revolution, adverse employment displacement of human resources (HR) can be expected. Given that UAE has expressly stated the quest to be the global leader in AI, the HR dynamics must also be explored. The First Industrial Revolution (1760-1840) was a period of significant innovations in manufacturing in Europe and the United States although the United Kingdom is recognized as leading the change. This period was marked with significant shift from the agrarian economy to a manufacturing context, overall transition from manual (hand) production methods to machine-based production, chemical manufacturing, iron production, advances in the utilization of steam/water power, development of various machine tools and implements and the transition to the mass manufacturing production (Landes, 1969). The Second Industrial Revolution (1870-1914) covered the period when significant improvements in steel production, electricity generation and utilization of petroleum products triggered several innovations with profound innovations that transformed society. The significant reduction in the cost of steel production allowed extensive railroad expansions and advances in the production of industrial machines (Hull, 1999). The Third Industrial Revolution also labelled Digital Revolution (1950-???) – this era heralded

semiconductors, computing (mainframe and personal), the internet, transition from analogue to digital platforms, demise of mechanical to digital technologies (Rifkin, 2011).

The above three revolutions can thus be summarized as the era of mechanical production to mass production and science to digital revolution. Thus, the Fourth Industrial Revolution, the era of Artificial Intelligence represents a discontinuous era which is not based on extrapolation. The First Industrial Revolution was positive overall in that average incomes rose substantially along with the improved standard of living overall (Lucas, 2002). The Second Industrial Revolution was more disruptive in terms of socio-economic consequences “these were turbulent years that saw labor violence, rising racial tension, militancy among farmers, and discontent among the unemployed. Burdened by heavy debts and falling farm prices, many farmers joined the Populist Party, which called for an increase in the amount of money in circulation, government assistance to help farmers repay loans, tariff reductions, and a graduated income tax” (Digitalhistory, 2016). The Third Industrial Revolution or the Digital Era is giving way to the Fourth Industrial AI triggered revolution. The Digital Era has had profound changes in all aspects of how people work and live. A good summation of the impact of the Digital Revolution era in *The Economist* magazine was thus stated “As manufacturing goes digital, a third great change is now gathering pace. It will allow things to be made economically in much smaller numbers, more flexible and with a much lower input of labour, thanks to new materials, completely new processes such as 3D printing, easy-to-use robots and new collaborative manufacturing services available online. The wheel is almost coming full circle, turning away from mass manufacturing and towards much more individualised production. And that in turn could bring some of the jobs back to rich countries that long ago lost them to the emerging world” (Markillie, 2012, Rivkin, 2011). The Fourth Industrial Revolution (AI era) is unlike the previous three eras due to the disruptive and discontinuous nature of the changes unlike the extrapolative nature of the past. The AI era is predicted to have profound socio-economic changes due to the advent of thinking and learning software and hardware with minimal need for human intervention.

In the past, human direction and oversight was needed to control/influence machines and processes. A survey conducted by the Mohammed Bib Rashid School of Government in 2017 found that more than 91% of Arab internet users were concerned about emerging technologies such as Artificial intelligence, 3D printing, cryptocurrencies and other emerging AI derived platforms. There are also concerns about political-economic, ethical, privacy and security due to these emerging technologies (The Arab World Online, 2017).

An Organization for Economic Cooperation and Development (OECD) brief confirmed that Information and Computing/communication Technology (ICT) has already profoundly changed the nature of jobs and skills as a result of the rate of discontinuous change which translates to skill obsolescence. As such, digital literacy and continuous training is needed to maintain currency by employees (Khaleej Times, 2014). According to a study conducted by the World Economic Forum (WEF) in 2017 found that advanced robotics and AI can translate to substantial profits in various industries but likewise AI is expected to result in job losses of around 5 million by 2020 globally. Furthermore, it was estimated that 47% the jobs in the UAE are at the risk of being automated (WEF, 2017).

Dubai appears to be in the fore-front in terms of AI deployment in the UAE. For example, an AI smart lab was launched in 2017 to train government and private sector employees in terms of utilizing AI in terms of service delivery. It is recognized that AI will make certain jobs obsolete yet humans will still be needed to undertake certain specific relationships with AI in the support role. For example, Dubai has deployed robot police at malls and tourist centers and the ultimate goal is to have a 255 robot police by 2030. Another target of the Dubai Government is to have 12% of city trips to be autonomous in order to reduce traffic congestion and increase safety (WEF, 2017). Dubai has also launched a 3D Printing Strategy with the goal of having 25% of building construction based on 3D printing. The strategy targets three areas such as construction, consumer and medical products.

## Conclusion

Dubai constructed the world's first 3D printed office building constructed in 48 hours and printed in 17 days. The project employed one printing manager; installation required seven people plus ten technician and specialists to handle the engineering tasks. It was estimated that this approach resulted in 50% reduction in labor and construction costs (Lifegate, 2017). The Dubai statistics Center estimates that the disruption of this paradigm shift in construction would be significant given that about 30.6% of males over the age of 15 were engaged in the construction sector as of 2016. As such, low skilled jobs will have to shift to higher skilled jobs which will require extensive retraining (Dubai Statistics Center, 2016).

In the education field, a private company in Abu Dhabi, Alef Education is utilizing AI to transform how children learn. They have developed a platform which focuses on core subjects such as math, science and English to custom tailor the curriculum to each student, "We capture millions of data points on a daily basis, a human could not process that many data points," Alef Education CEO Geoffrey Alphonso told CNN. "What we do with that data is we look at machine-learning algorithms that can actually identify struggling concepts, mastery of different lessons," (CNN Business, 2019). Project Oyoon (eyes) will be deployed in Dubai to improve security with tens of thousands of surveillance cameras using artificial intelligence and machine learning to help track criminals. Facial recognition software will track and analyze movements and then issue warnings to suspects. An AI system will be deployed at the Abu Dhabi Airport Midfield Terminal to monitor travelers in and out of the country with the aim of phasing out immigration officers. Visitors will be able to walk through a scanning tunnel that will monitor their gait/physical characteristic in addition to other unique biometrics, such as iris recognition and finger prints, to ensure a seamless transition through airports (The National, 2018).

The UAE is acknowledged as a leader in AI. A report by dubaiadvantage.com (2019) noted that Dubai was ranked No. 1 in Foreign Direct Investment (FDI) Technology Transfer for AI & Robotics and No. 3 in in the Top Global FDI Locations for AI & Robotics. As AI becomes more advanced, the UAE government must align the legal environment to attain necessary congruence. At present, the debate about regulation ranges from a

laissez faire approach whereby the law should evolve responsively as opposed to a strict legal environment which could hamper creativity. There is also the need to effectively manage the employment displacement that will result from the on-going deployment of AI. Perhaps a new work structure such as a 4-day week may become appropriate given the changing nature of work. Stephen Hawking (2014) offered the following comment “everything that civilization has to offer is a product of human intelligence; we cannot predict what we might achieve when this intelligence is magnified by the tools that AI may provide. But the eradication of war, disease, and poverty would be high on anyone's list. Success in creating AI would be the biggest event in human history. Unfortunately, it might also be the last.”

AI has the future in terms of considerable benefits for government, business and economies via its significant contributions to efficiency, effectiveness, productivity and innovation. However, the future research should focuses more on the ethics side of AI and answers the following questions:

- Do we trust AI?
- Should we be afraid of Artificial Intelligence?
- Are we sure that our algorithms do what we want them to do and are aligned with human values?
- How we would like to cope with the fact that AI has no emotions, so it has no empathy as well?
- If artificial intelligence is faster, stronger and smarter than human beings are we still safe in our planet?
- How do we feel with the perspective that several jobs taken by humans will be lost in favor of machines?

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## Leadership Journey in School: A Bibliometric Analysis of Instructional Leadership from 1941 to 2022

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**Abstract:** Leadership in educational settings, especially in schools, has a long history. Instructional leadership is a leadership style that is seen to increase school effectiveness. This study aims to map bibliographic data on instructional leadership over the past eight decades (1941-2022). The quantitative research approach to analyzing bibliographic information using bibliometric analysis was sourced from the Scopus database, which initially amounted to 951 documents, then became 717 documents after the screening process. Hallinger P. is the author with the most co-authorship networks, and the United States is the most co-authorship network on instructional leadership. The article "The Impact of Leadership on Student Outcomes: An Analysis of the Differential Effects of Leadership Types" by Robinson, V. M. J. (2008) is the article with the highest number of citations, and Hallinger P. is the author with the highest number of citations. The author's co-citation visualization of instructional leadership reveals 4 clusters: 1) measuring the instructional leadership, 2) school effectiveness and improvement, 3) the role of the school principal, and 4) leadership for school restructuring, performance, and achievement. The keyword network visualization for instructional leadership reveals 4 clusters: 1) the impact of instructional leadership on school climate, 2) the application of instructional leadership in school settings, 3) the relationship of instructional leadership with the concept of educational leadership in general, and school principals in particular, 4) instructional leadership efforts in developing professional and leadership teachers and teaching and learning processes that ultimately improve accountability. Future research about instructional leadership focuses more on teacher efficacy, school climate, principal preparation, and teacher professional learning.

**Keywords:** Instructional Leadership, Bibliometric Analysis, School Principal, School Effectiveness, School Climate

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## Introduction

Instructional leadership has a positive impact on schools. Effective instructional leadership can create an excellent school (Bafadal et al., 2021); by supporting that facilitates learning for all school community (Hallinger & Hosseingholizadeh, 2020); explaining the vision and mission of the school, guiding teachers in curriculum preparation, and creating a safe and comfortable environment for learning to influence the teaching and learning process in schools and classrooms to improve for all students (Hallinger et al., 2020). Research shows that instructional leadership can create effective learning and teaching activities to create excellent schools. The principal's practice as a learning leader has a significant effect on learning outcomes and student achievement (Jalampang & Raman, 2020), improving student learning outcomes (Robinson et al., 2008) and developing teacher professions and competencies to enhance the quality of learning in schools (Brauckmann et al., 2016; Bush, 2015). The principal works with the teacher and provides feedback on the teaching and learning process in the classroom (Stewart, 2006), in the way the principal exerts his influence on the learning process of students through the practice of teachers (Hallinger & Hosseingholizadeh, 2020). Learning and teaching activities are the main focus and elements that distinguish instructional leadership from other leadership models. Curriculum and teaching management, monitoring and evaluating teacher performance and student development, identifying learning and teaching difficulties, and developing corrective strategies that have an impact on improving learning are requirements of instructional leadership (Alanoglu, 2022); effective school management will create a healthy child or student and a conducive learning environment (Sunandar et al., 2022). Thus, the positive impact of learning leadership carried out by the principal affects teachers, students, and school community. The principal is a dreamer of learning in the school. Principals who take on the most important roles as learning leaders are considered effective principals in the 21st century (Hallinger, 2011). In addition, instructional leadership focuses on the principal's concentration on the teaching and learning process and avoiding time-consuming administrative or managerial tasks (Brewster & Klump, 2005); the principal encourages teachers to make decisions according to student achievement or develop students, not just administrative matters (Stronge et al., 2008). A systematic review reveals that instructional leadership has emerged as one of the most influential models to guide research, policy, and practice in school leadership (Hallinger et al., 2020).

The concept of instructional leadership came to the fore because scholars identified the factors that influence the creation of effective schools. Initially, this concept appeared in the United States based on the evidence that leadership can positively impact student learning outcomes (Bush, 2015) and improve the effectiveness and efficiency of learning in schools (Spears, 1941). Path-goal theory by House forms the basis of an instructional

leadership approach. It is based on the idea that the leader sets goals for subordinates, guides and supports them to achieve the goals already set (House, 1996). Instructional leadership is a form of directive leadership centered on educational activities and transforming schools (Hallinger & Murphy, 1985). It is a blend of expertise and charisma that builds a culture and is oriented toward the school's vision, mission and goals (Alanoglu, 2022). Instructional leadership is directed at the teaching and learning process that results in interaction between teachers and students to achieve curriculum goals (Sim, 2011) in the form of actions taken or delegated by the principal to promote a quality learning process in the school (Mestry et al., 2013). Instructional leadership is a behavior demonstrated by the principal, which directly or indirectly affects teaching and learning (Çalik et al., 2012); to improve teacher performance in curriculum delivery through the learning process (Chabalala & Naidoo, 2021). Therefore, instructional leadership is the principal's ability to lead the school by performing roles and actions that are very important to develop the curriculum, improve teacher competence, and create a positive learning climate for students.

There have been many publications about instructional leadership research conducted in various countries recently such as in di Azerbaijan (Sindhvad et al., 2022) factors influencing instructional leadership capacity; Israel (Shaked et al., 2021) sociocultural norms that make up the principal's instructional leadership; U.S. and Belgium (Urlick et al., 2022) instructional leadership influence opportunity to learn; Turkey (Bellibaş et al., 2022) linking instructional leadership to teacher practices; Kuwait (Alsaleh, 2022) the influence of heads of departments' instructional leadership, cooperation, and administrative support on school-based professional learning; Maldives (Shafeeu, 2022) the Effect of Instructional Leadership on Student Achievement; Malaysian (Awang et al., 2022) influence of virtual instructional leadership on teachers' commitment, (Fred & Singh, 2021) instructional leadership practices in under-enrolled rural schools; China (Liu et al., 2022) instructional leadership related to teacher self-efficacy and student academic performance; Indonesia (Nurabadi et al., 2022) digital principal instructional leadership in new normal era (Puruwita et al., 2022) instructional leadership practices and teachers' job performance at high-performing vocational schools, (Anselmus Dami et al., 2022) principal self-efficacy for instructional leadership in the perspective of principal strengthening training; South Africa (Mestry & Govindasamy, 2021) perceptions of school management teams and teachers of the principal's instructional leadership role in managing curriculum changes, (Malinga et al., 2021) instructional leadership capacity of secondary school science heads of department; Sweden (Liljenberg, 2021) professional development practice to enhance principals' instructional leadership-enabling and constraining arrangements; and many more documents about instructional leadership since it was first published in 1941 until 2022 in international journals indexed by Scopus. However, no document examines instructional leadership using bibliometric analysis. This study aims to map bibliographic data on instructional leadership for the last eight decades (1941-2022).

## Method

The authors use a quantitative research approach to analyze bibliographic data related to the literature collection on instructional leadership. The bibliometric analysis aims to explore clearly defined bodies of knowledge

(Kuzhabekova, 2021; Zupic & Čater, 2015), to highlight broad trends in knowledge production and dissemination (Hallinger & Kovačević, 2019), and to identify thematic research trends, and (co)citation analysis to locate the most highly cited researchers (McGinity et al., 2022). The bibliometric analysis leverages the capabilities of the VOSviewer software program to analyze a more significant number of documents when compared to previous review research (Hallinger & Kovačević, 2022). VOSviewer is a program we developed for constructing and viewing bibliometric maps (Van Eck & Waltman, 2010). Thus, bibliometric analysis with VOSviewer is considered appropriate for reviewing documents to reflect on the accumulated knowledge of instructional leadership after 80 years since it was first published.

### Identification of documents

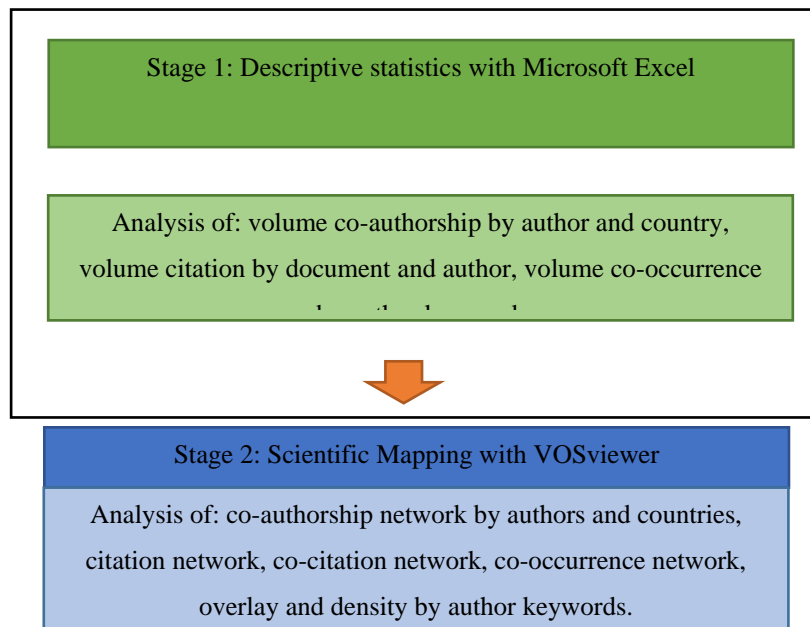
The Scopus index is used to identify published documents about instructional leadership. Authors use keywords TITLE-ABS-KEY ( "instructional leadership" ). The search yielded 951 published documents on instructional leadership from 1941 to 2022. The author uses the Scopus filter to limit only 'articles' to the document type, "final" to the publication stage, "journal" to the source type, "English" to the language to change the search keywords to TITLE-ABS-KEY ( "instructional leadership" ) AND ( LIMIT-TO ( PUBSTAGE , "final" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ). This led to the elimination of 231 documents. Thus, the final database consists of 720 articles. The bibliographic data is exported from Scopus to MS Excel in CSV format. The database consists of 720 rows corresponding to the document that has gone through the filter process and 54 columns of bibliographic data that describe the features of the document. Then, the author manually checks the database exported from Scopus so that it finds some unqualified documents. Four documents are unqualified because the author data and publication year are unclear, and three documents are unqualified because the document type, publisher, and ISSN are unclear, so 717 documents are obtained for bibliometric analysis.

### Data analysis

The author performs two stages of analysis. The first research stage uses descriptive statistics to describe trends related to the volume of co-authorship by author and country, citation by document and author, co-occurrence by author keywords. Descriptive analysis is performed with Microsoft Excel. The second stage of analysis is using VOSviewer version 1.1.18 to displaying maps constructed using multidimensional scaling techniques (Van Eck & Waltman, 2010; Zupic & Čater, 2014). The bibliometric analysis includes co-authorship analysis, co-occurrence analysis, citation analysis, etc., which can be displayed in network visualization, overlay visualization and density visualization (Van Eck & Waltman, 2011).

Co-authorship network analysis is used to identify relationships between authors and between authors' countries. The applicability of co-authorship networks has been regarded for evaluation of research collaborations (HabibAgahi et al., 2022). Citation analysis is used to identify "high-impact" leadership documents. A high number of citations is generally construed as an indicator of 'scientific impact' based on the assertion that other

scholars' ideas in the cited documents have been read and used (Garfield, 2007). Co-citation analysis is used to identify the documents that most significantly influence articles on instructional leadership. When a couple of authors are frequently cited in the same list of references, there will likely be intellectual similarities in the content of their work (Small, 1973). Co-citation analysis is used to calculate the frequency of 'author pairs' cited in the reference list of instructional leadership articles which can ultimately identify the 'intellectual structure' of instructional leadership. The intellectual structure delves into authors, documents, or sources that significantly impact the academic field and help transmit knowledge (Khare & Jain, 2022). Finally, keyword analysis is used to highlight trends in publications. A keyword analysis is used to create a network map that visualizes the relationships between keywords which is then used to highlight the 'conceptual space' that appears in instructional leadership publications (Ding et al., 2001; Zupic & Čater, 2015).



Gambar 1. The bibliometric analysis process of the instructional leadership database

## Results

### Co-authorship Analysis

The author with the most collaborations with other authors on the topic of instructional leadership, namely: Hallinger P. collaborated with 43 authors, Goldring E. collaborated with 34 authors, Shaked H. collaborated with 16 authors, Bellibas M. S. collaborated with 15 authors, and Neumerski C. M. collaborated with 15 authors.

Based on Figure 1, it is clear that the co-authorship network by author consists of 4 clusters. The first cluster (C1) has the most co-authorship networks, consisting of 70 authors with Hallinger P. and Shaked H. as the

dominant writers. The second cluster (C2) has a co-authorship network of 40 authors with Goldring E. as the dominant author. The third cluster (C3) has a co-authorship network of 37 authors, but no dominant authors exist in this cluster. The fourth cluster (C4) has a co-authorship network of 35 authors with Bellibas M.S. as the dominant author. It can be seen that the dominant authors in each cluster are the top 5 co-authorships.

Table 1. Top 5 Co-authorship by author of instructional leadership, 1941–2022 (ranking by total link strength)

Author	Citations	Documents	Total Link Strength
Hallinger P.	23	1567	43
Goldring E.	10	366	34
Shaked H.	15	79	16
Bellibas M.S.	8	115	15
Neumerski C.M.	4	312	15

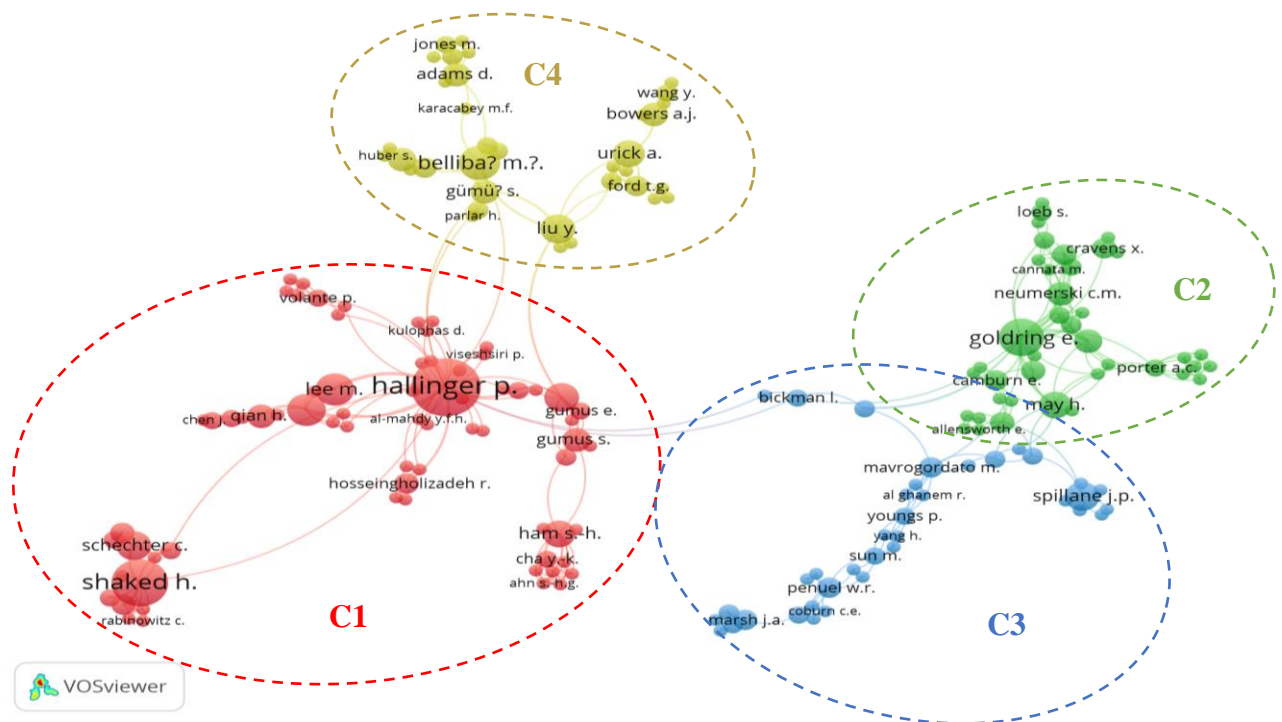


Figure 1. Network Visualization of Co-authorship by author of instructional leadership, 1941–2022

Table 2 shows the countries with the most collaborations with other countries on the topic of instructional leadership, namely: The United States collaborates with 44 countries, Thailand collaborates with 28 countries, South Africa collaborates with 26 countries, Hong Kong collaborates with 22 countries, and Malaysia collaborates with 19 countries.

Based on Figure 2, it is clear that the co-authorship network by country consists of 4 clusters. The first cluster (C1) has the most co-authorship networks, composed of 18 countries with South Africa as the dominant country.

The second cluster (C2) is a cluster with a co-authorship network of 12 countries but there is no dominant. The third cluster (C3) has a co-authorship network of 9 countries with the United States as the dominant country. The fourth cluster (C4) has a co-authorship network of 8 countries with Malaysia as the dominant country. It can be seen that the dominant country in each cluster is the top 5 co-authorship.

Table 2. Top 5 Co-authorship by country of instructional leadership, 1941–2022 (ranking by total link strength)

Country	Documents	Citations	Total Link Strength
United States	344	7245	44
Thailand	21	1022	28
South Africa	49	467	26
Hong Kong	28	565	22
Malaysia	42	211	19

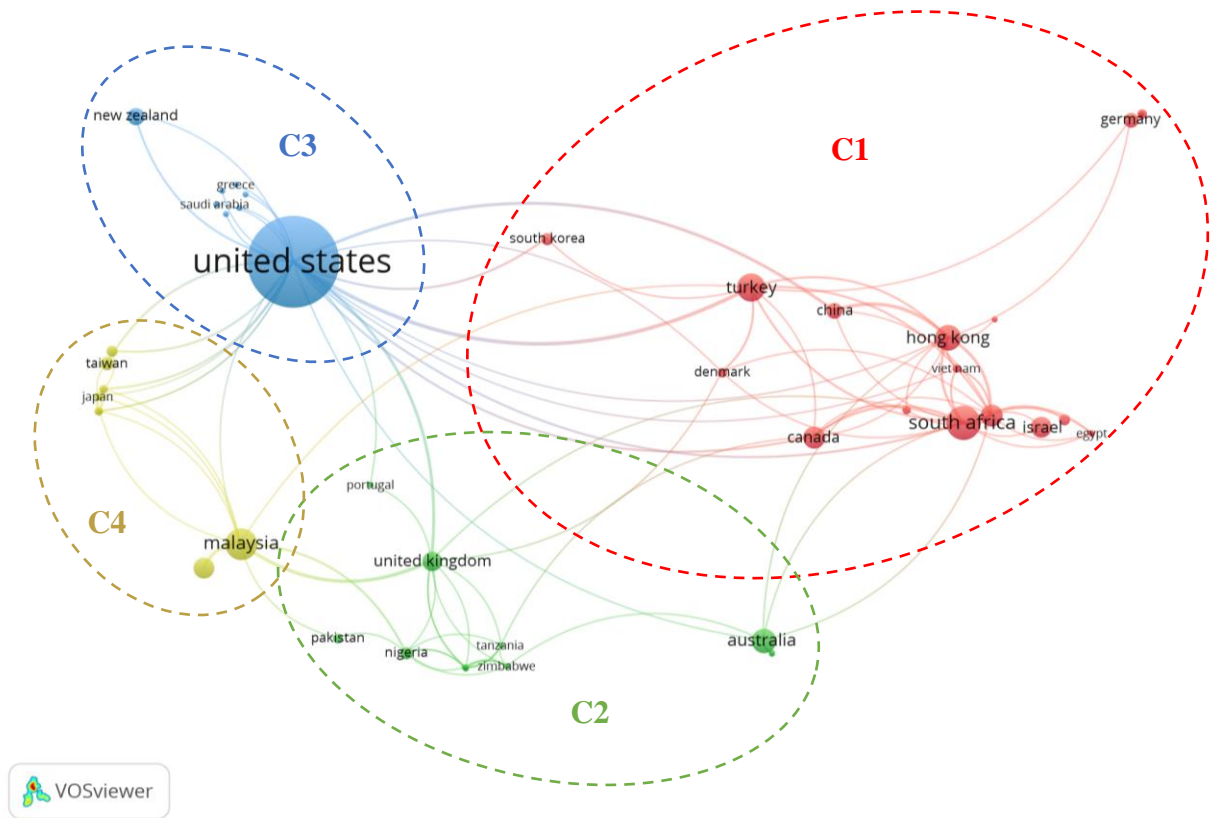


Figure 2. Network Visualization of Co-authorship by country of instructional leadership, 1941–2022

### Citation Analysis

The document with the most citations on the topic of instructional leadership is "The Impact of Leadership on Student Outcomes: An Analysis of the Differential Effects of Leadership Types" with a total of 1,032 (Robinson et al., 2008), followed by "Leading Educational Change: reflections on the practice of instructional and



transformational leadership" with a total of 635 citations (Hallinger, 2003), "Leadership for School Restructuring" with 367 citations (Leithwood, 1994), "Teachers sense of efficacy and commitment to teaching" with 350 citations (Coladarci, 1992), and "The Impact of Leadership on Student Outcomes: How Successful School Leaders Use Transformational and Instructional Strategies to Make a Difference" with a total of 274 citations (Day et al., 2016).

Table 3. Top 5 Citation by document of instructional leadership, 1941–2022 (ranking by citations)

Document	Citations
Robinson V.M.J. (2008)	1032
Hallinger P. (2003)	635
Leithwood K. (1994)	367
Coladarci T. (1992)	350
Day C. (2016)	274

Table 4 shows the authors with the highest citations on instructional leadership. Hallinger P. is the author with the highest number of citations at 1,567, followed by Robinson V.M.J. with 1,199 citations, Spillane J.P. with 399 citations, Goldring E. with 366 citations, and Camburn E. with 355 citations. Robinson V.M.J is only four documents but has high citations.

Table 4. Top 5 Citation by author of instructional leadership, 1941–2022 (ranking by citations)

Author	Documents	Citations
Hallinger P.	23	1567
Robinson V.M.J.	4	1199
Spillane J.P.	6	399
Goldring E.	10	366
Camburn E.	3	355

### Co-citation Analysis

The author's co-citation map for instructional leadership reveals 4 clusters, each comprised of scholars associated with a particular school of thought. Cluster 1 (C1) is about measuring instructional leadership. Scholars led by Spillane J.P., Louis K.S., and Goldring E. began to apply forms of capital and construction of instructional leadership, measuring school principals' instructional leadership competence and teacher evaluation systems. Cluster 2 (C2) is about school effectiveness and improvement. Scholars led by Hallinger P., Jantzi D., Walker A. dan Hoy W.K. began to apply leadership development for school effectiveness and improvement, program implementation, professional teacher learning, and leader development. Cluster 3 (C3) is about role of the school principal. Scholars led by Murphy J., Harris A., Bush T., Blasé J. and Day C. began to apply to assess and develop the instructional leadership of school principals, and barriers to implementing the

instructional leadership role. Cluster 4 (C4) is about leadership for school restructuring, performance and achievement. Scholars led by Leithwood K., Heck R.H., and Rowan B. began to apply leadership in schools responding to a variety of restructuring initiatives, principals’ instructional leadership and school performance, principal instructional leadership and the identification of high-and low-achieving schools.

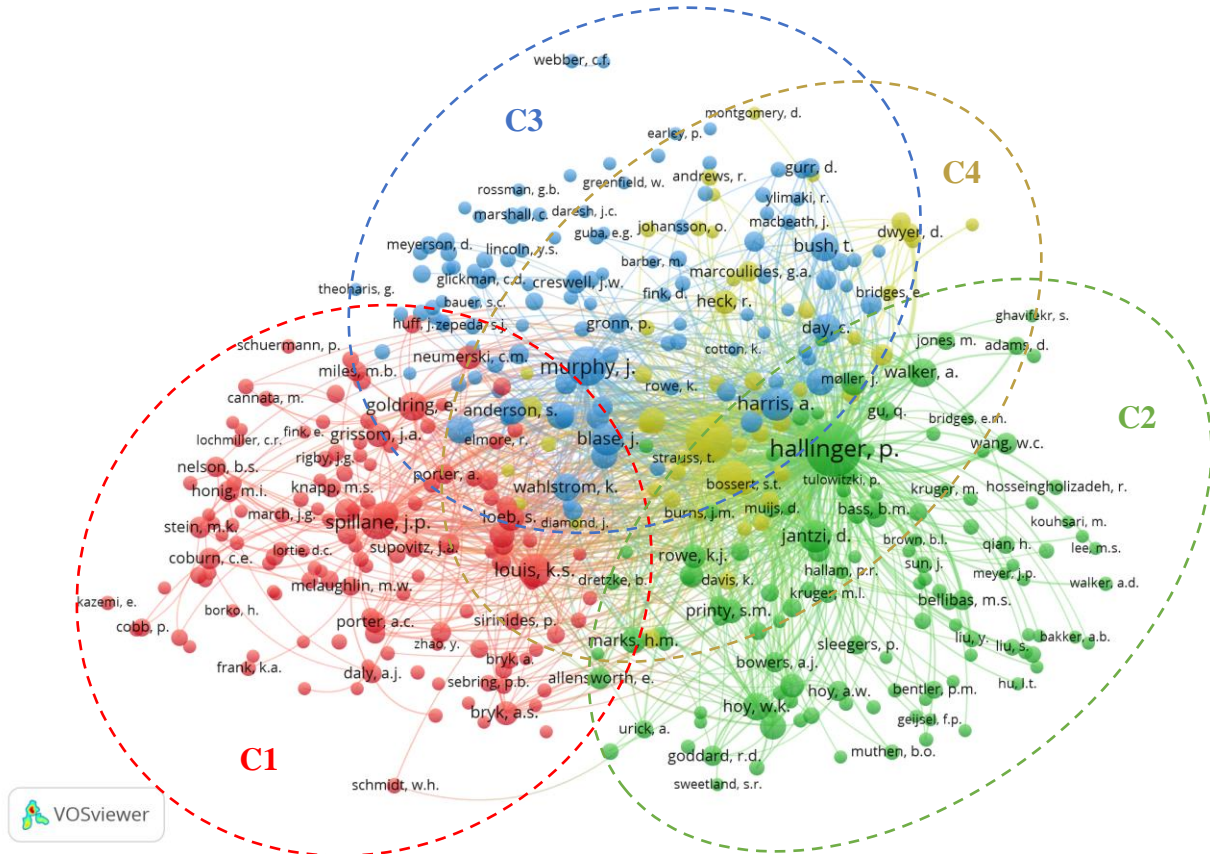


Figure 3. Author co-citation map of instructional leadership, 1941–2022 (threshold 20 citations, display 422 authors).

**Co-occurrence Analysis**

The most occurrence of keywords on the topic of instructional leadership, namely: leadership, principal, professional development, school leadership, transformational leadership, distributed leadership, school improvement, teacher leadership, management, educational leadership, principal preparation, student achievement accountability, teacher evaluation, and school climate. Other keywords only have occurrences below 11.

Keyword network visualization for instructional leadership reveals 4 clusters. Each cluster represents a subfield of scientific analysis. Cluster 1 (C1) consists of 19 keywords, such as school climate, teacher efficacy, self-efficacy, teacher professional learning, teacher collaboration, student achievement, student outcomes, etc.,

which is the impact of instructional leadership on school climate (Akhir et al., 2019; Dutta & Sahney, 2016; Jalapang & Raman, 2020), teacher (Ma & Marion, 2021; Qadach et al., 2020; Siriparp et al., 2022) and student (Goddard et al., 2021; Kazi, 2021; Rodrigues & Ávila de Lima, 2021). Cluster 2 (C2) consists of 18 keywords, such as school and district management, collaboration, school climate and culture, district-based administration, and administrators, etc. is the application of instructional leadership in a school setting (Kasprzhak et al., 2022; Lingam et al., 2021; Shaked, 2021), district management (Mestry, 2019; Mpundu et al., 2021; Sumintono et al., 2019) and school culture (Gümüş et al., 2022; Ismail et al., 2021; Liu et al., 2021). Cluster 3 (C3) consists of 17 keywords, such as leadership, educational leadership, principals, principal preparation, leadership preparation, and school principal, etc. is a relationship between instructional leadership and the concept of educational leadership in general (Wang, 2011), school Principal in particular (Aas & Paulsen, 2019; Goff et al., 2012). Cluster 4 (C4) consists of 16 keywords, such as professional development, accountability, teaching and learning, teacher professional development, teacher leadership, etc. are instructional leadership efforts in developing professional and leadership teachers and teaching and learning processes that ultimately increase accountability (Blasé & Blasé, 2000; Kim & Lee, 2020; Lee et al., 2012).

Table 5. Top 15 Co-occurrence by author keywords of instructional leadership, 1941–2022 (ranking by occurrences)

Keyword	Occurrences	Total Link Strength
Leadership	68	143
Principal	43	87
Professional Development	35	54
School Leadership	29	68
Transformational Leadership	28	63
Distributed Leadership	24	50
School Improvement	23	48
Teacher Leadership	23	72
Management	15	36
Educational Leadership	14	28
Principal Preparation	13	30
Student Achievement	13	31
Accountability	12	34
Teacher Evaluation	12	26
School Climate	11	44

The items are colored differently based on the year of publication. Based on Figure 5, shows that the topic of instructional leadership today (in 2020 and the future) is more focused on teacher efficacy (Siriparp et al., 2022; Sukarmin & Sin, 2021; Thien, Lim, et al., 2021), school climate (Dutta & Sahney, 2022; Jalapang & Raman, 2020), principal preparation (Vogel & Alhudithi, 2021), and professional teacher learning (Bellibaş et al., 2021;

Thien, Liu, et al., 2021).

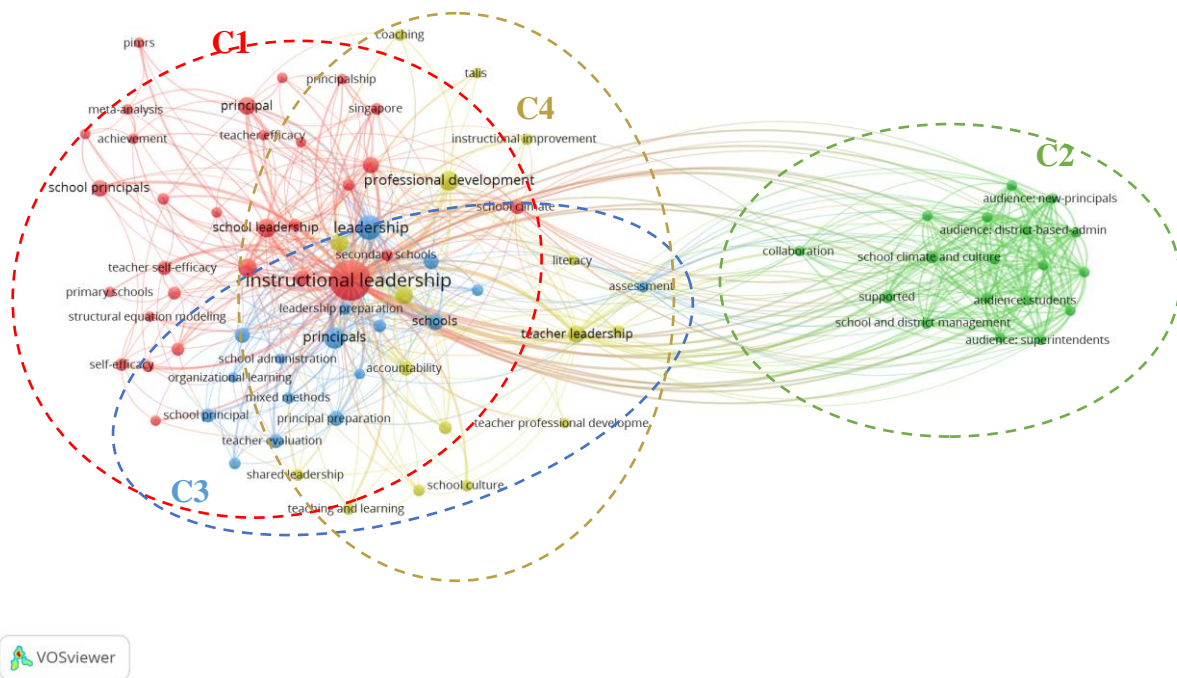


Figure 4. Keywords network visualization of instructional leadership (threshold 5 occurrences, display 81 keywords).

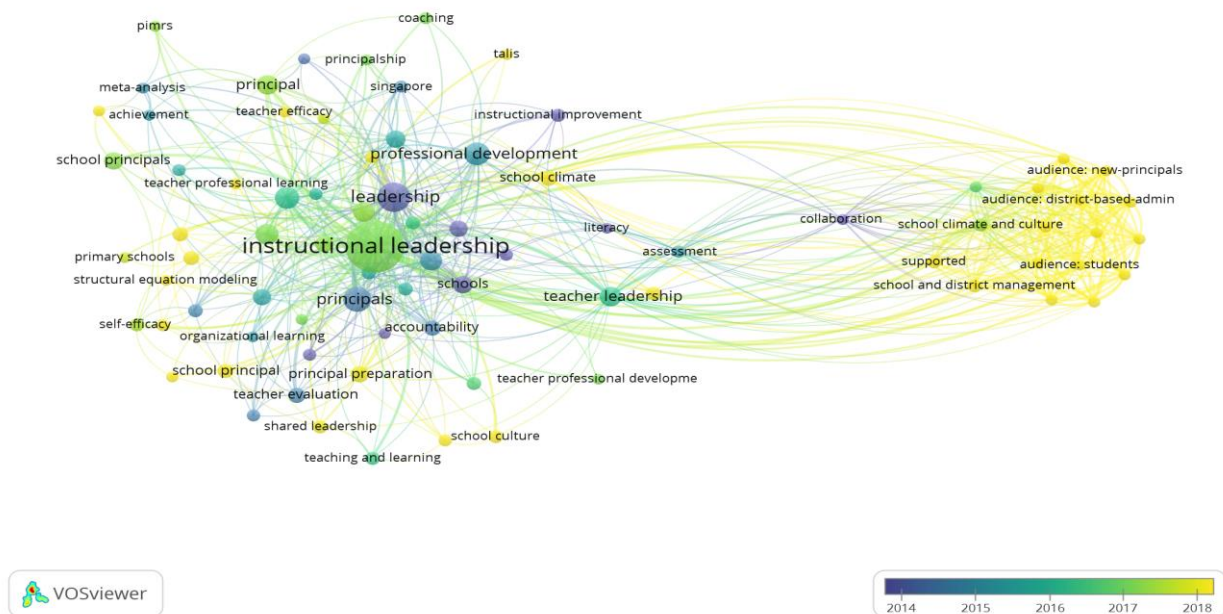


Figure 5. Keywords overlay visualization of instructional leadership (threshold 5 occurrences, display 81 keywords).

Figure 6 shows that the keyword instructional leadership is often found in various documents in the Scopus database. Instructional leadership is often associated with student achievement, leadership, and school

effectiveness.

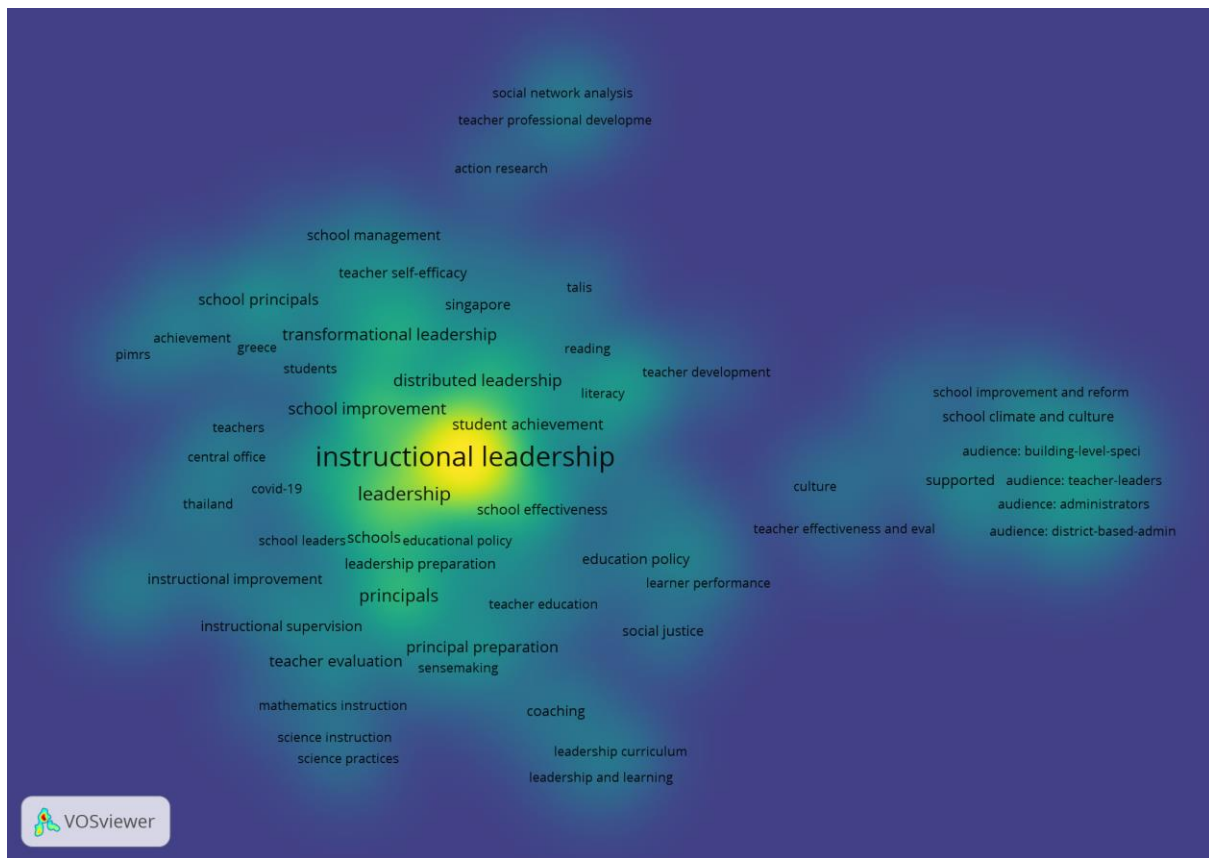


Figure 6. Keywords density visualization of instructional leadership (threshold five occurrences, display 81 keywords).

## Discussion

### Limitations

Earlier, we highlighted the methodological limitations of this review. Here we wish to add one additional limitation that concerns the generalizability of our findings to the field of instructional leadership. Our study examined a Scopus database of journal articles about instructional leadership. Moreover, co-authorship, citation, co-citation, and co-occurrence analysis enabled the identification of authors, countries, documents, and keywords beyond those contained in our dataset of instructional leadership journal articles. Thus, the results of this review should be interpreted as tentative benchmarks that can be reinterpreted through studies that use alternative methods and against new trends as they develop in the future.

### Interpretation of the findings

The bibliometric analysis employed in this review offers a unique perspective on the long-term historical development of instructional leadership. We observed that there had been relationships between authors and

between countries on the topic of instructional leadership. The highest relations between authors amounted to 43 collaborations, and between countries amounted to 44 collaborations. Co-authorship is still an essential indicator of collaborative work and an appropriate means of studying patterns of cooperation (Santos & Santos, 2016). The development of citations from documents and authors on the topic of instructional leadership can be seen from the highest number of citations in documents 1,032 and authors 1,567 citations. To measure the influence of an author or paper, then citation is the most frequently used method since it can quickly identify existing scientific articles (Rashid, 1991; Zupic & Čater, 2015). The author's co-citation visualization of instructional leadership reveals 4 clusters: 1) measuring the instructional leadership, 2) school effectiveness and improvement, 3) the role of the school principal, and 4) leadership for school restructuring, performance and achievement. Co-citation has evolved as a complementary approach to analyzing scholarly impact (Zupic & Čater, 2015). Co-citation is the frequency with which two units (e. g. authors) are cited together in other documents (Small, 1999). Co-citation analysis assumes that when two authors are frequently 'cited together,' they share an intellectual affinity (Small, 1999; Zupic & Čater, 2015). The keyword network visualization for instructional leadership reveals 4 clusters: 1) the impact of instructional leadership on school climate, 2) the application of instructional leadership in school settings, 3) the relationship between instructional leadership and the concept of educational leadership in general, and school principals in particular, 4) instructional leadership efforts in developing teacher professional and leadership and the teaching and learning process which ultimately increases accountability. Co-occurrence analysis to analyze the structure and development of the scientific literature (Chen et al., 2016). The topic of instructional leadership today (in 2020 and the future) focuses more on teacher efficacy, school climate, principal preparation, and teacher professional learning. The overlay visualization is chosen as a more useful tool for verifying recent trends in the academic field as soon as it allows us to classify the items using a timescale (Shvindina, 2019). Instructional leadership is often associated with student achievement, leadership, and school effectiveness. Density visualization can be seen in the keywords that often appear (Hamidah et al., 2020).

## Conclusion

Hallinger P. is the author with the most co-authorship networks, and United States is the country with the most co-authorship networks on instructional leadership. The article "The Impact of Leadership on Student Outcomes: An Analysis of the Differential Effects of Leadership Types" by Robinson, V. M. J. (2008) is the article with the highest number of citations. Still, Hallinger P. is the author with the highest number of citations. The author co-citation visualization of instructional leadership reveals 4 clusters: 1) measuring the instructional leadership, 2) school effectiveness and improvement, 3) role of school principal, and 4) leadership for school restructuring, performance and achievement. The keyword network visualization for instructional leadership reveals 4 clusters: 1) the impact of instructional leadership on school climate, 2) the application of instructional leadership in school settings, 3) the relationship of instructional leadership with the concept of educational leadership in general and school principals in particular, 4) instructional leadership efforts in developing teacher professional and leadership and the teaching and learning process which ultimately increases accountability

## Recommendations

Future research about instructional leadership focuses more on teacher efficacy, school climate, principal preparation, and teacher professional learning.

## Acknowledgements

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## Financial Education in the Digitalization Era: A Bibliometric Analysis

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**Abstract:** In the era of digitalization, financial education is essential because it is one of the most critical skills a tech-savvy generation z can acquire. Seeing the rapid change in financial access from traditional to digital today, with bibliometric approach seeks to present how financial education is needed in digital finance. It is increasingly evolving so that Generation Z does not fall into digital traps such as credit and impulsive purchases. Based on the Scopus database, 137 documents have been published from 1999 to 2022. Journals, authors, countries, articles, themes, and publication trends have been used to identify influential works, describe financial education in the era of digitalization, and identify gaps. The United States is the leading producing country with 69 documents and is also the most in citations. In addition, bibliometric analysis shows that the journal of financial counseling is the most productive journal researchers often go to on financial education; next, there is Journal of Consumer Affair. Of the 332 keywords used in the document, financial literacy, financial knowledge, and financial behavior are often identified. Recent themes identified in the last three years include financial inclusion, digital finance, and financial technology. This study provides a comprehensive overview of the state of research on financial education in digital finance for generation z in the transition period to lead to financial well-being. The results are particularly relevant for children studying financial education, given the rising levels of credit and impulsive purchases for Generation Z in the digital financial age, which exposes individuals to fast financial services and requires informed decision-making. This study helps academic researchers know the core of financial education and identify relevant areas that need to be investigated in future research.

**Keywords:** financial education, digital financial, generation-z, scopus database, bibliometric analysis

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## Introduction

Every stage of human life requires financial resources to fulfill our needs, from birth to old age. Technological advancements and globalization have provided people with easier access to financial products and services, but this also complicates financial decision-making. To avoid financial mistakes, individuals must be digitally finance-savvy. Proper understanding and management of finances contribute to a more prosperous life. Good financial knowledge is essential for effective financial management. Many criminal activities occur today due to financial struggles, often resulting from a lack of sound financial knowledge. Hence, financial education in both formal and non-formal settings is crucial, and it should start at a young age to instill positive financial habits.

At the highest global policy level, governments have prioritized youth as a target for financial education efforts (OECD 2012). Past research has shown that financial education in elementary schools can improve student financial literacy, especially when delivered through innovative methods like a simulated classroom economy (Batty et al., 2020). Comparing financial education in schools, the primary finding is that "investing in the implementation of school financial education curricula does indeed impact financial knowledge, and to a smaller extent financial behavior" (Kaiser & Menkhoff, 2020). Financial education programs for young people have significant and robust effects on financial knowledge, behavior, related preferences, and personality traits associated with financial behavior. Overall, the evidence supports school-based financial education programs as highly effective in increasing financial knowledge among children and youth (Frisancho, 2020).

This study examines the influence of financial education from an early age on life's welfare. As finance has become increasingly digital, this research also explores digital finance in today's world. In this context, children and teenagers quickly adopt financial technology trends. There has been no prior research specifically investigating the dynamics of financial education for children and adolescents in the digital era. This paper seeks to address the following research questions: 1. What are the publication trends in financial education related to digital finance, considering authors, countries, citations, and keywords? 2. What research themes are influential in this area? 3. How has research on financial education and digital finance evolved in recent years, and what are the current trends? 4. What are the gaps and recommendations for future research?

Drawing from the data sources and methodologies described, this article investigates the significance of financial education in schools for preparing children for financially independent lives. Young people who achieve financial independence can enhance the well-being of their parents. The article concludes by summarizing the primary findings, along with outlining conclusions and potential directions for future development.

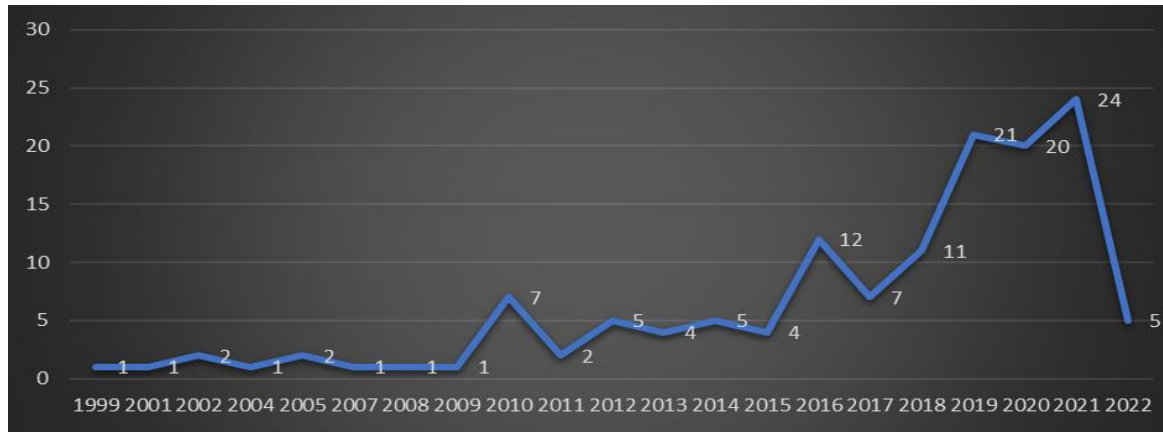


Fig. 1 Historical evolution of the article’s publication, data source Scopus.

**Method**

The bibliometric approach examines specific scientific research by utilizing bibliographic data for performance analysis (Noyons, Moed, and Luwel 1999) and is often employed to evaluate research within a particular domain (Liao et al., 2018). As such, bibliometric analysis serves as a valuable instrument for academics or scholars to examine citations, keywords, co-citations, countries, and article authors in a specific research field.

In the initial phase of this systematic review, a literature keyword search was conducted to minimize potential biases from researchers. The chosen terms included "financial education," "digital financial," "financial literacy," "generation z," and "high school," covering all years. The final sample comprised 137 articles in total. Subsequently, a bibliometric mapping method using VOS Viewer software (van Eck & Waltman, 2010) was employed, allowing for the visualization of various networks derived from co-authorship, co-occurrence, and co-citation analyses.

**Results and Discussion**

**Number of publications**

An upward trend was observed in the number of publications analyzed. Fig.1 displays the progression of the annual count of academic articles on financial education, digital finance, and financial literacy for Generation Z and high school students. After the first article (Peng et al., 2007), this research area received relatively limited attention for the next decade. However, a noticeable growth trend emerged in 2016, with a significant increase in the number of publications. Another surge was observed in 2019, with the highest number of publications recorded in 2021 (n=24). Various studies (Kangwa, Mwale, and Shaikh, 2021); (Sconti, 2022); (Jain & Raman, 2022); (Yin Yin, Yusof, and Abe, 2022) have explored the connection between finance and digitalization, as the Covid-19 pandemic has transformed the landscape into a fully digital environment.



**Publication by Author**

A total of 340 distinct authors contributed to the 137 articles. As evident in Table 1, Danes emerges as the most prolific author. In four of his studies, he collaborates with multiple authors from the same institution, indicating strong networking within this research community. Lastly, it is worth noting that the United States stands as the most represented country.

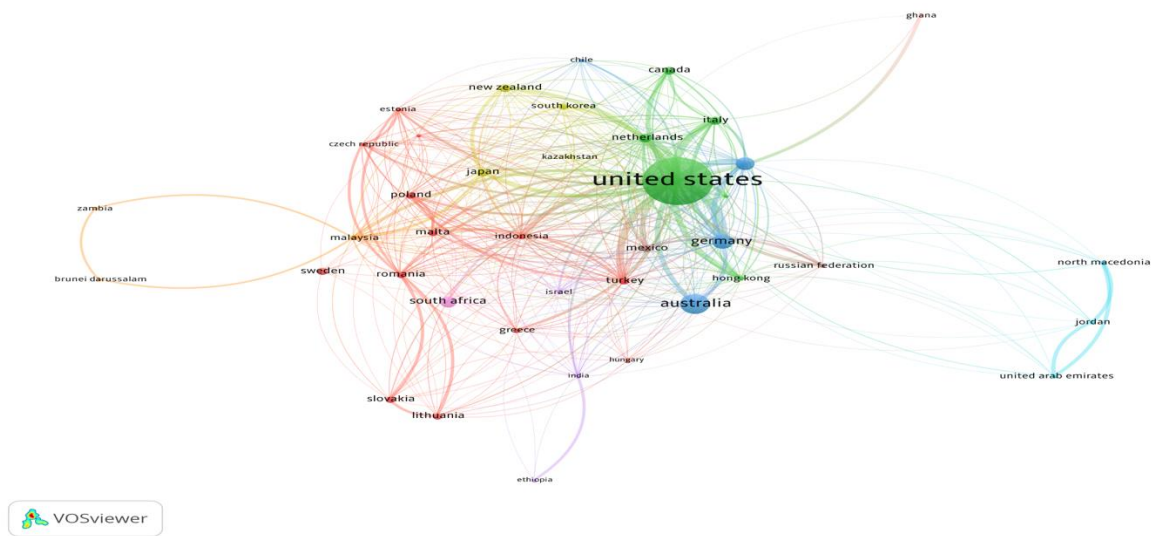


Fig. 2. Bibliographic coupling by country. Using VOSviewer software

Table 1. Most prolific authors in financial education and financial literacy

Rank	Name of Author	Country of Author	University/Institution	Number of publications
1	Danes S.M	USA	University of Minnesota	4
2	Gracia S	Mexico	UCC Business School	3
3	Xiao	USA	University of Rhode Island	3
4	Asarta	USA	University of Delaware	3
5	Walstad	USA	University of Nebraska - Lincoln	3
6	Bhattacharya	USA	California state University at Fullerton	3
7	Gill A	USA	California state University at Fullerton	3
8	Lucey T. A	USA	Illinois State university	3
9	Lusardi A	USA	George Washington University School of Business	3

### Most cited articles

Table 2 presents the papers with the highest number of citations in absolute terms (>100). The most relatively cited paper, Lusardi and Mitchell (2010), can be used as a reference for literature reviews on this topic. Two of the most cited papers discuss the joint determination of financial education implementation in high schools. Peng et al. (2007) examine the impact of personal finance education provided in high schools and colleges, while Walstad, Rebeck, and MacDonald (2010) demonstrate that a well-designed and appropriately executed financial education program can positively and significantly enhance the financial knowledge of high school students, aligning with previous research findings.

Table 2. The 10 most frequently cited publications. Source: Author's

Rank	Title	Authors	Year	Source title	Cited by
1	Financial literacy among the young	Lusardi A., Mitchell O.S., Curto V.	2010	Journal of Consumer Affairs	547
2	Financial Socialization of First-year College Students: The Roles of Parents, Work, and Education	Shim S., Barber B.L., Card N.A., Xiao J.J., Serido J.	2010	Journal of Youth and Adolescence	298
3	The impact of financial literacy education on subsequent financial behaviour	Mandell L., Klein L.S.	2009	Journal of Financial Counselling and Planning	214
4	Understanding Economic Abuse in the Lives of Survivors	Postmus J.L., Plummer S.-B., McMahon S., Murshid N.S., Kim M.S.	2012	Journal of Interpersonal Violence	142
5	The impact of personal finance education delivered in high school and college courses	Peng T.-C.M., Bartholomae S., Fox J.J., Cravener G.	2007	Journal of Family and Economic Issues	128
6	The effects of financial education on the financial knowledge of high school students	Walstad W.B., Rebeck K., MacDonald R.A.	2010	Journal of Consumer Affairs	115
7	Consumer financial education and financial capability	Xiao J.J., O'Neill B.	2016	International Journal of Consumer Studies	104
8	Financial literacy of high school students	Mandell L.	2008	Handbook of Consumer Finance Research	101

Rank	Title	Authors	Year	Source title	Cited by
9	Financial planning curriculum for teens: Impact evaluation	Danes S.M., Huddleston-Casas C., Boyce L.	1999	Journal of Financial Counselling and Planning	86
10	Financial Education and the Debt Behaviour of the Young	Brown M., Grigsby J., Van Der Klaauw W., Wen J., Zafar B.	2016	Review of Financial Studies	81

Author’s Country

Table 3 reveals that the majority of the authors are affiliated with universities in the United States, with representation from other countries such as Germany, Mexico, and England. While many of the most influential institutions are American, the research focus in this area is relatively low. This suggests that interest in this topic is widespread among teams with diverse affiliations within these institutions, and as will be discussed later, there are some highly prolific authors.

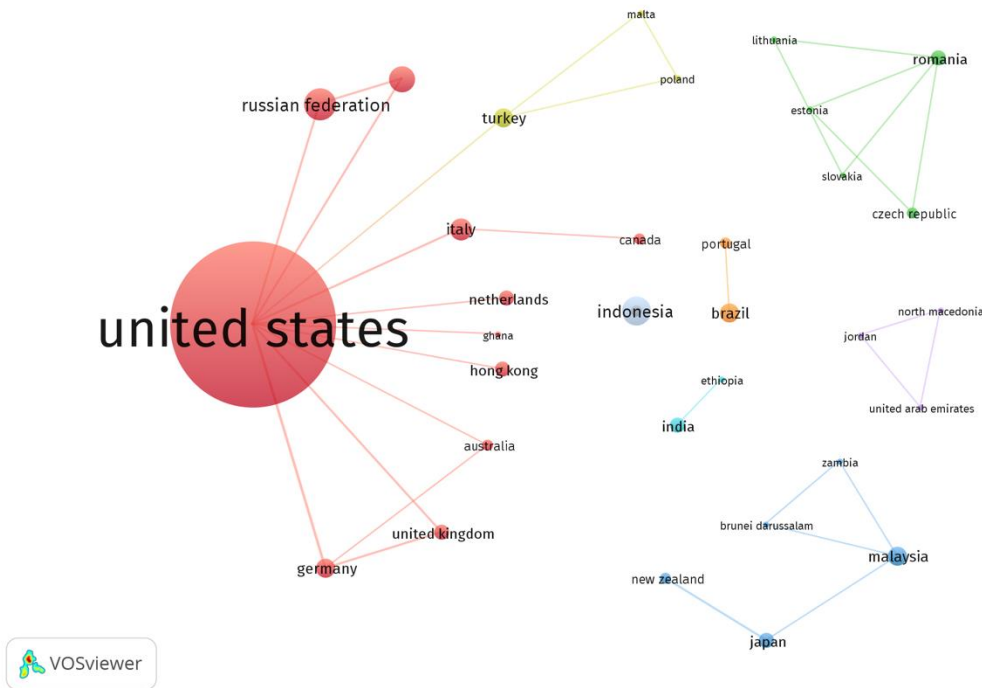


Fig. 3. Co-authorship by country, using VOSviewer software

Figure 3 displays that among the 44 countries of author origin, the largest cluster comprises 14 countries, represented by the red cluster. These include the United States, Germany, the United Kingdom, Australia, Hong Kong, Ghana, the Netherlands, Italy, Canada, the Russian Federation, Turkey, Malta, and Poland.

Table 3. Distribution of articles by most influential countries with the greatest total link strength.

Country	Document	Citations	Total Link Strength
United State	69	2709	16
Germany	4	134	6
Mexico	6	26	4
Romania	3	22	4
Russian Federation	8	7	4
United Kingdom	3	101	4
Italy	5	36	3
Japan	3	37	3
Malaysia	4	6	3
Turkey	4	27	3

Focusing on the most prolific journals, Figure 4 presents the sources with the highest number of articles on the research topic, along with the main areas to which the articles are connected. The journals are linked with various research areas, including economics, finance, counseling, family issues, and consumer affairs. Therefore, financial education and digital finance studies currently sit at the intersection of financial counseling, consumer affairs, and economic behavior. It is evident that there are no specialized publications exclusively dedicated to financial education and digital finance, indicating a potential gap to be addressed in future research.

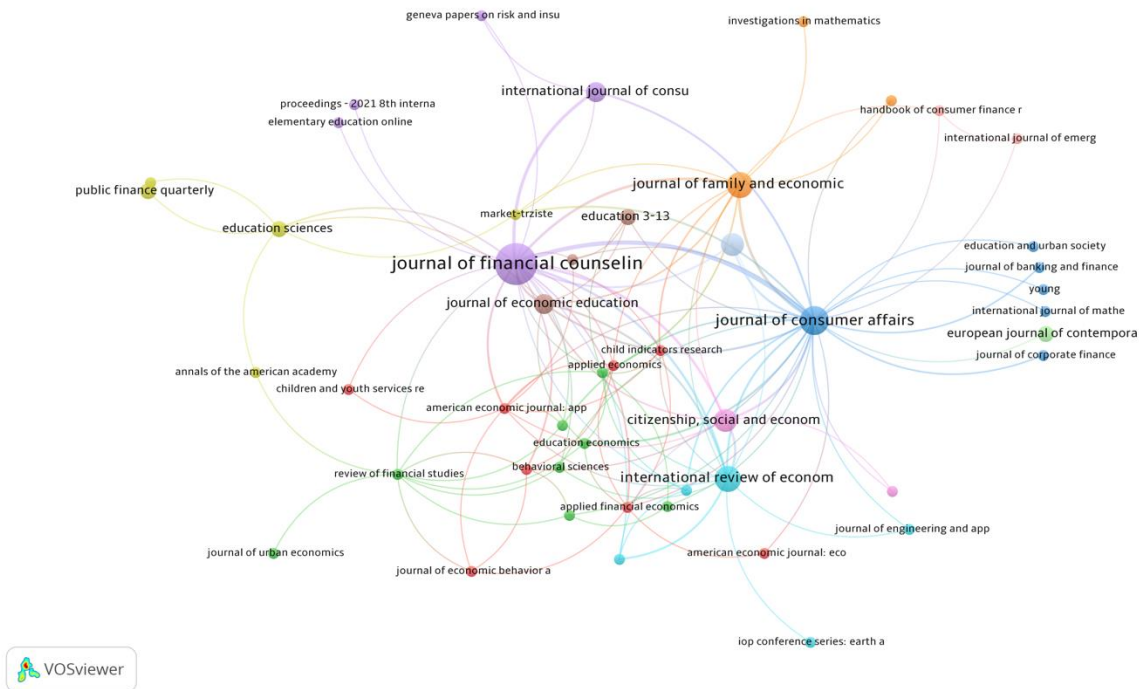


Fig. 4. Citation network of source, using VOSviewer software.

**Thematic of the reached field**

In our analysis of the 137 articles, we identified 332 keywords, of which 56 met the threshold of at least two occurrences. The most frequently occurring keywords are "financial literacy" (70 occurrences, 121 total link strength), "financial education" (38 and 73), "high school" (6 and 11), and "generation z" (5 and 9), while "digital financial" does not appear in the core set.

The "financial education" node in the red cluster exhibits a thicker line with "financial literacy" and a thinner line with "personal finance," "high school," "college student," "consumer education," "generation z," and "financial technology." This node is also closely linked to "economic education," "curriculum," "financial mathematics," "financial knowledge," and "financial behavior," which belong to the green cluster. The "savings" node in the purple cluster is also closely related to "money management," indicating that these two keywords are an integral aspect of the financial literacy and financial education literature.

The green cluster pertains to research fields associated with financial education. Therefore, words such as "attitudes towards money," "teen finances," and "evaluation" are highlighted as they are related to one another. The words in the red cluster are particularly noteworthy as they elucidate the impact of financial education when it is integrated with Generation Z to equip them with the necessary skills to achieve financial independence.

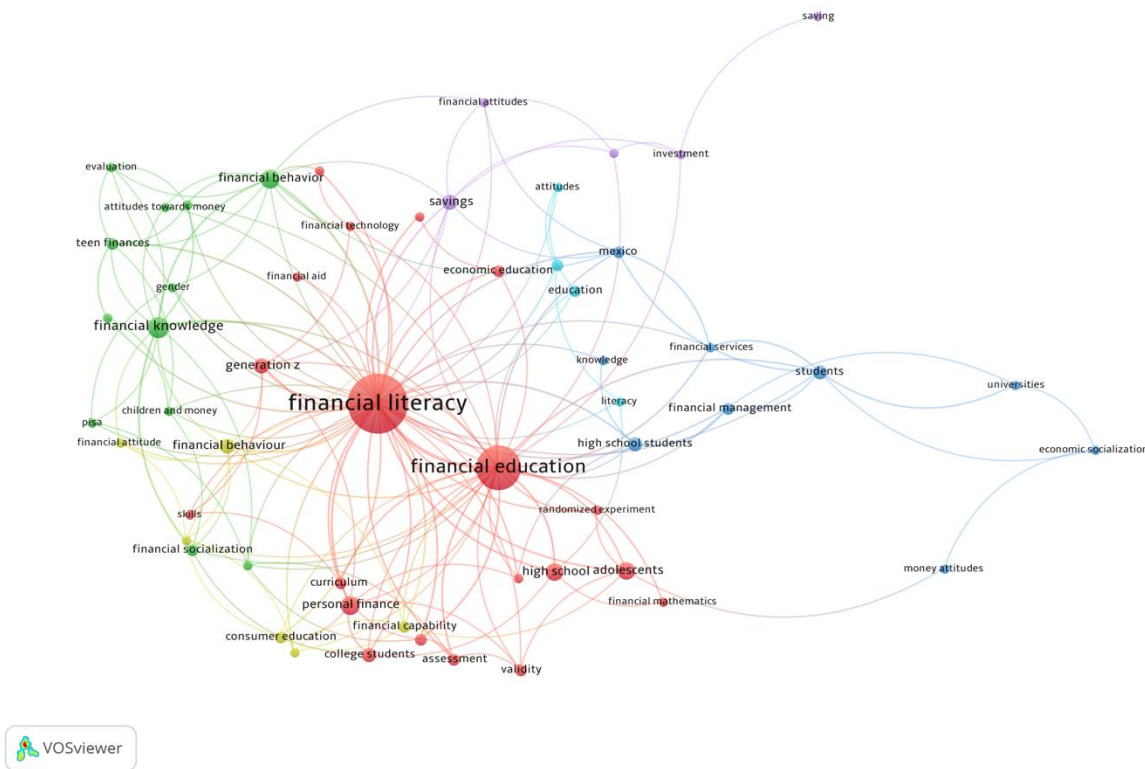


Fig. 5. Co-word analysis. Prepared using VOSviewer software

Lastly, the blue keyword group can be linked to financial education, as "students," "universities," "economic socialization," and "money attitude" are the most prominent keywords. The presence of these comparatively lower-frequency keywords suggests the potential for further development in this area of study.

### Recent research trends

To identify the latest research trends and prominent topics, we conducted an in-depth analysis of articles published on the subject in 2021-2022, extracting the primary research themes, which we have summarized in Table 4.

Table 4. Research Trends 2021 & 2022

No	Reference	Title	Objective
1	(Khan et al. 2021)	Do financial literacy and financial education influence smoking behaviour in the United States?	Examines the ability of rational decision-making to reduce irrational behavior in smoking behavior in the United States, related to the effect of financial literacy and financial education
2	(Jiang et al. 2021)	The nexus between digital finance and economic development: Evidence from China	Investigate the influence of digital finance on economic growth and study the mechanisms of its influence
3	(Ahmad et al. 2021)	Digital financial inclusion and economic growth: provincial data analysis of China	Examines the impact of digital financial inclusion and human capital on China's regional economic growth.
4	(Shankar, Vinod, and Kamath 2022)	Financial well-being – A generation Z perspective using a Structural Equation Modelling approach	Assess the financial well-being of Indian Gen Z students concerning financial literacy, financial fragility, financial behaviour, and financial technology.
5	(Johan, Rowlingson, and Appleyard 2021)	The Effect of Personal Finance Education on The Financial Knowledge, Attitudes and Behaviour of University Students in Indonesia	They measured the impact of a 14-week personal finance education course on financial knowledge, attitudes, and behavior.
6	(Rodriguez-Raga and Martinez-Camelo 2022)	Game, guide or website for financial education improvement: Evidence from an experiment in Colombia schools	Evaluates the impact of a financial education program consisting of three different learning tools for children (6–18) in Bogota, Colombia, in 2018.
7	(Maldonado, de	The effects of parental involvement in	To provide causal evidence on

No	Reference	Title	Objective
	Witte, and Declercq 2022)	homework: two randomised controlled trials in financial education	parental involvement's effects on student outcomes in a financial education course based on two randomized controlled trials with a total of 2779 students from grades 8 and 9 in Flanders.
8	(Ling and Pang 2022)	A Vignette-Based Transformative Multiphase Mixed Methods Interventional Study Featuring Venn Diagram Joint Displays: Financial Education With Hong Kong Early Adolescent Ethnic Minority Students	To investigate the social justice problem of poverty in financial education with Hong Kong early adolescent ethnic minority students.
9	(Kaiser et al. 2021)	Financial education affects financial knowledge and downstream behaviours	Studying the rapidly growing literature on the causal effects of financial education programs in a meta-analysis of 76 randomized experiments with a total sample size of over 160,000 individuals.
10	(Kim, Lee, and Lee 2021)	Student Loans and Financial Satisfaction: The Moderating Role of Financial Education	Examined the relationship between holding a student loan and financial satisfaction and financial education's moderating role using the 2015 National Financial Capability Study dataset.
11	(Zhang, Lu, and Xiao 2021)	Can financial education improve consumer welfare in investment markets? Evidence from China	Examines the potential impact of financial education programs offered by financial institutions on individuals' investment diversification.
12	(Heo, Lee, and Rabbani 2021)	Mediation Effect of Financial Education between Financial Stress and Use of Financial Technology	Investigated the relationship between financial stress and financial technology and included the mediating role of financial knowledge based on the ABC-X model.
13	(de Beckker, de Witte, and van Campenhout	The effect of financial education on students' consumer choices: Evidence from a randomized experiment	Investigate this claim by analysing the impact of a financial education course on consumer choices made by 688

No	Reference	Title	Objective
			students in the 8th and 9th grades.
14	(Feng, Zhang, and Li 2022)	Environmental decentralization, digital finance and green technology innovation	They analyze the impact of digital finance on green technology innovation.
15	(Amagir et al. 2022)	SaveWise: The impact of a real-life financial education program for ninth grade students in the Netherlands	Experimental study with a pre-post and follow-up design evaluates the financial education program "SaveWise" for ninth grade students in the Netherlands (n=713)
16	(Hartmann, de Cássia Pistóia Mariani, and Maltempi 2021)	Financial education in high school: An analysis of didactic activities related to uniform periodic series from the point of view of critical mathematics education [Educação Financeira no Ensino Médio: Uma análise de atividades didáticas relacionadas a séries periódicas uniformes sob o ponto de vista da Educação Matemática Crítica]	Identify and analyse didactic activities developed in High School which may involve decision making in economic-financial situations related to uniform periodic series.
17	(García-Santillán, Zamora-Lobato, and Molchanova 2021)	Money Management, Savings and Investment as Central Topics in Financial Education: How Do High School Students Perceive Them?	Analysing how high school students perceive the topics of money management, savings and investment.
18	(Lee et al. 2021)	The Money Smart for Older Adults Program: A Qualitative Study of the Participants' Financial Well-Being	Examine the financial circumstances of older adults in the program and explore how it could better support their financial well-being.
19	(Valenzuela Montoya, López Torres, and Aguilar Sandoval 2022)	Debt and financial education in university students [Endeudamiento y educación financiera en estudiantes universitarios]	Determining the relationship that indebtedness has with financial education.
20	(Luo, Luo, and Lv 2022)	Can Digital Finance Contribute to the Promotion of Financial Sustainability? A Financial Efficiency Perspective	Summarizes the theoretical mechanism of digital finance to improve financial efficiency and sustainability.
21	(Io Prete 2022)	Digital and financial literacy as	They are assessing the implication of



No	Reference	Title	Objective
		determinants of digital payments and personal finance	digitalization for individual investors who can access digital financial products and markets without financial literacy.
22	(Baulkaran 2022)	Personal bankruptcy and consumer credit delinquency: the case of personal finance education	Examine the impact of personal finance education on credit delinquency.
23	(Sconti 2022)	Digital vs. in-person financial education: What works best for Generation Z?	An experiment that involved implementing a financial education program called "Futuro Sicuro" with a sample of 650 High School students in Italy.
24	(Seebeck and Wolter 2022)	Financial education of founders, is it important? A case study of Jacobs Startup Competition	To examine the effect of founders' financial education on the quality of financial information provided to investors and on the founding team's perceived capabilities.
25	(Tian and Wang 2022)	Financial literacy education and high school students - overview, analysis, suggestions and implications	Analyses the importance and implications of financial literacy education by providing: 1) an overview of four countries' high school financial education and through empirical analysis; 2) identified the importance that financial literacy education plays in improving personal financial capabilities; 3) raised helpful suggestions to improve the outcomes of financial literacy education; 4) ends with a discussion on the implications of high school financial literacy education.
26	(Pakhnenko et al. 2021)	Digitalization of financial service in European countries: Evaluation and comparative analysis	Evaluate the level of digitalization of financial services (DFSI) based on three components: digital inclusion, financial inclusion, and digital financial services.
27	(López-	Financial education in Colombia:	They identified the opinions of the

No	Reference	Title	Objective
	Rodríguez and López-Ordoñez 2022)	challenges from the perception of its population with socioeconomic vulnerability	vulnerable population in Colombia regarding money-saving based on the realities of their financial education.
28	(Kalmi and Rahko 2022)	The effects of game-based financial education: New survey evidence from lower-secondary school students in Finland	The effects of game-based financial education approaches using a sample of lower-secondary school students in Finland
29	(Gerrans 2021)	Undergraduate student financial education interventions: Medium term evidence of retention, decay, and confidence in financial literacy	To analyze teaching for delivering financial education through university students as they seek and gain independence, including financial independence.
30	(Agasisti et al. 2021)	Financial Education during COVID-19 - Assessing the effectiveness of an online programme in a high school	They are investigating the effectiveness of financial education intervention in an Italian high school conducted during the period of school closure due to COVID-19.
31	(Lin and Zhang 2022)	The impacts of digital finance development on household income, consumption, and financial asset holding: an extreme value analysis of China's microdata	To examine digital finance development's roles in household income, consumption, and financial asset holding from an extreme value theory perspective..
32	(Yue et al. 2022)	The rise of digital finance: Financial inclusion or debt trap?	The impact of digital finance on households, while digital finance has brought financial inclusion, it has also increased the risk of households falling into a debt trap.
33	(Wagner and Walstad 2022)	Gender differences in financial decision-making and behaviours in single and joint households	They investigate gender differences in household financial behavior using data from the 2018 National Financial Capability Study, a large and nationally representative survey about adults' financial behavior, knowledge, and attitudes.
34	(Ha 2022)	Effects of digitalization on financialization: empirical evidence from European countries	Examine the association of digital transformation and financial development.

No	Reference	Title	Objective
35	(Coda Moscarola and Kalwij 2021)	The Effectiveness of a Formal Financial Education Program at Primary Schools and the Role of Informal Financial Education	Examines the effectiveness of a formal financial education program for improving the financial literacy of primary school children and how this effectiveness is influenced by informal financial education provided by parents, such as giving pocket money and discussing money matters.
36	(Horwitz et al. 2021)	Workplace Financial Education and Change in Financial Knowledge: A Quasi-Experimental Approach	Investigate the relationship between adult participation in a comprehensive workplace financial education program and changes in financial knowledge levels.
37	(Santos, Rodrigues, and Lanza 2021)	Impacts of financial education on the reduction of economic vulnerability of low income elderly [Impactos da educação financeira na redução da vulnerabilidade econômica de idosos de baixa renda]	Conduct and evaluate the implementation of the Financial education program for adults, and see its effect on reducing the economic vulnerability of low-income elderly in Palmas_TO
38	(Delgadillo and Lee 2021)	Association between Financial Education, Affective and Cognitive Financial Knowledge, and Financial Behaviour	They examined the relationship between financial education participation and affective and cognitive financial knowledge.
39	(Ghafoori, Ip, and Kabátek 2021)	The impacts of a large-scale financial education intervention on retirement saving behaviours and portfolio allocation: Evidence from pension fund data	Analyse the causal impact of a large-scale financial education intervention on retirement saving behaviors and asset allocation decisions.
40	(Salas-Velasco, Moreno-Herrero, and Sánchez-Campillo 2021)	Teaching financial education in schools and students' financial literacy: A cross-country analysis with PISA data	Assessing the effectiveness of the Financial Education curriculum in schools in all countries participating in PISA 2012.

## Conclusion

The results of our analysis indicate that financial education has been a topic of interest for high-level academics over the past 25 years, with a noticeable increase in publications during this time. However, the main limitation of this paper stems from the selection of documents for analysis. While we collected all publications in this

research stream from the Scopus database, some relevant studies may have been excluded, as some documents analyzed may not include keywords that could slightly alter the analysis results. The ongoing digitalization of finance is causing significant changes in financial management that could have long-term consequences for individuals and society. The question remains whether citizens are adequately prepared for this rapid process of change. Generation Z children will likely adapt more quickly to these changes, but can they manage their finances effectively? Will digitization make them more efficient or even more wasteful? The answers to these questions will significantly influence decisions and behavior as economic actors. Financial education plays an essential role in families and society. Children who study financial education will be better prepared for the future, and it will be easier for them to achieve financial independence. Learning about financial education from an early age can also improve parents' welfare. Moreover, there is a need for further research in the field of financial education and digital finance. Therefore, we hope that there will be a greater interest in discussing this topic in the future.

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## Teaching Aviation English: The Sweet and the Bitter


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**Abstract:** The development of the aviation industry after the COVID-19 pandemic is prompting aviation institutions to improve their courses, including English courses. A teacher who teaches English for aviation has an important role to play in adapting the teaching style to the needs of the students. This paper explored the experiences of teachers in teaching aviation English to students in the aircraft maintenance program. The participants were three English teachers from three different aviation schools in Malaysia. Semi-structured interviews were conducted as part of a fully qualitative study, and the data were analyzed thematically using ATLAS.Ti software. The findings revealed that they faced both successes and challenges in teaching aviation English, which were categorized into three areas: opportunities, feelings, and progress. The subthemes for successes were seizing opportunities, positive feelings, and good progress, while missing opportunities, negative feelings, and slow progress were the subthemes for challenges. Seizing opportunities referred to participants mastering their teaching tasks, while positive feelings referred to satisfaction with teaching, feedback from students, and enjoyment of the learning process. The sub-theme of good progress referred to the participants' better progress. The sub-themes for challenges, on the other hand, were missing opportunities, negative feelings, and slow progress. It referred to the lack of institutional support, limited knowledge about aviation and sources, while the negative feelings referred to frustration with students, technical instructors and a lack of confidence in the knowledge they had. On the other hand, participants felt that their progress was slow when they had to deal with different levels of students, which was time-consuming and related to the nature of learning and teaching aviation English. The findings would help curriculum developers and English teachers to provide an English course that meets the needs of aviation students.

**Keywords:** Aviation English, Success, Challenges, English teachers

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## Introduction

Aviation English is not only limited to the future pilot and air traffic controllers. It also refers to English that should be used by any persons who are responsible to provide services that are related to the safety of aviation such as maintenance line, cabin crew and airfield operations specialist. Aviation English is a part of ESP (English for Specific Purposes), a special English language designed specifically for aviation students and all aviation personnel to use in the workplace. It involves more jargon used among aviation personnel in terms of speaking and writing purposes to ensure smooth flight operations.

ESP is a language teaching approach, which directly deals with the syllabus, methods and activities (Hutchinson, 1987). The purpose of ESP is used for language learning based on the students 'needs and the needs of early learning. According to ESP model, which is developed by Hutchinson and Waters in 1987, there were three (3) elements which was highlighted in this model; necessities, lacks, and wants. 'Necessities' in this model refers to the type of needs that is determined by the demands of the target situations.

Meanwhile, 'lacks' in this model means the differences that exist between the target proficiency and what the target learners know. The last element is 'wants' which refers to the what the learners want to know. Teaching ESP is more challenging compared to teaching general English. It not only requires the teachers' English proficiency but also the knowledge in the specific field. Additionally, ESP teachers face difficulties when implementing an interdisciplinary approach in their classes (Prudnikova, 2013).

The voice of English teachers should be heard because they are the subject matter experts in the language to meet the needs of the students, e.g., in designing the course and selecting appropriate topics and materials. For countless years, this problem has been perceived as a phenomenon that will continue to worsen and recur frequently. This paper therefore examines the experiences of English teachers in teaching English to aviation students, particularly in the aircraft maintenance course.

## Literature Review

Although 21st century education has introduced English for Specific Purposes (ESP), English teachers still face the challenge of equipping students with industry needs and communication skills. They face the challenge of teaching unfamiliar subjects and have to deal with subject specialists. Teachers of ESP lack professional value orientation and knowledge in a particular field (Khamis et al., 2019). Knezovic (2016) found that there is a gap between the practices of ESP teachers and curriculum developers and the demands of the labor market for some elements in their curriculum. This has led them to face a dilemma in terms of subject knowledge (Wu & Badger, 2009). They should be able to interpret the curriculum and select appropriate materials based on the content and tasks used in the learning process (Alexander (2012), Bracaj (2014), and Arno & Mancho (2015).

In Malaysia context, a study that was conducted by Khamis et al., (2015) had revealed some challenges that faced by ESP teachers which are lack of guideline for specific professional values, knowledge in the specific field and lack of ESP and teaching. However, this study did not focus in any aviation area. Meanwhile, English teachers faced issues with using modules or syllabuses, as well as significant issues in their daily teaching, such as student-related issues, time constraints, limited resources, and a lack of training (Sanitah et al. 2017). Nevertheless, this study only focused on the problems and challenges of teaching ESL in vocational colleges and the participants were only selected from certain location, which is Negeri Sembilan.

All the studies reported above did not focus specifically on English in aviation. Moreover, many previous studies focused only on the challenges faced by teachers. However, far too little attention has been paid to teachers' experiences of teaching ESP specifically in the area of aircraft maintenance, focusing on both the successes and the challenges. Therefore, this paper explored the experience of English teachers in teaching English to aviation students, focusing on both the successes and challenges specifically in teaching aircraft maintenance students.

## **Methodology**

### **Research Question**

The objective of this study was to determine the experiences of English teachers in teaching aviation English in Malaysia. Hence, the research question was formulated to guide the writing of the study. The research question was: What are the successes and challenges of teaching aviation English in Malaysia?

### **Methods**

To obtain information about teachers' experiences of teaching aviation English in Malaysian aviation schools, this study used the semi-structured interview, which is commonly used in qualitative research and is the most common qualitative data source. It describes a good narrative of key events and provides insight into the participants' perspectives.

### **Participants**

Three English teachers were involved in this study. All of them are currently teaching English at three different aviation schools in Malaysia. They have more than 8 years of teaching experience. The participants were assigned pseudonyms to preserve their identities. For example, DrSa is a PhD holder with 15 years of teaching experience, while MdmZue and MdmThi are master holders with 8 and 15 years of teaching experience respectively. A pseudonym is used in this study as the researcher wishes to keep the personal details of the participants confidential. According to Allen and Wiles (2016), a pseudonym is an unreal name often used by the researcher or author to protect the privacy of the participants.

Data Analysis

The data were analysed guided by Braun and Clarke’s six-step thematic analysis with the help of ATLAS.ti.

Results

The results of the qualitative study showed that teachers experienced both successes and challenges in teaching aviation English. Success can be interpreted as achieving the outcomes desired or hoped for by the participants. In this study, it refers to seizing opportunities in completing tasks, positive feelings and making good progress. In contrast, a challenge is a new or difficult task that tests participants' competence and expertise. This includes lack of institutional support, limited knowledge of aviation and also slow progress in learning and teaching aviation English. Figure 1 shows the three sub-themes for each success and challenge, which are key words in the research question.

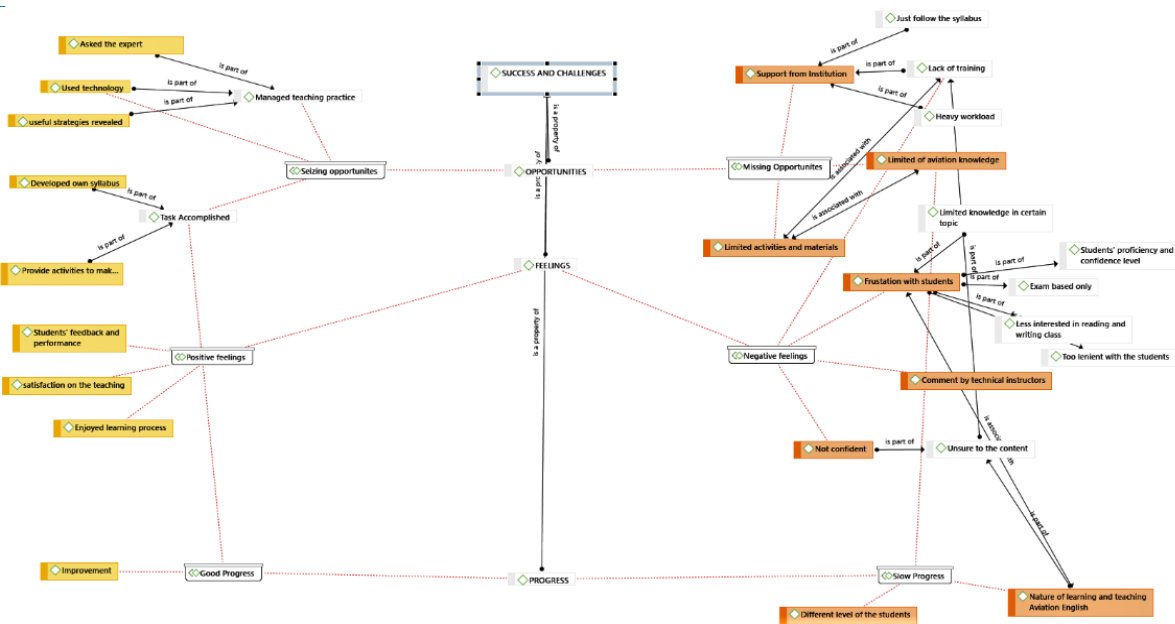


Figure 1. Three Sub-themes for Each Success and Challenge

Figure 1 is a network view output from ATLAS. ti. There were three sub- themes positioned under successes and three sub- themes for challenges in teaching aviation English. The details of sub- themes are as follows.

Theme 1: Successes in teaching Aviation English

The subthemes of successes in teaching are seizing opportunities, positive feelings, and good progress. The details of the success subthemes are like below.

### *Success- Seizing opportunities*

The participants managed to conduct the lessons with the help of experts such as the technical instructor and the industry representative. They took the opportunity for discussion and guidance from the technical instructors, some of whom had previously worked in industry.

*...Sure, I did that (asked questions) with persons from industry as well as technical lecturers....(DrSa)*

Participants in this study also tended to use the technology facilities in order to assist them in carrying out their teaching tasks. The development of technology nowadays enables users to find information quickly and easily. Moreover, it can provide higher quality results. For example, participants used this type of tool when they had problems understanding a particular jargon and were unsure of the exact pronunciation.

*...Normally, I look up the material on the internet. If I couldn't ask the engineer (technical instructor), I would look it up on the internet... (MdmZue)*

Apart from that, the participants were also able to come up with some useful strategies for teaching. They learnt new things and strategies to achieve the learning outcomes of teaching and to implement their teaching practise. For example, they directly asked students about the current technical modules they had learnt to connect to aviation English, and prepared examples and activities related to aviation to promote students' engagement in class. In addition, the teachers also discovered strategies that were effective for teaching their students, such as activities involving project-based learning and teamwork.

*.... I would say communicative... teaching and learning methodologies, and I prefer students to be more hands-on and involved in a variety of projects. They so enjoyed doing things together and functioning cooperatively in groups. They dislike reading and writing exercises that are typically done alone. It's a little stressful. So, a lot of teamwork.... (MdmThi).*

In the same sub-theme, they were able to develop their own curriculum to meet the needs of the students. As content developers, they used the opportunity they had to improve the content of the curriculum, change and provide materials, lesson plans or even the tests if they did not meet their expectations.

In summary, they took the opportunity to implement their teaching tasks by questioning the expert, using technology and finding out some useful strategies for their teaching process. They also used the opportunity to accomplish tasks such as developing the curriculum and providing activities for their class.

### *Success- Positive feelings*

In this study, participants also experienced positive feelings when students responded well and performed well

in class. When students responded well, teachers also expressed satisfaction about their teaching practise with enthusiastic words such as "very nice", "fun", "wow" and "successful".

*.... Because I gave them a choice the last time, let's pretend they choose to bring the mock up to the class. Yet, if you can't, you'll have to make your own mock up. They did it based on a real mock-up of an aeroplane. Very nice... (DrSa)*

Meanwhile, the teachers also expressed their positive feelings as they too learnt aviation English gradually. They reported that they made efforts to meet the students' needs and abilities by connecting with the real learning situation, e.g. by going to the aircraft hangar and workshop for visual learning.

*....The student would be giving a presentation based on what they found in the workshop and hangar, so we had to be at the hangar and the workshop.... (DrSa)*

In general, these positive feelings can be divided into three situations experienced by teachers: when students give feedback and are satisfied with their performance in class, when they are satisfied with the teaching and when they enjoy the learning process to understand the aviation area.

#### *Success- Good Progress*

Many participants pointed out that they generally felt a good progress, starting from the first year of teaching Aviation English to the current year. This good process of aviation knowledge enhancement is gradually getting better to meet teachers' expectations and students' needs. Most of them frequently used the words "improved", "more confident" and "better".

*....As time passes, I believe it is critical to ask around. Now that I will be in my fifth year at this school, I am extremely certain that even when my students or colleagues and I am having a normal conversation, I can relate to them or clearly comprehend what they are talking about.... (MdmZue)*

All participants showed gradual changes and improvements compared to the first year of teaching English

#### **Theme 2: Challenges in teaching Aviation English**

The sub-themes for challenges were missing opportunities, negative feelings and slow progress. The details of the sub-themes for challenges are as follows.

#### *Challenge- Missing opportunities*

On the contrary, participants felt that they encountered challenges when they missed opportunities for support

from the institutions in which they work. Firstly, one of the participants stated that English teachers were not adequately trained while they need to develop the right methodology and teaching materials.

*.....Previously, we had English for Technical Purposes and English for Commercial Purposes, but now it has changed to general English, which is communicative English. So we no longer receive that type of training.... (MdmThi)*

When asked about strategies to select the content her students need, she added that she has to follow the curriculum given by the institution as it is compulsory for teachers in class. It seems that she did not have the opportunity to research and develop her own curriculum based on the students' needs.

*In terms of the content, I strictly stick to the syllabus, but in the end, we must follow it because it is a requirement... (MdmThi)*

In addition, the participants felt that they did not receive support from the institutions due to their heavy workload. They did not have enough time to prepare the activities and materials for the classes because they had a tight schedule.

*I sometimes talk with Madam Kay (her colleague) , and seek her advice on many topics. At one point, having to teach all the programs made me feel quite stressed. Technical English, Aviation Business, Pilot Program, and KV are also included....*

Moreover, the sources and textbook for the maintenance section were very limited, unlike the English lessons for pilots and the air traffic control program. Therefore, they felt that they missed the opportunity to better prepare their students.

*.... Because aviation English textbooks are highly pricey and not readily accessible. So, I usually google the information.... (MdmZue)*

In addition, teachers have also missed the opportunity due to their inadequate knowledge of aviation, which may affect their teaching, and their sense of insecurity about certain aviation-related issues.

*.... It would be a little tough for me to remember if I tried because you didn't have any experience in aviation or teaching English for a particular reason. since I used to teach the common English language in general, such as grammar. After that, it would take time for the transition from standard general English to aviation English... (DrSa)*

The interviews revealed that teachers missed their opportunities due to inadequate institutional support in implementing the curriculum, lack of training and heavy workload. They also missed opportunities because they



had limited knowledge of aviation and limited sources such as activities and materials.

#### *Challenge- Missing opportunities*

Participants' challenges also parallel their feelings. Their feelings were negative when they faced challenges in the form of frustration with students and people around them like technical instructors and when they lacked confidence in their skills and knowledge. Teachers reported negative feelings such as frustration with students because of their skills and confidence and the attitude of students being less interested in literacy lessons.

*.... They seem uninterested in writing and grammatical rules, in my opinion. They, therefore, gave those less attention. But we have writing assessments as part of our curriculum and testing. I have no idea why they didn't like writing at all....(MdmThi)*

They also complained that students viewed the assessment of English subjects as only exam-based and not as lifelong learning. From this qualitative interview, it showed that the teachers were confronted with the students' attitude in the classroom, the negative comment from the technical instructor regarding their efforts, e.g. the exam papers that contained questions unrelated to their field. All this affected their confidence when teaching in the classroom.

#### *Challenge- Slow Progress*

Although good progress such as improvements has already been mentioned, participants also told us that they experienced slow progress. They saw it as a challenge that learning aviation English took a lot of time to encourage the students to excel.

*....If, let's say, it weren't for teaching, I might not have been able to become familiar with aviation. Since students were being taught the contents, there was a need to know about aviation. So it came... I suggest that it took longer... slowly, or in another word, depending on needs.... (DrSa)*

This teacher (DrSa) also pointed out that the different level of the students was one of the reasons for the slow progress. It was in the nature of mastering the English language in aviation, because she had to try different methods until she found the most successful approach or activities.

*....As I have stated, try and error. Make a postmortem. We examine the topic here, I suppose. I frequently asked the other teachers about this particular batch. To compare with the performance in my class... (DrSa)*

In summary, the participants made slow progress because they needed more time to find the best approach, materials and activities to teach. They used the 'trial and error' approach or did a follow up because they had different groups and different levels of students. They also admitted that it could be the nature of ESP itself, because even a teacher learns ESP.

## Discussion

As reported earlier, participants experienced both successes and challenges in teaching English to the aviation students. They experienced success when they took opportunities to implement their teaching tasks, when they had positive feelings and when they made good progress. In contrast, they experienced challenges when they missed opportunities because they did not receive enough support from the institution, had limited knowledge of aviation, had negative feelings and made slow progress.

In terms of success in teaching aviation English, the teachers in the interviews agreed that they were able to fulfil their teaching responsibilities in the classroom, including preparing the activities and materials and developing the curriculum for the students. They took advantage of the opportunities available to them by consulting experts such as technical instructors and people working in the industry. At the same time, they used the internet to find all the information they wanted to know. By completing the teaching tasks, they were able to point out the useful strategies that are effective and can attract the attention of their students in the class. In the interviews, the teachers also commented positively on their students' performance and were happy to see their good progress in enhancing their knowledge of aviation English. It can be said that the teachers were motivated to use different strategies and methods to prepare lessons and meet the students' needs. The classroom and the teaching-learning process are more effective when teachers are motivated. A successful classroom and excellent learning outcomes depend on an engaged teacher. Motivation spurs people on, helps them focus and contributes to their ability to perform well over time. There is a link between teacher motivation and the motivational strategies teachers use, which in turn affect student motivation and English achievement (Bernaus et al., 2009). Therefore, any change in the education system that promotes teacher motivation can affect students' educational achievement.

Meanwhile, the research findings of this qualitative study also revealed several challenges categorised under three sub-themes: lack of opportunities, negative feelings and slow progress. On the sub-theme of lack of opportunities, teachers admitted that they were not adequately supported by the institutions in which they work. They had to cope with a heavy workload, were provided with the English as a Foreign Language curriculum, which was compulsory to follow, and did not receive sufficient ESP training. There was no adequate training to prepare teachers for the change in curriculum that affects teaching practise (Iswati & Triasuti, 2021; Sanitah et al., 2017). Inadequate training will certainly affect the teaching and learning process.

In this study, teachers also frequently mentioned their limited knowledge of aviation and inadequate sources of English aviation subjects. All these affect their confidence in teaching the subjects, which relates to the second sub-theme of challenges: negative feelings. They also expressed their frustration with the students' performance in class and the subject teacher's negative comments. Teachers are under pressure to show that they are "intellectually capable" of mastering the subject matter in order to overcome their inferiority problem (Melles et al., 2005). The experts acknowledged that the challenges facing English teachers were very serious and warned

of the implications for teachers' classroom practise as outlined by Benesch (2001). They needed skills that related to the learning of their student pilots and facilitated practises related to aviation, as well as meeting the demands of future flight personnel in the workplace.

Finally, the last sub-theme on the challenges of teaching aviation English is slow progress. Teachers felt that learning and teaching aviation English was not part of their area of expertise. Teaching is not only part of a planned task for the teachers, but also an ongoing process that takes place throughout the time the teacher is at the facilities and interacting with the students. In order to understand the context of aviation, the teacher has to go through a long process of mastering it and incorporating it into the lesson. The different language levels of the students, which forced the teachers to follow a 'trial and error' approach, also contributed to the slow progress.

## **Conclusion**

Teaching experience is clearly linked to student success over the course of a teacher's career. This study provided a new perspective on the experiences of English teachers in aviation that was previously unexplored. The findings of the study were also crucial for researchers at ESP, as the issues raised formed the basis for future research and offered insights into the important success and challenges of teaching English to aviation students. All stakeholders, including teachers, technical educators, legislators, higher education institutions, and industry players, need to exchange ideas, take appropriate action, and share best practices to meet industry expectations.

## **Recommendations**

This study used a qualitative technique with semi-structured interviews to get a complete picture of the case. Generalisability of industry players' views on workplace communication skills was not the intended aim of this study due to the small number of participants. Moreover, this study mainly examined communication skills in the aviation industry, specifically in aircraft maintenance.

Future research should examine workplace communication skills with a larger sample size, both qualitatively and quantitatively. More research is needed to evaluate the effectiveness of university courses that emphasise communication skills from an employer's perspective to meet industry needs.

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## Constriction of Pancasila Student Profile Assessment for 21st Century Students in Elementary School


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**Abstract:** Student Profile Pancasila is a character that characterizes Indonesian students. For this reason, the character values of Pancasila students should be instilled in schools from an early age. The purpose of this study was to construct a Pancasila student character instrument for elementary school students. This study uses a quantitative approach with a sample of 697 grade 3 and grade 4 students in Soppeng district. Data analysis in this study uses validity and reliability. Content validity using Aiken's V for 40 items succeeded in reducing the instrument to 35 items with a validity index at 0.76 – 1. CFA analysis to prove content validity shows that the model is fit with 24 items. The reliability estimation shows that a 24-items instrument is reliabel. Thus it can be concluded that the 24 items of the Pancasila Student Profile instrument in construction terms can be used to measure the character of 21st century students in Indonesia.

**Keywords:** character; pancasila student profile; validity; reliability

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### Introduction

To face the challenges of the 21st century, the study regarding character has become crucial among educational and psychological experts. Character has been a target of governments in various countries to create good, employable, sociable, and high moral global citizens (Taylor, 2018; Allen & Bull, 2018). The World Economic Forum (2015) identified three main skills that students must acquire in facing the 21st century challenges, called fundamental literacy, competencies, and character qualities. Furthermore, character qualities include curiosity, initiative, persistence, adaptability, leadership, and social and cultural awareness. Providing character education to students can improve social-emotional skills, and academic development (Lovat, 2017).

Various educational institutions uphold character education in achieving individual and societal welfare, although character education is termed differently such as life skills, character development, ethics education or values education (Jose, 2021). Character is a daily activity that can be observed (Wyne, 1991) and can be formed through the educational environment, especially character education. Character education as an educational institution's effort to improve the psychological development of students for them to have ethical, democratic, and effective behavior. Furthermore, they can contribute more to society and have high level of excitement to be a well-behaved person (McGrath, 2018). Creating the individual character is influenced by the environment (Lickona, 1994), which is both family and society; and the family is the initial place in educating someone's character (Patching, 2014). However, schools remain a place to provide good character stimulus to students (Sriwilujeng, 2017). Regulating education through character education will prepare students to face the challenges of the 21st century.

Indonesia is one of the countries which makes character education as they key point to make the citizens be ready to face the challenges in this century. Character education in Indonesia focuses on preparing an intelligent and superior society that is able to unite pluralism and a multicultural society (Najmina, 2018). Although character education in Indonesia has long been implemented, the strengthening of character education began to be felt since the 2013 curriculum change through the character education program (Sultoni, 2016). Currently, the Ministry of Education and Culture has established a character education formula called the Pancasila Student Profile. Pancasila Student Profile is a character that represents the way Indonesian people behave and act in accordance with the ideology of Pancasila (Asa, 2019). The Pancasila Student Profile is also a solution to the problem of character degradation that occurs among students due to foreign cultural acculturation. Thus, character based on Pancasila values is a solution in shaping the character of Indonesian society in facing the challenges of the 21st century.

The Pancasila Students Profile aims to form citizens who have a personality that can reflect Indonesian citizens and survival in the era of globalization (Sabon et al., 2022). The implementation of character education based on the Pancasila Student Profile in schools is carried out at school through formal and informal learning. In the implementation process, the Centre for Character Strengthening issued a frame of reference in the form of the Pancasila Students Profile dimensions. The dimensions of the Pancasila Students Profile include 6 aspects which are described as follows.

First, faith and fear of God. This contains religious values where this value can be a character foundation for the younger generation in facing the demands of the times (Astuti et al., 2020). Religion is a foundation of character in human life (Muhtar et al. 2019). The value of religiosity that a person believes will affect the ways and patterns of actions taken in everyday life. Religious values have an important power and have a strong social influence in social life (Emmons & Paloutzian, 2003). Indonesian students are expected to have noble morals that are manifested through good attitudes and behaviors towards themselves, others, and the environment as a reflection of their devotion to God Almighty and the manifestation of their beliefs (Pusat Penguatan Karakter, 2020).

The second is global diversity. 21st century education emphasizes producing global citizens who can take firm

responsibility in global challenges characterized by the uncertainty of time (Hartung, 2015). In education policy, globalization which is often also termed as the 21st century is related to intercultural understanding (Selter, P & Halbert, K., 2017). Global citizenship is further defined by Hartung (2015) as people who recognize themselves as democratic members of a global community that is not limited by the state. Indonesian students who are cultured, have a mature self-identity, can show themselves as a representation of the noble culture of their nation, while having a strong insight or understanding and openness to the existence of various regional, national, and global cultures (Kemdikbud, 2020).

The third is cooperative work. Cooperative work is defined as the ability to carry out activities together voluntarily so that activities can run smoothly, easily, and lightly (Mistiani et al., 2022). Cooperative work or *gotong royong* is a local wisdom that is the cultural heritage of the Indonesian people (Sibarani, 2018) which means cooperation to help each other in achieving common goals (Taylor & Aragon, 1991) by combining strength, potential, resources, and financing. Based on the two definitions expressed, cooperative work has similarities with cooperation and collaboration in 21st century skills.

The fourth is independence. Independence is one of the attitudes that has the initiative for self-development and its achievements based on the recognition of its strengths and limitations as well as the situation faced and is responsible for the process and results (Kemendikbud, 2020). Becoming more independent individuals that have self-confidence, and independence in doing their own tasks and responsibilities, respect time and have reliable skills in their duties (Gea, 2003). Independence can help individuals solve various problems they have without relying on others by relying on their knowledge, attitudes, and skills (Suryanti et al., 2022). Independence is one of the characteristics needed by society in facing the challenges of globalization.

The fifth is critical thinking. Critical thinking is one of the most discussed skills in education today. Indonesian students are expected to have the ability to process qualitative and quantitative information objectively, analyse information factually, evaluate information and conclude information and use it in decision making (Espey, 2017; Kemdikbud, 2020). Critical thinking skills involve reasoning and logic in decision making, problem solving, and inference (Fuad et al., 2017; Tiruneh et al. 2017; Akpur, 2020).

The last one is Creativity. The creativity within students will lead them to modify, reuse, and even create new ideas. In addition, learners can also view information from a different perspective (Rahardjanto, 2019). Creativity also presents the ability to create or provide unique ideas from alternative viewpoints (McGregor, 2007). Creative individuals can make connections or links between things that have never existed before and produce new (original) thoughts (Yusnaeni et al., 2017). Creativity is related to aspects of fluency, flexibility, originality, and elaboration (Tohir et al., 2018).

The six aspects of the Pancasila Student Profile dimension framed by the Indonesian Ministry of Education become a reference for educational institutions in developing programs and projects in character building to form a 21st century society. Character development does not just happen without environmental conditioning.



Character development is achieved through learning, training, habituation, and modelling (Pala, 2011). For this reason, the role of schools is expected to support the formation of 21st century character for students in a comprehensive and measurable manner.

Character measurement, especially the Pancasila Student Profile, is carried out by the Ministry of Education and Culture annually. However, measurement and evaluation are only carried out at certain levels recently. In addition, the available measuring instruments are also not owned by schools, so the evaluation materials are only sourced from the government. In addition, previous studies have developed scales to measure the character of the Pancasila Student Profile but only at the junior and senior high school levels (Sabon et al., 2022; Mistiani et al., 2022). No one has yet developed a Pancasila Student Profile assessment instrument specifically for secondary level primary schools (grades 3 and 4).

So far, teachers tend to conduct observations and interviews in measuring student character (Zuchdi et al., 2014). The self-assessment-based character instrument for elementary school that we developed specifically for the intermediate level can be used practically for schools to take measurements periodically, to see the progress of student character. The results of character measurement can be used as a reflection to see the success of the program developed by the school.

Based on the description above, this research was conducted with the aim of developing a self-assessment-based Pancasila Student Profile character assessment instrument for elementary schools. This instrument was developed based on the six dimensions of the Pancasila Student Profile that have been described previously. The instrument was developed scientifically and tested by validity and reliability estimation.

## **Method**

### **Participants**

We recruited grade 3 and 4 students from 16 primary schools in Soppeng Regency, South Sulawesi, to test the psychometric properties of the PSP scale. The selected schools were schools recommended by the Education Office, where the schools have implemented the latest curriculum in Indonesia that supports the Pancasila student profile character strengthening program. The questionnaire was completed by 697 students based on paper and pencil tests. Participation was anonymous, confidential, and voluntary. Students were given the freedom to decide whether to participate and fill out the questionnaire seriously.

### **Instrument Development**

The elementary school Pancasila Student Profile instrument was developed with the stages of developing affective instruments (Mardapi, 2018: 18; Azwar, 2019) (1) Determining instrument specifications consisting of determining objectives, studying relevant theories, determining indicators, and preparing grids; (2) writing instruments, where we make statements based on indicators; (3) Determining scoring guidelines, negative and

positive items are each coded to facilitate scoring, positive items are worth 1 = never, 2 = rarely, 3 = often, 4 = always, and vice versa for negative items; (4) reviewing the instrument, we involved 7 competent experts (2 psychology experts, 2 measurement experts, 3 education practitioners) were asked to assess the developed instrument which was then analyzed using Aiken's formula; (5) conducting trials, small-scale trials and wide-scale trials. Initially, we conducted a pilot test with 26 students in grades 3 and 4 in one school to see their understanding of the instrument items developed. If there were sentences that were difficult to understand because they were ambiguous, we revised them. Then we went to 16 schools to conduct a wide-scale trial so that 697 students filled in and returned the instrument; (6) analyzing the instrument, after scoring the instrument that had been filled in by students, we conducted a quantitative analysis to get proof of validity and reliability; (7) assembling the instrument, items that were proven valid and reliable were rearranged into a series of ready-to-use instruments.

### Data Analysis Procedure

Data analysis in this study used validity and reliability. Instrument validity was proven by content validity and construct validity. Content validity involved 7 experts and practitioners to evaluate the relevance of aspects, indicators, and the meaning and clarity of items on the initial 40-item developed. Each expert provided responses separately through a 4-point Likert scale form (1 = not relevant, 2 = somewhat relevant, 3 = moderately relevant, 4 = very relevant) to avoid neutral choices (Davis, 1992). We performed item revision and elimination based on Aiken's V value with a standard of 0.76 (Aiken, 1985). There were 5 items that had a validity index  $<0.76$  so the items were eliminated from the instrument. Construct validity was proven through a pilot test of 697 grade 3 and grade 4 elementary school students.

The construct validity test was carried out using Confirmatory Factor Analysis (CFA). The CFA test is conducted to confirm the theory and confirm whether the indicator variables can confirm a factor (Hair et al., 2010; Ferdinand, 2014). Model fit criteria generally use 4 criteria namely (1) Model convergence and acceptable range of parameter estimates, (2) fit indices, (3) significance of parameter estimates and related diagnostics, and (4) measurement invariance across multiple samples (Netemeyer et al., 1996). However, in this study the criteria used are fit indices which are classified into absolute fit indices, comparative or incremental and parsimony. The analysis was carried out with the help of the windows version of the Lisrel application. The next analysis is the reliability test. Reliability is carried out with the aim of knowing the extent to which the measurement results of an instrument can be trusted (Otaya et al., 2020). In other words, reliability shows the consistency of the scores obtained from the measurement results (Liu, Yin, & Wu, 2020). Hair et al (2010) explained that the reliability test in CFA analysis includes composite reliability (CR) and variance extracted (AVE). Hair et al (2010) state that CR values  $\geq 0.7$  include good reliability, while CR values between 0.6 and 0.7 include acceptable reliability, provided that the indicator has a factor load that matches the criteria. Internal consistency can also be measured using the Average Variance Extracted (AVE) estimate. The recommended AVE value is  $> 0.5$  (Hair et al, 2010).

## Results

### Instrument Validity

Instrument validity consists of content validity and construct validity. Construct validity was assessed by 7 experts by giving scores on several criteria such as 1) suitability of items for indicators and aspects, 2) instrument writing rules, 3) suitability of content and language selection for the target age of the instrument, 4) clarity of sentence use (unambiguous). Experts were given an assessment sheet in the form of a 4-points Likert scale. The results of expert evaluation were then analysed using Aiken's formula to obtain the validity index of each item (Retnawati, 2016; Azwar, 2014). The results are as follows.

Table 1. Distribution of aspects, indicators, items and V-Aiken

Aspects	Indicator	Item	Code	V-Aiken
Have faith and fear of God	Religious morals	I believe that everything on earth is created by God (favorable).	IT1	1.00
		I perform worship without any coercions from others (favorable).	IT2	0.95
	Personal morals	I have breakfast before going to school (favorable).	IT3	1.00
		I take a shower before going to school (favorable)	IT4	0.71
	Manners towards others	I visit friends who are in need (favorable)	IT5	0.76
		I make friends with anyone regardless of religion and ethnicity (favorable)	IT6	0.57
	Manners towards nature	I do not litter anywhere (unfavorable)	IT7	1.00
		I switch off the television after watching (unfavorable)	IT8	0.71
	Morals towards the Nation	I obey the class rules (favorable)	IT9	0.71
		I attend the flag ceremony on Monday (favorable)	IT10	0.95
Global diversity	Recognize and respect culture	I feel embarrassed when I speak Bahasa (unfavorable)	BG1	0.90
		I like listening to the folk songs (favorable)	BG2	1.00
	Intercultural communication and interaction	I find it difficult to talk to friends who go to a different school from me (unfavorable)	BG3	0.86
		I enjoy learning the local language of other ethnic groups (favorable)	BG4	0.86
	Reflection and responsibility towards the experience of diversity	I feel uncomfortable playing with friends who come from a different ethnicity to me (unfavorable)	BG5	0.95
		I feel that learning about other cultures will destroy our culture (unfavorable)	BG6	0.95
	Social justice	I feel sad when a friend is marginalized in class (favorable)	BG7	0.71

		I vote for the class leader if there is an election (favorable)	BG8	1.00
Cooperative Work	Collaboration	I am involved in completing group tasks (favorable)	GR1	0.81
		I prefer to do group work by myself (unfavorable)	GR2	0.95
	Concern	I join my friends cleaning the class (favorable)	GR3	0.95
		I donate to the natural disaster victims (favorable)	GR4	0.86
	Sharing	I never lend my pencil to my friends (unfavorable)	GR5	0.90
		I never share my meals with my friends (unfavorable)	GR6	0.86
Independency	Self-understanding	I cannot do my homework independently (unfavorable)	MD1	0.86
		I re-learn the difficult lessons at home (favorable)	MD2	0.90
	Self-regulation	I am easily angry when I get bullied by friends in class (unfavorable)	MD3	0.95
		I am late in completing assignments (unfavorable)	MD4	1.00
Critical thinking	Acquire and process information	I ask the teachers when I do not understand the lessons (favorable)	KT1	0.95
		I use one source only to finish the assignment (unfavorable)	KT2	0.95
	Analyze and evaluate reasoning	I look for the easiest way to complete the task (favorable)	KT3	0.90
		I do my assignments in a hurry (unfavorable)	KT4	1.00
	Reflecting on one's own thinking	I have expressed my opinion correctly (favorable)	KT5	0.86
		I think repeatedly before deciding something (favorable)	KT6	0.90
Creativity	Generate original ideas	I struggle when asked to express my opinion (unfavorable)	KR1	0.90
		express my different opinions in class (favorable)	KR2	1.00
	Produce original work	I create my assignment with my own ideas (favorable)	KR3	0.95
		I do my art assignments exactly the same as the examples given (unfavorable)	KR4	0.86
	Having flexible thinking	I can only copy the example given by the teacher (unfavorable)	KR5	0.95
		When given a free drawing assignment, I make it according to what is in my mind (favorable)	KR6	0.86

Based on the table above, the Aiken validity index score is in the range of 0.57 - 1.00. According to Aiken (1985), the cut off value for 7 raters with a 4-choice scale is 0.76. So that at this stage there are 5 items that are eliminated, namely IT4, IT6, IT8, IT9 and BG7. At this stage it became the first instrument reduction process with 35 items that were content valid.

The next stage is content validity with CFA using the windows version of Lisrel 8.8. We tested 35 items on 697 students in grades 3 and 4 for further item reduction. The initial CFA results on the Pancasila Student Profile character instrument are presented in table 2. Table 2 shows that in general the model is still not fit. The predetermined fit parameter values are still not met such as NFI, IFI, CFI, TLI, AGFI. The Pancasila Student Profile instrument model and loading factor values can be seen in Figure 1.

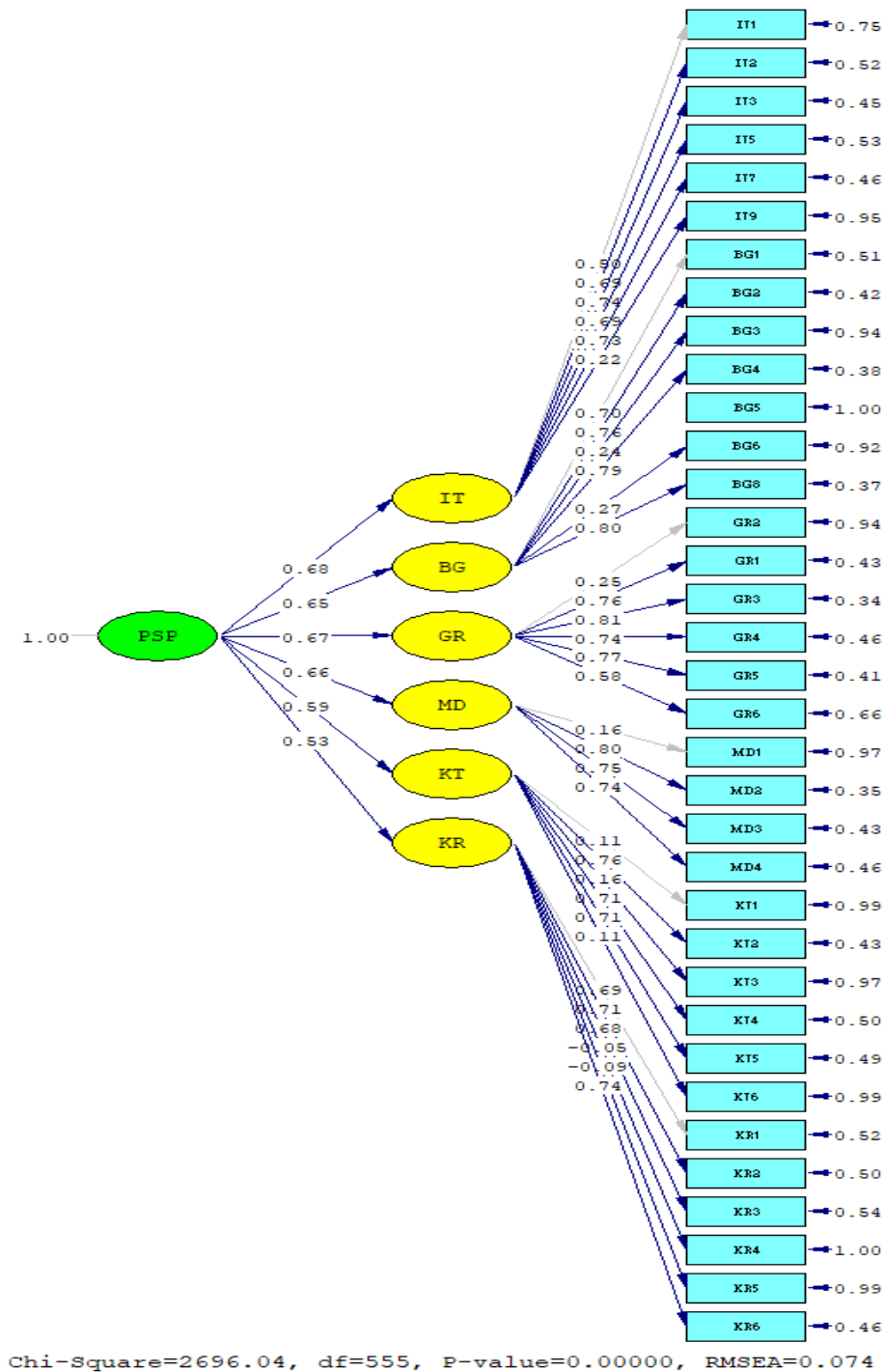


Figure 1. Initial measurement model of pancasila student profile instrument

Table 2. Evaluation of model fit of cfa first model

Category	Fit Parameters	Output	Criteria	Result
Absolute fit	Chi-Square	2696.04	$\geq 0.05$	Fit
	Goodness of fit index (GFI)	0.9	$\geq 0.9$	Fit
	Root mean square error of approximation (RMSEA)	0.074	$\leq 0.05$	Less Fit
Incremental fit	Normed fit index (NFI)	0.81	$\geq 0.9$	Not Fit
	Incremental Fit Index (IFI)	0.88	$\geq 0.9$	Not Fit
	Comparative Fit Index (CFI)	0.88	$\geq 0.9$	Not Fit
	Tucker-Lewis Index (TLI)	0.80	$\geq 0.9$	Not Fit
	Adjusted Goodness Fit of Index (AGFI)	0.88	$\geq 0.9$	Not Fit
Parsimonius fit	Parsimonius Normal Fit Index (PNFI)	0.75	0.6 – 0.9	Fit

Because the model does not yet fit, we modified the model to get a better model. Model modification is done by eliminating items that have a loading factor value  $< 0.5$ . The loading factor weight used as the basis in this study was  $\geq 0.5$  (Hair et al, 2010). In Figure 1, there are 11 items that have a loading factor value below 0.5 so they are eliminated at this stage. These items are IT1, IT10, BG3, BG6, GR2, MD1, KT1, KT3, KT6, KR4, and KR6. Thus, the CFA test for the final model did not include these 11 items. The fit model parameters after 11 items are removed can be seen in table 3 and figure 2.

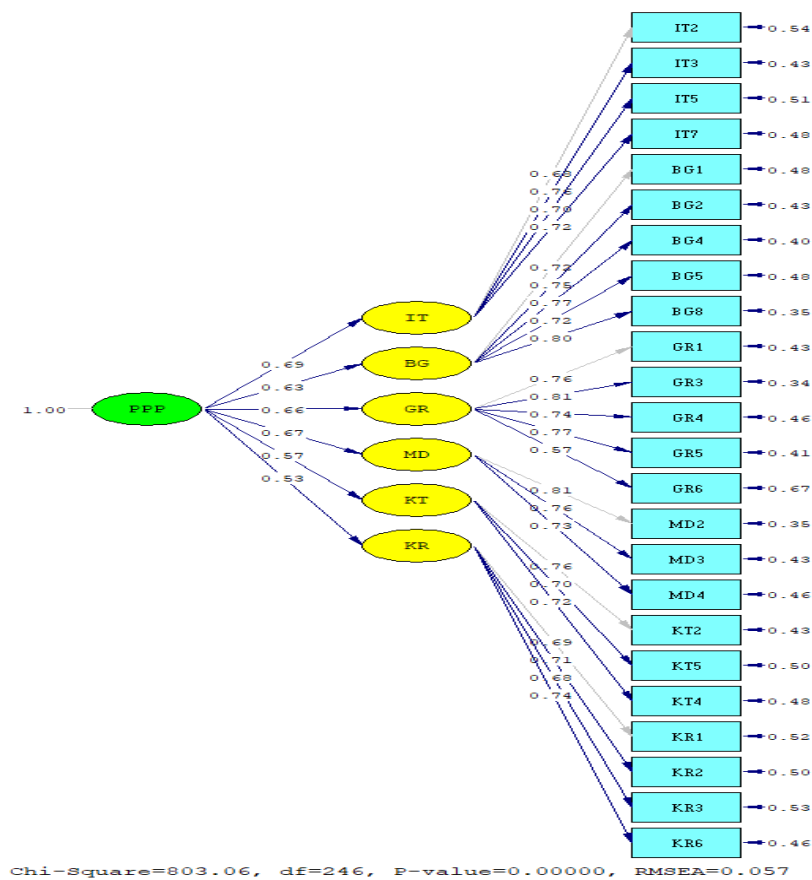


Figure 2. Final measurement model of pancasila student profile instrument

Table 3. Evaluation of model fit of final stage cfa results

Category	Fit Parameters	Output	Criteria	Result
Absolute fit	Chi-Square	803.06	$\geq 0.05$	Fit
	Goodness of fit index (GFI)	0.95	$\geq 0.9$	Fit
	Root mean square error of approximation (RMSEA)	0.057	$\leq 0.05$	Fit
Incremental fit	Normed fit index (NFI)	0.93	$\geq 0.9$	Fit
	Incremental Fit Index (IFI)	0.97	$\geq 0.9$	Fit
	Comparative Fit Index (CFI)	0.97	$\geq 0.9$	Fit
	Tucker-Lewis Index (TLI)	0.92	$\geq 0.9$	Fit
	Adjusted Goodness Fit of Index (AGFI)	0.94	$\geq 0.9$	Fit
Parsimonius fit	Parsimonius Normal Fit Index (PNFI)	0.83	0.6 – 0.9	Fit

Table 2 shows the results of the CFA test after modifying the reduction of several items. In the final model, the Chi-square p value is above 0.05, which means that there is no significant difference between the ideal model and the proposed model. The values in the Incremental fit category such as NFI, IFI, CFI, TLI, AGFI have also changed for the better so that they are in accordance with the fit model. Thus, the proposed model fits the empirical data. The complete model and factor loadings can be seen in Figure 2.

### Instrument Reliability

After the validity test is carried out, the reliability test is then carried out. Reliability is the internal consistency of an instrument that can be measured based on the level of item homogeneity. We use CFA results to support the evidence of reliability with construct reliability (CR) and variance extracted (VE). The reference for instrument reliability is if the CR value from the calculation is  $\geq 0.60$  and the AVE value from the calculation is  $\geq 0.40$  (Wijanto, 2015: 76; Hair et al., 2010: 125). Another opinion used as a reference in this study is Huang (2017: 186) that a CR value of 0.63 is considered good and an acceptable VE value ranges between 0.30 and 0.66 (Huang et al., 2017).

Table 4. Construct reliability results with composite reliability (CR) and variance extracted (VE)

Aspects	CR	VE	Result
Have faith and devotion to God Almighty and have noble character (IT)	0,70	0,38	Reliable
Global diversity (GD)	0,84	0,45	Reliable
Cooperative Work (GR)	0,83	0,45	Reliable
Independence (IN)	0,75	0,50	Reliable
Critical Thinking (CT)	0,62	0,35	Reliable
Creativity (CR)	0,74	0,41	Reliable

Based on the table above, the Composite Reliability (CR) and Variance Extracted (VE) coefficient values for the

aspects of faith and devotion to God Almighty and noble character are 0.70 and 0.38, which means reliable. The Composite Reliability (CR) and Variance Extracted (VE) values for aspects of global diversity are 0.84 and 0.45, which means reliable. The Composite Reliability (CR) and Variance Extracted (VE) values for the gotong royong (cooperative work) aspect are 0.83 and 0.45 which means reliable. The Composite Reliability (CR) and Variance Extracted (VE) values of the independent aspect are 0.75 and 0.5 which means reliable. The Composite Reliability (CR) and Variance Extracted (VE) values of the critical reasoning aspect are 0.62 and 0.35 which means reliable. The value of Composite Reliability (CR) and Variance Extracted (VE) of the creative aspect is 0.74 and 0.41 which means reliable. Thus, the developed Pancasila student profile character assessment instrument can be said to be reliable so that it has a good level of reliability.

## Discussion

This study aimed to develop and validate a comprehensive scale for measuring Pancasila Student Profile (PSP) based on the theoretical framework of Indonesian Ministry of Education and Culture. The instrument development process has gone through several reduction processes which were originally 40 items. The developed Pancasila Student Profile instrument consists of 6 aspects which are translated into 19 indicators and 24 items. This instrument can be used to measure student character because it has been proven valid and reliable. An instrument is said to be of good quality if it meets the criteria of validity, reliability, and practicality (Gronlund and Linn, 1990). If an instrument has not met the criteria of validity and reliability, the data obtained cannot be trusted and will affect the conclusions (Kerlinger, 2006). The instrument validation process with content validation testing, obtained valid evidence that 35 items meet the desired criteria. The results of the analysis using Aiken's V formula showed that the validity index was in the range of 0.51 - 1.00. 5 items were eliminated because they did not meet the cut score of 0.76, so the 35 surviving items will be tested at a later stage.

The results of construct validation as evidenced by the CFA test show that the proposed model fits the empirical data after codification. Initially, 35 items were analyzed using CFA to see the suitability of the model, but because there were still some criteria that did not fit, modifications were made by discarding items that had a loading factor value  $<0.5$ . This reduced the valid instrument to 24 items which were retested with CFA resulting in a better measurement model. NFI, IFI, CFI, TLI, AGFI, which were initially not fit, have now increased after model modification so that they meet the fit indices criteria. Not only that, other criteria such as Chi-square, GFI, RMSEA and PNFI also look better after model modification. The results of instrument reduction at the CFA stage are reviewed based on each aspect. The findings on the first aspect, namely faith and fear of God, are measured by 4 valid and reliable items. The 5 indicators developed at the beginning have been reduced to 4 indicators. This happened because two items on the indicator "state morals" were eliminated during the validation process. As explained by Muhtar et al. (2019) that belief and piety to God can be manifested through polite behavior, cleanliness, tolerance, and concern towards the environment. So that the fulfilment of other indicators can form citizens who have good state morals.



The findings on the second aspect, global diversity, the items that remained valid and reliable which is 5 items. At the beginning of the development there were 7 items, 2 items were cancelled during the validation process, but all indicators are represented by items that measure this aspect. Several items that survive can measure aspects of global diversity, namely students who can love their ancestral culture, locality, and identity but can still think openly and accept differences through intercultural interactions (Jamaludin et al., 2022). The findings on the third aspect, cooperative work, the initial developed items were 6 items then reduced to 5 items. In this aspect, only 1 item was eliminated. The three valid items should reflect the value of gotong royong (cooperative work), which is a local wisdom of the Indonesian nation that generally means cooperation (Sibrani, 2018) to achieve common goals as social beings (Kurniawati & Mawardi, 2021). In the fourth aspect, independence, there are 3 valid and reliable items out of 4 originally developed items. Independence in the Pancasila Student Profile means that students do not always depend on others in making choices and completing their responsibilities (Kluwer et al., 2020). In the fifth aspect, critical thinking, the 6 items developed at the beginning were reduced to 3 items. However, the three items measure each indicator so that the indicators are still represented. This aspect was also observed to have the lowest validity and reliability compared to the others. In some studies, critical thinking is measured using cognitive tests, but because it is related to character, this study uses a Likert scale. Critical thinking in the Pancasila Student Profile means that students can make decisions on the consideration of existing facts by thinking fairly (Kemendikbud, 2022). The sixth aspect, creativity, has 4 items that are proven valid and reliable. There were 2 items that were cancelled during the validation process because initially the proposed 6 items. The four items describe the ability of students who can reuse, modify, and even create new and original ideas (Rahardjanto, 2019).

The last test conducted was reliability estimation as evidenced by composite reliability and variance extracted scores. The results show that all six aspects fulfil reliability with CV and VE values above 0.63 and 0.3. Composite reliability indicates internal consistency and homogeneous variance between measurement items (Whidhiharso, 2016), so that even though the sentence items are different, they still measure the same construct (Huck, 2007). Thus, it can be concluded that the Pancasila Student Profile Instrument to measure 21st century character is valid and reliable based on the instrument construction that has been carried out. This instrument can be used at the intermediate level in primary schools.

## Conclusion

In conclusion, the construct of the Pancasila Student Profile instrument to measure student character in the 21st century is psychometrically valid and reliable. The 24-item Pancasila Student Profile instrument consists of six aspects, namely faith and devotion to God Almighty and noble character, global diversity, cooperative work, independence, critical reasoning, and creativity. The six aspects were developed into 19 indicators resulting in 24 items. The validity of the instrument is proven by construct validity through model fit test and evaluation of model fit criteria. The reliability of the instrument has also been proven to be good based on composite

reliability and variance extracted analyses. To our knowledge, this is the first instrument to measure the character of the Pancasila Student Profile specifically made for grades 3 and 4 in elementary school. The measurement results using this instrument can later be used as preliminary data in comparing the character scores of students at other levels in Indonesia.

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## Teaching Sustainability outside the Classroom: Preliminary Findings of Food Waste from Indonesian University Students

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**Abstract:** The fact that Indonesia becomes the first country contributing to food loss and food waste among the G20 countries in 2021 is an opportunity to evaluate the effectiveness of sustainability education taught in universities. This study aims to map students' initial knowledge and skills in processing the food waste and to create an integrated food waste management design in a higher education institution. An explanatory sequential mixed method was used in this study involving 641 student respondents for the quantitative phase and three institutions for the qualitative phase. The quantitative phase found that 67.71% of students did not have experience processing organic waste, and their perception about waste segregation benefit is still in the moderate category. However, the index number of students' self-identity is high (80.94) regarding their perception that they had behaved in an environmentally friendly manner. This finding is then communicated with several related institutions during the qualitative phase to develop an integrated sustainability education model outside the formal curriculum to improve students' knowledge and skills in processing food waste.

**Keywords:** Sustainability, Education, Food Waste, Higher Education Institutions

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## Introduction

Globally, Romero-Luis et al. (2021) found that campaign regarding the circular economy and bioenergy through education is still in their early stages and have a low level of maturity. Although many studies states that teaching about sustainability and circular economy in the classroom has shown a positive trend (Bugallo-Rodríguez & Vega-Marcote, 2020; Williams et al., 2018), there are also research results that criticize it. Several studies suggest that so far, the insights about the circular economy taught in class have been more conceptual (Hens et al., 2018; Kirchherr & Piscicelli, 2019) and inconsistent with the content of knowledge being taught (Fonseca et al., 2018). In addition, the material taught is not simple, concrete, inclusive and transparent (Corvellec et al., 2021). This causes the concept of sustainability and circular economy that are taught in classes are failed to develop critical, imaginative and innovative thinking about sustainable development (Kopnina, 2018). Another problem related to classroom learning regarding the circular economy, sustainability, and other relevant matters are difficulty to observe changes in student behavior permanently due to the limited number of meetings and evaluation duration (Bugallo-Rodríguez & Vega-Marcote, 2020), the need for more lecturers, the teaching load for lecturers will become heavier, faculty financial management problems related to the increasing complex activities to be carried out, construction of new facilities, and difficulty of determining the right evaluation design (Wandl et al., 2019).

The UN has a global performance ranking that assesses university performance in supporting SDGs called the Times Higher Education (THE) Impact Rankings. The 2022 Impact Rankings is the fourth edition and the overall ranking includes 1,406 universities from 106 countries/regions. THE Impact Ranking uses carefully calibrated indicators to provide comprehensive and balanced comparisons across four broad areas: research, stewardship, outreach, and teaching. In 2022, the university with the best TPB practice is Western Sydney University (Australia) with a score of 99.1; Arizona State University (United States) with a score of 98.5 and Western University (Canada) with a score of 97.8. Only 28 Indonesian universities are listed in this rank board. It implies that most universities in Indonesia have not paid much attention to their role in supporting sustainable development. The top 10 national rankings of listed Indonesian universities can be seen in Table 1.

Table 1. Listed Universities with the Highest Sustainable Development Score in Indonesia

No.	World Rank	University	Total Score
1.	18	Universitas Indonesia	95,1
2.	87	Universitas Gadjah Mada	89,2
3.	101-200	Institut Teknologi Bandung	82,1 – 88,5
4.	101 – 200	Universitas Padjajaran	82,1 – 88,5
5.	201-300	Universitas Airlangga	76,9 – 82,0
6.	201-300	Institut Teknologi Bandung	76,9 – 82,0
7.	201-300	Universitas Diponegoro	76,9 – 82,0

8.	301-400	Universitas Sebelas Maret	72,0 – 76,7
9.	301-400	Institut Teknologi Sepuluh November	72.0 – 76,7
10.	401-600	Universitas Brawijaya	65,0 – 71,9

Source: THE Impact Rankings (2022)

Table 1. shows that almost every university has a high partnership score (Partnership for the Goals -TPB number 17). Ironically, only two universities were able to achieve a high Education Quality score (TPB number 4), namely IPB and UNS. Apart from these two higher education institutions, there is no ranking regarding the quality of education that contributes to achieving the total score of the top 10 universities in Indonesia.

Although only a few universities in Indonesia are listed in THE impact rankings, several universities and study programs in Indonesia have introduced the concept of sustainable development. However, based on the results of searching various information using internet searching techniques, it was found that most of these courses were presented for the Master Program and the discussion in them was focused on the approach of each scientific discipline. For example, the Insitut Teknologi Sepuluh Nopember Surabaya (ITS) has a course on "Sustainable Development" which is taught to students of the Master Program in Development Studies, the Postgraduate School of Universitas Brawijaya (UB) offers courses on Sustainable Development and Environmental Insight in the Master Program in Environmental Resource Management and Development (<https://ppsub.ub.ac.id/akademik/program-studi-interdisciplinary/>), Tadulako University equips Master of Economics students with Green Economy courses (<https://siaga.kemdikbud.go.id>). Several universities also teach it to students in undergraduate study programs, but with a tendency to only teach it to certain study programs such as study programs related to engineering and economics. For example, Mulawarman University requires undergraduate students in the Development Economics Study Program to take Natural Resource and Environmental Economics courses, ITS with the same study program features courses on Sustainable Development Education (semester 5) and Sustainable Society: Theory and Practice (semester 6). Interestingly the courses in semester 6 are opened for other study programs. On the other hand, Universitas Negeri Semarang (UNNES) introduced the Environmental Education course as a general subject which is a mandatory for all undergraduate students in any study program.

The problems and obstacles to teaching sustainability inside the classroom require a more concrete solution than simply improving the existing curriculum design. De la Torre et al. (2021) argues that there are other ways to help transition of circular economy by promoting the concept of sustainability outside the formal curriculum. The results of these thoughts inspire novelty in this research: how universities should not only focus on integrating the concept of sustainability into the formal curriculum, but also be able to become pioneers of this transformation through a more concrete movement that is supported by all components of the HEIs.

### **Food Waste Problem in Indonesian HEIs**

In 2021, Indonesia became the largest food waste producer in Southeast Asia according to Food Waste Index



2021 developed by United Nations report Environment Program (UNEP). The total food waste in Indonesia reaches 20.93 million tons annually. This number has a significant impact on greenhouse gas emissions. The related data could be seen in Figure 1.

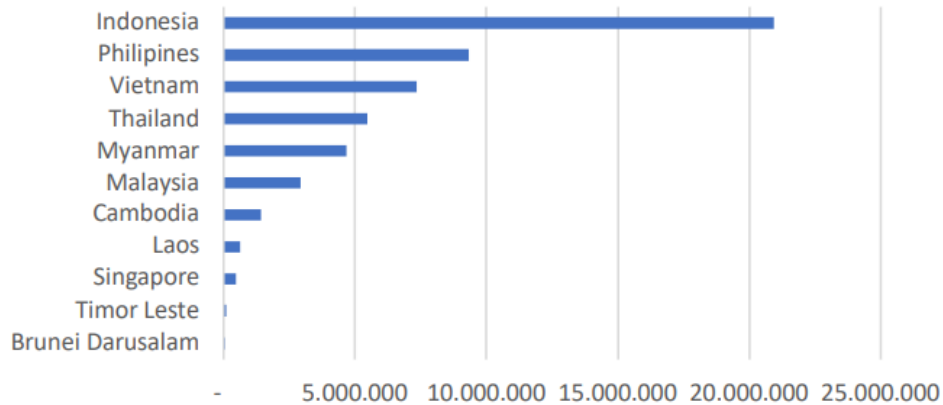


Figure 1. Household Foodwaste Estimate (tons/year) in South East Asia

Source: Food Waste Index, UNEP (2021)

Furthermore, according to the Sustainable Development Report (2022), Indonesia is listed as one of the countries that has not made enough progress in meeting the 2015 Paris Agreement targets. In general, the composition of organic waste in the form of food scraps in households is proven to have a larger amount than inorganic waste, which ranges from 60% to 73% of the total household waste generation (Arief, 2019; Brigita & Rahardyan, 2013; Khasanah et al., 2019; Widiarti, 2012). However, compared to inorganic waste management, the progress of food waste management in Indonesia seems quite slow. Several research results try to unravel the causes of the slow progress in food waste management activities, including: the lack of awareness of the government in providing special food waste processing facilities (Brigita & Rahardyan, 2013); lack of public awareness and knowledge in sorting waste (Brigita & Rahardyan, 2013; Kurniawan & Santoso, 2020; Yudistirani et al., 2016); there are no resources specifically employed to sort waste and a lack of creative communities in waste management (Kurniawan & Santoso, 2020).

Non-profit organizations whose activities focus on reducing FLW actually exist and are developing in Indonesia, such as "Food Cycle Indonesia" (Jabodetabek), "Garda Pangan" (Surabaya), "Hunger Bank" (Bandung), "Zero Waste Indonesia" (online community). Foodbank of Indonesia (FoI) and other similar non-profit organizations. Most of these organizations operate as food banks that are committed to distributing food assistance to underprivileged people in need. In addition, several organizations also carry out recycling activities and sell their products online. Several movements that focus on reducing food waste have also come from corporate initiatives in the form of Corporate Social Responsibility (CSR) such as McDonalds with the "Food Rescue" program, DBS Bank with the "Towards Zero Food Waste" program, or Aswata Insurance Company with the "Fighting the Food Waste" program. Food Waste Action".

In a smaller scope such as the university environment, most stakeholders still do not have awareness in waste management. The problem of waste in tertiary institutions still does not reflect the success of teaching in the classroom. The generation of waste in tertiary institutions is recorded in several studies as still high and the management is not optimal. The findings of Nurjannah et al. (2020) in their case study in a university canteen estimated the weight of leftover food produced by each respondent studied was 147 grams/day with a percentage of leftover food weight per individual of 38% of the portion served. The estimated value of food waste from this amount is IDR 4,244 per individual/day with the percentage value of food waste per individual being 38% of the total cost incurred for consuming food per day. Meanwhile, the results of other studies regarding waste generation in the campus environment found varying amounts, namely every day the campus produces waste weighing 123.43 kg (Masrida, 2017), 770 kg (Yuliandari et al., 2019), up to 12 tons (Retnoningsih et al., 2022). Based on the results of these studies, the percentage of types of organic waste is greater than other types of waste.

The number of students in Indonesia is 9.32 million people in 2022 (Indonesian Department of Education, 2023). They are all potential to be the agent of change regarding to environmental transformation. The irony that occurs in this case is that students who are expected to become the agents of change, especially in terms of promoting circular economy transformation and becoming pioneers of the concept of sustainability in all aspects of life, are in fact still far from expectations. A study by Sima et al. (2022) revealed that the lack of knowledge and lack of student interest in activities related to environmental issues is the biggest obstacle to the success of tertiary institutions in Romania. The majority of respondents to a study in the United Arab Emirates agreed that young people generate more food waste than their parents, most of which comes from excessive food purchases and poor food management (Yagoub et al., 2022).

Studies on the behavior of disposing of food waste by Indonesian students are still limited to describing the behavior of disposing of food waste and the factors that influence it (Amalia, 2019); identification of types of waste in the university area (Dewilda & Julianto, 2019); and an inorganic waste processing model (Sunandar et al., 2020). Studies on organic waste management models in HEIs involving the students are still very difficult to find in Indonesia. Therefore, the research questions of the current study are:

1. How is the students' perception about food waste management?
2. How university could build an integrated food waste management with students' active participation?

## **Method**

An explanatory sequential mixed method was used in this study. The quantitative phase used a cross-sectional online survey conducted in Universitas Negeri Semarang, Indonesia which is the state university that declared their vision to be international reputable conservation university in Indonesia. As many as 641 students across disciplines and semesters filled in the survey anonymously to know about their knowledge about waste management, their perception about it, and their perception about their environmentally friendly self-identity.

The survey was adopted from Nguyen et al. (2022) with minor adjustment and had been re-tested in terms of its reliability and construct validity. The descriptive qualitative methods using index number was applied to explain the findings regarding research question number 1 up to 3.

The qualitative phase was done by doing interviews to 4 key persons, they are: the manager of the central landfills Jatibarang Semarang City, the head for integrated organic waste processing site of UNNES named *Tempat Pembuangan Sampah Terpadu* (TPST) UNNES, the staff of Conservation Development Unit (UPT Bangvasi) UNNES and the head for household sub-division of UNNES. The interview transcripts were analyzed using N-Vivo program to do the interactive method as Miles et al. (2018) explained which are data condensation, data display, drawing and verifying conclusion about how to build an integrated food waste management with students' active participation.

## Results

### Respondents Demographic Data

A total of 641 anonymous respondents who are active students in Universitas Negeri Semarang, Indonesia completed the online survey. The Demographic data and respondents' characteristics are shown in Table 2.

Table 2. The Demographic Data

Indicators	Answer Options	Total	Percentage
Sex	Female	485	73,4%
	Male	176	26,6%
Semester	1	414	64,59%
	3	122	19,03%
	5	74	11,54%
	7	15	2,34%
	More than 7	16	2,50%
Residence	Boarding house	485	73,4%
	Parents' house	128	19,4%
	Rent House	40	56,1%
	Private House	8	1,2%
Have experience in managing organic waste	No	450	68,1%
	Yes	211	31,9%
Have pet(s) or livestock	No	403	62,87%
	Yes	238	37,13%

Indicators	Answer Options	Total	Percentage
How to deal with the organic waste currently	Put it in garbage bin without sorting process	350	54,60%
	Put it in garbage bin after sorting process	100	15,60%
	Feed it to pet(s)/livestock	26	4,06%
	Put it in composter	11	1,72%
	Others	154	24,02%

As cited in the Table 2, more than a half of students do not have any experience in managing organic waste. However, the 31,9% students with the experience of managing organic waste shared interesting experience they did to their organic waste, such as: processing the organic waste into compost, utilizing food waste as animal feed (since 37,13% of respondents stated they have pets and livestock), restoring the leaves waste into artistic souvenirs, or just simply burying the organic waste at their backyard. As many as 54,60% students revealed that they just simply put the waste without sorting it. This fact requires deeper attention because waste separation is an important thing to achieve high rates of waste reuse and recycling (Stoeva & Alriksson, 2017). Despite this fact, the number of students who have taken care their waste separation reached 100 students, even only 11 students that put their organic waste into the composter by themselves.

### Students' Perception about Food Waste Management

Table 3 describes the students' perception about food waste management based on 3 indicators: perceived personal benefits of sorting food waste, inconvenience in sorting food waste, and environmental self-identity by measuring index number for each indicator.

Table 3. Students' Perception about Food Waste (FW) Management

No	Statement	Answer Frequency (%)				Index	Category	
<b>Personal benefits of sorting food waste (Cronbach's <math>\alpha = 0.89</math>)</b>								
1	Putting FW into the green bin is the right thing to do	9,7	15,9	46,3	20,3	7,8	60,12	Moderate
2	I feel good when I sort and dispose of FW correctly into the green bin	7,3	10,3	33,1	28,9	20,4	68,96	Moderate
3	By using the green bin for FW, my rubbish bin stays cleaner and does not need to be taken out as frequently	19,8	28,5	30,3	12,5	8,9	52,44	Low

**Inconvenience and lack of control in using the green bin (Cronbach's  $\alpha = 0.79$ )**

<b>4</b>	I do not have sufficient information regarding FW going into the green bin	7,6	14,9	35,7	26,8	15	65,34	Moderate
<b>5</b>	It is expensive to buy supplies (e.g. compostable bags, kitchen caddy, etc.) to sort into the green bin	10,8	24	39,6	16,9	8,7	57,74	Moderate
<b>6</b>	I do not want to deal with the smell and the mess of food when sorting	10,5	18,4	33,8	24,8	12,5	62,08	Moderate
<b>7</b>	FW It takes too much time and effort to sort FW into the green bin	8,9	21,4	38,8	22,8	8,1	59,96	Moderate
<b>8</b>	I have no control over FW as other people in the house are the ones disposing FW	10,5	17,6	33,7	24	14,2	62,76	Moderate

**Environmental self-identity (Cronbach's  $\alpha = 0.89$ )**

<b>9</b>	Acting environmentally friendly is an important part of who I am	3,4	1,6	3,4	10,5	81,1	92,86	Very High
<b>10</b>	I am the type of person who acts in an environmentally friendly way	0,8	3,1	32,4	40,6	23,1	76,42	High
<b>11</b>	I see myself as an environmentally friendly person	1,4	4,1	39,4	35,6	19,5	73,54	High

Note: All items were assessed on 5-point Likert scales; higher values correspond to stronger agreement with the statement or higher frequency of recycling habit. FW=Food waste (Adopted from Nguyen et al., 2022)

**University's Perception about Food Waste Management**

According to the interviews with the key persons, the outcomes of qualitative phase in the current research were classified, sorted and arranged using NVivo to identify themes and patterns of interviews transcript. The NVivo tools used in this analysis are including: word frequency (word cloud and cluster analysis), text search, and hierarchy chart. Figure 2 displays the word cloud of 25 most frequent words mentioned during interviews with minimum length of word as many as 3 characters. The word "waste" dominated conversation by mentioned 82 times (4.92% of total words during interviews), followed by "UNNES" which mentioned 56 times (3.36%), "TPST" (34 or 2.04%), garbage (33 or 1.98%) and Bangvasi (23 or 1.38%). It implies that by putting aside the words "waste" and "UNNES" which are the main topics of conversation, TPST UNNES and Bangvasi are considered as the main actors related to waste management at UNNES, especially to set "programs" (22 times or 1.32%) for managing garbage.



Figure 2. Word Cloud of Waste Management Interviews  
Source: NVivo Output (2023)

Figure 3 shows the cluster analysis of word mentioned during interviews.

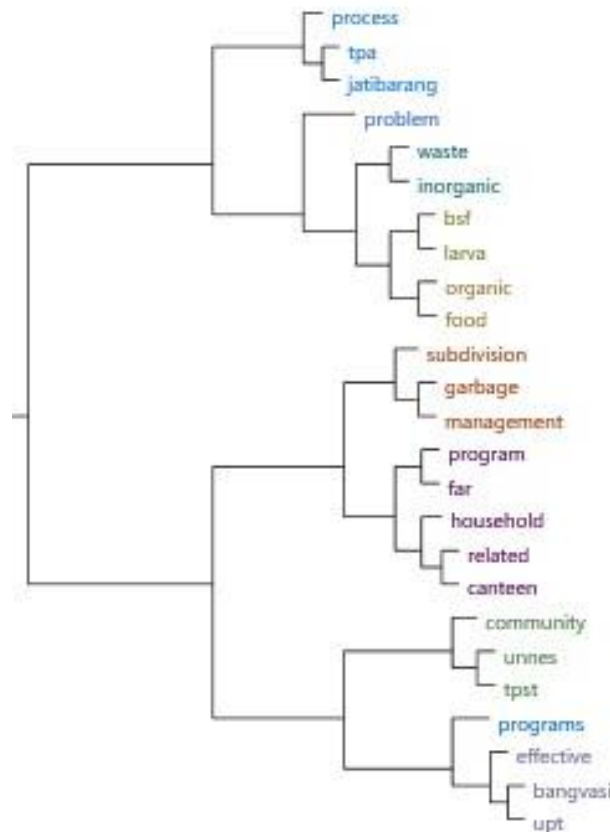


Figure 3. Word Cloud of Waste Management Interviews  
Source: NVivo Output (2023)

The two main clusters talk about the wrong process of waste management (organic and inorganic waste) has become the main problem in the city final landfill (TPA Jatibarang) and the other cluster focuses more in UNNES waste management program. Furthermore, in the first cluster about TPA Jatibarang, the interview results revealed that they tried to develop an education program for citizens about organic waste management by cultivation Black Soldier Fly (BSF) larvae which has economic value to be traded as animal feed. Meanwhile, the waste management in UNNES is handled by TPST UNNES collaborating with UPT Bangvasi and Household Sub-division. BSF larvae cultivation is also implemented in TPST UNNES as a strategy to recover food waste energy into new energy, while other organic waste such as leaves and grass are processed into organic fertilizer. The food waste is collected from campus canteens and sorted by janitors before distributed to TPST UNNES. UPT Bangvasi claimed that the waste management program has been effective enough to handle campus' waste so far. However, when it comes to student community, they also admitted that there is a problem with sustainability and durability of typical student community concerning in conservation.

The discussion about youth community for supporting waste management campaign in university was led to some important points mentioned by the key persons during the interviews. The theme "community" itself was analyzed using text search query and produced some structured concepts shown in Figure 4.

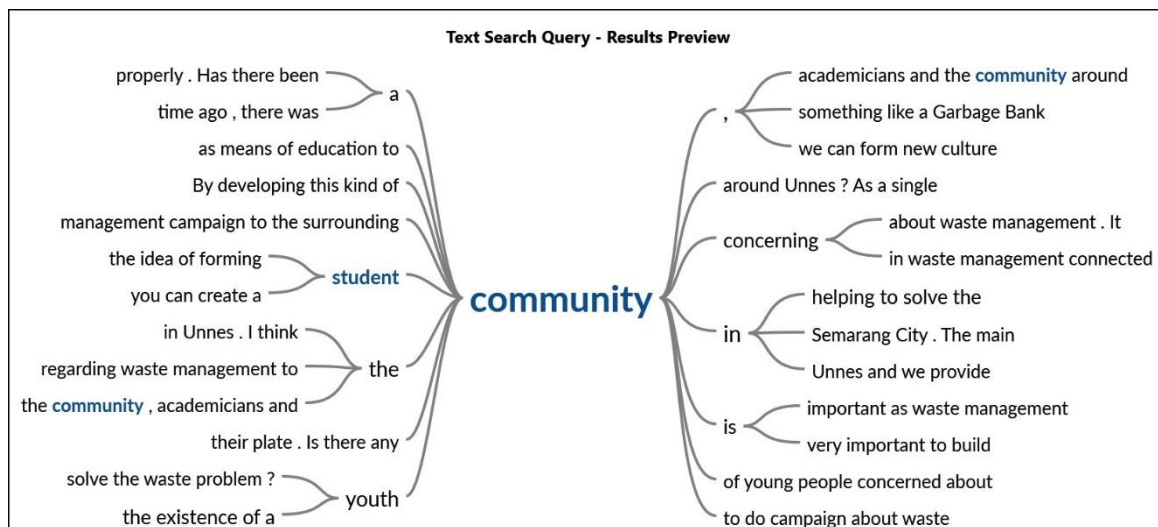


Figure 4. Text Search Query for Community Theme

Basically, all the key persons interviewed reacted positively about an idea to form a youth community concerning in waste management campaign. According to them, the following are some things that need to be considered if students want to create a waste-aware youth community: (1) representation; (2) program durability; and (3) sustainability. Representation was proposed by TPST considering there are many faculties in the university so each of it need its representative to make sure the waste management education can reach all students, lecturers, and canteen sellers in all faculties on campus. Program durability was suggested by Household Sub-Division as they experienced typical communities set short-term programs which do not have a solid management to achieve long-term goals. The implementation of this long-term program is important

because it takes a long time to change the culture, for example a culture for sorting waste, mindful eating, zero plate waste, etc. Meanwhile, sustainability was emphasized by UPT Bangvasi regarding the fact that some community just vanished simply when the founder graduated from university. The youth community in the university needs to make sure that the system they have can be run by all members of the community so that if there is a change in members this will not affect significantly to community activities.

## Discussion

The interviews revealed that basically the university waste management units have implemented zero waste policy consistently by arranging university waste independently without sending them to the city landfills. However, this program run at institutional level by hiring people who professionally and specifically manage the waste. University should not forget its function to provide the waste management education for their students. The fact that students in conservatory university which has a particular and mandatory common course related to conservation knowledge named “Pendidikan Lingkungan Hidup” or “Environmental Education” in the first semester still have low awareness in managing their waste becomes evidence that incorporating environmental issues into the curriculum in the form of courses does not necessarily increase environmental awareness around students. Meanwhile, Kurniawan & Santoso (2020) found that more participation from the creative community is needed to overcome this waste processing problem, especially food waste.

Based on the interviews with university parties, student community might be needed to support the environmental education inside the class by providing more real action outside the class. Creating a community concerning in waste awareness and waste management among university students is not easy. Holdsworth & Quinn (2012) stated that there is always a possibility that students from different backgrounds may not have the sense of belonging or inclusiveness towards the community. This study in line with the finding of environmental self-identity variable that students are tend to create a positive image of themselves, in this case is to tell others that they care enough about environmental issues, even though in the reality they have not participated actively in protecting the environment.

Student community heavily depends on volunteers. Therefore, to build a strong student community it is important to treat the volunteers based on their motivation joining community. Clary et al. (1998) formulated a set of six essential motives of volunteers and developed the Volunteer Function Inventory (VFI) which consists of six motivational functions that volunteering may serve: (a) values, communicating values that are personally important; (b) understanding, learning about the world, developing skills; (c) social, strengthening one’s social relationships, being concerned about social rewards; (d) enhancement, growing psychologically; (e) career, gaining career-relevant experience; and (f) protective, addressing personal problems, reducing negative feelings. In order to get deal with sustainability issue, it is recommended that in recruiting volunteers, the committee should first identify their motivation in registering for the community program and assign them tasks that will enable them to achieve their goals.



In terms of community programs, there are studies suggested many programs to manage the waste designed specifically for students. For instance, in order to reduce canteen's plate waste, several studies have proposed various alternative interventions that can be carried out, such as: provision of food tasting spoons in the canteen (Cardwell et al., 2019; Malefors et al., 2022); doing campaign about plate waste (Visschers et al., 2020); plate tracker installation, forecasting canteen visitors (Malefors et al., 2022); changes in food serving infrastructure (Berkowitz et al., 2016; Lorenz et al., 2017; Thiagarajah & Getty, 2013; Vermote et al., 2018); and even providing incentives to consumers (Priefer et al., 2016). All those activities could be handled by student community by spreading volunteers in the campus canteen. In addition, volunteers could also be educated to transform food waste into products such as fertilizer (Kurniawan & Santoso, 2020; Loan et al., 2019) and BSF larvae (Fowles & Nansen, 2020; Ojha et al., 2020).

Other than the discussed aspects (representation; program durability; and sustainability), the future student community should also consider the role of social media in carrying out waste awareness campaigns. (Scholtz et al., 2016) found that the social media campaign had numerous positive benefits for promoting environmental awareness in South African HEIs. Social media can be utilized in online advocacy such as the Greenpeace Mediterranean food campaign which has had significant success in its short time in Turkey (Özdemir, 2012). The study of Haenlein et al. (2020) revealed that Instagram and TikTok are the most prominent social media recently because they have the youngest user bases. The implication is that these two social media users are very vulnerable to all forms of online communications, including online campaign about environmental awareness. The student community could manage their social media as one of the tools for campaigning, recruiting members, and informing their future agendas to public.

## Conclusion

The fact that there is a gap between university programs and students' knowledge and skills in terms of waste management raises awareness to bridge this gap by grounding knowledge about the environment to be more than just in the form of formal courses. A student community is needed to increase the environmental awareness, knowledge and skills of students. However, building a community needs extra time and efforts. Therefore, university should plan some strategies to make sure the student community could be representative, durable, and sustainable. The strategies are including food waste campaigns in faculty canteens, several workshops, voluntary activities, and online campaigns using social media. By building the student community, the university gets the better chance to promote sustainability and environmental awareness outside the classroom in the more relatable and interesting way for students. The future study is planned to identify the students' motivation joining this community and how social media engagement support community agendas.

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## Tertiary Educators' Awareness of and Readiness to use Virtual Reality (VR) in Remote Online Learning

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**Abstract:** COVID-19 pandemic has transformed the conventional education landscape to online remote learning. However, this transition has brought about certain challenges such as low levels of student engagement and motivation, which raises the question of whether students are actually learning. Using Virtual Reality (VR) in teaching and learning (T&L) could increase engagement as it provides interactive experience that necessitates students' online presence. Literature shows students are aware of VR benefits, yet not many tertiary educators are using VR. Thus, this study aims to investigate Malaysian tertiary educators' awareness of VR and readiness to explore its potential in remote online T&L through a questionnaire survey adapted from previous studies that applied the Technology Acceptance Model (TAM) as their theoretical framework. Of 26 respondents, only 4 had VR experience in the classroom. While others lacked VR experience, their perceptions were positive, and they were aware of the challenges of using VR. It can be concluded these challenges are partly the reasons why VR is under-utilised. The findings implicate the need to train and familiarise tertiary educators in the use of VR for the continuous intention to use VR. It is believed that when more educators have more intimate knowledge of VR, the more students will benefit regardless if the classes are remote online or otherwise.

**Keywords:** Virtual reality, Tertiary educators, Remote online learning, Technology Acceptance Model (TAM)

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## Introduction

The COVID-19 pandemic has necessitated the adoption of remote online learning (ROL). Due to lockdowns disrupting once-thriving classroom environments, education providers were forced to rapidly deploy online learning technologies to facilitate engagement with learners remotely (Turnbull et al., 2021). Remote learning is not to be confused with online learning. Online learning refers to learning that is facilitated online, but not necessarily remotely as both teacher and students can be in the same classroom while working through lessons (Roe, 2020). Remote learning refers to when learning takes place in distanced locations without the need for physical presence in a traditional classroom setting. In remote learning, technology is utilised to disseminate information such as through video conferencing, and discussion boards (Roe, 2020). ROL can take various forms, including live virtual classes conducted in real-time through video conferencing platforms, pre-recorded lectures or instructional videos that students can access at their convenience, online discussion forums or chat groups for collaboration and communication, and digital platforms or learning management systems where course materials, assignments, and assessments are shared and readily available for learners.

The COVID-19 pandemic has significantly accelerated the adoption and prominence of ROL, as it provides a flexible and accessible alternative to in-person education when physical attendance is not feasible or safe. As a result, educators have transitioned from the traditional face-to-face, synchronous learning approach to remote online teaching, where interactions with students occur virtually through online meeting platforms like Zoom, Microsoft Teams, or Webex. This shift has posed challenges as students grapple with learning in isolation, facing internet connectivity issues, family disruptions, and sharing devices with siblings (Song & Lim, 2022; Kruszewska et al., 2022). Furthermore, not only do educators have had to adapt to new platforms and systems, they also have had to contend with issues such as poor learner engagement and motivation (Capone & Lipore, 2022; Aldossari & Altalhab, 2022). Joshi et al. (2020) reported findings from a survey administered in 2 rounds on agriculture and natural resource science students and instructors in a US-based university that students consider the lack of hands-on experience and poor instructions as the most important weaknesses of online learning. This is because in online classes, students often attend with their cameras turned off, making it difficult for educators to gauge their level of participation.

Furthermore, in the new normal shaped by the pandemic, it has been observed that ROL is practical as many universities now embrace substitute blended learning (Shi et al., 2021). Different from blended learning in

which classrooms are flipped, ROL allowing students to cover specific materials beforehand and utilize class time for practice and discussions, in substitute blended learning, students take charge of their own learning for a designated period. Educators would provide carefully crafted and curated learning materials and assessments for students to access and complete during that period. Presently, the learning process is a one-way approach, lacking interactive elements. However, this signifies that ROL will endure in teaching and learning due to its convenience and flexibility. This follows that the issue of learner engagement will also persist as engaging and maintaining student engagement is a primary goal for educators. According to Tawafak et al. (2020), it is important to measure the academic performance for students through the improvement of using technology integration as a support for teaching methods to help students in their studies especially in online learning. The challenge of remote learning and online learning is ensuring learner engagement during online classes.

### **Virtual Reality (VR) in Teaching and Learning (T&L)**

A potential solution to foster learner engagement for ROL is the integration of Virtual Reality (VR) in Teaching and Learning (T&L) practices. VR can be defined as a simulated interactive environment created by a three-dimensional computer-generated graphics system, complemented by various interface devices (Guttentag, 2010; Brey, 2014). This technology offers users an immersive experience, allowing them to explore and interact with artificial, digital worlds (Shen et al., 2020). A VR system typically provides real-time, viewer-centered head-tracking perspective, a wide field of view, interactive controls, and a binocular display (Doerner et al., 2022; Cruz-Neira et al., 1993). Popular examples of VR include games like Resident Evil 7 (PlayStation) (Pallavicini et al., 2018) and Microsoft Flight Simulator (Trinon, 2019). Unlike Augmented Reality (AR), which enhances the physical environment using tools like mobile phones e.g., to chase after a Pokémon in the streets, VR immerses users in a completely virtual world, effectively blocking out their real surroundings. This raises the question, “Is it more effective to rely on predominantly one-way learning approaches, or should students be immersed together in a virtual world for their learning experience?” Findings from recent studies indicate that students are interested in the use of this technology (Shen et al., 2018) and the idea that immersive learning through a virtual environment presents a compelling alternative.

Since VR's existence in the 1960s to its application in T&L in the late 90s and early 2000s, educators and researchers began recognizing the potential of VR as a tool to enhance learning experiences and improve engagement. Initially, VR was primarily utilized in specialized fields such as medical training and military simulations due to its cost and complexity. Over time, VR technology has become more advanced and more accessible. To date, its use in T&L has also expanded to various educational settings and disciplines such as science, engineering, art, history, offering students immersive and interactive experiences that can deepen their understanding and engagement with the subject matter. Literature reveals VR increases learner engagement, motivation and learning outcomes as VR makes learning not only an interactive experience that requires students' online presence (Shen et al. 2018), but students also find it more interesting and fun to learn as the emphasis is on the teaching materials (Ahmad et al., 2019). Literature has also shown that students were open enough to using VR to the extent that they were willing to pay extra tuition fees (Wong et al., 2020).



However, despite all its potential and the interest students have shown, the widespread adoption of VR in T&L is still relatively limited, and it remains largely under-utilised by educators in the classroom (Wong et al., 2020). Wong et al. (2020) further add that VR is still not a trend in local tertiary institutions as educators are still reluctant in adopting the technology mainly due to lack of technical skills. Similarly, according to Md Shamsudin and Abdul Majid (2019: p.19), “current pedagogical methods and tools at the tertiary level are unable to provide students with realistic and practical usage of virtual reality due to incompetence and lack of IT skills among educators”. To resolve that, Halili (2019) suggested for Malaysian educators to be given training to enhance their IT skills and be exposed to more VR applications.

Md Shamsudin and Abdul Majid (2019) also claimed that universities lack the needed facilities to prepare students and educators for VR in the teaching and learning process. It was argued that for the courses to apply mobile VR applications effectively, a framework should be developed and proposed to assist educators and students in higher education institutions. No doubt that the learning process will be more engaging and motivating for the learners using VR, but VR applications apparently bring a lot of challenges in terms of financial support from the learning institutions, and the readiness of the educators to apply VR in their classroom (Adnan, 2020; Md Shamsudin & Abdul Majid, 2019).

Furthermore, many VR applications require students to physically be in a lab or attached to Head Mounted Devices (HMD) which may not be possible in ROL. As such, how will educators address this challenge as the VR technology that educators can use in ROL would be limited. As such, Rafidi (2020) stated that it is high time for Malaysian educators to embrace 21st learning such as VR as it is one of the technology pillars of Industry Revolution 4.0. While the global lockdown is perceived negatively as it has disrupted the entire education system and student learning, it should be seen as a catalyst to spur 21st century learning and VR is among the technological pillars of the Industrial Revolution 4.0 (Rafidi, 2020).

### **Virtual Reality (VR) for Tertiary Education**

The Ministry of Higher Education (MOHE)’s Fourth Industrial Revolution (IR4.0) Action Plan involves four strategies such as Strengthening Education Governance System towards IR4.0; Enhancing Education 4.0 Ecosystem; Developing Highly Skilled and Knowledgeable Talent for IR4.0; and Enhancing Research and Innovation Towards IR4.0 (Raman & Rathakrishnan, 2019). Therefore, Malaysian higher education institutions should be prepared to gear their educators to cater to the demand of the IR4.0 policy by providing them with appropriate knowledge, skills and values. The real problem faced by education in universities is a need for several applications in learning and education and tool technologies to improve their outputs and improve on teacher-student prospects (Tawafak et al., 2019). Our research has found that, to date, there is a lack of studies on Malaysian tertiary educators’ awareness and readiness on using VR applications for remote online teaching. While VR is promising for engaging learners in ROL, the question is whether educators are willing to adopt VR. Therefore, this study explored Malaysian tertiary educators’ awareness of VR. This study also aimed to provide insight to the educators’ readiness to explore VR in remote online T&L.

**Technology Acceptance Model (TAM)**

Technology Acceptance Model (TAM) is a theoretical framework that aims to explain the process of user adoption and acceptance of new technologies. This framework studies individuals' attitudes and intentions related to the use of a particular technology and how these factors influence their actual usage behavior. TAM consists of two significant components. Figure 1 illustrates TAM proposed by Davis (1989).

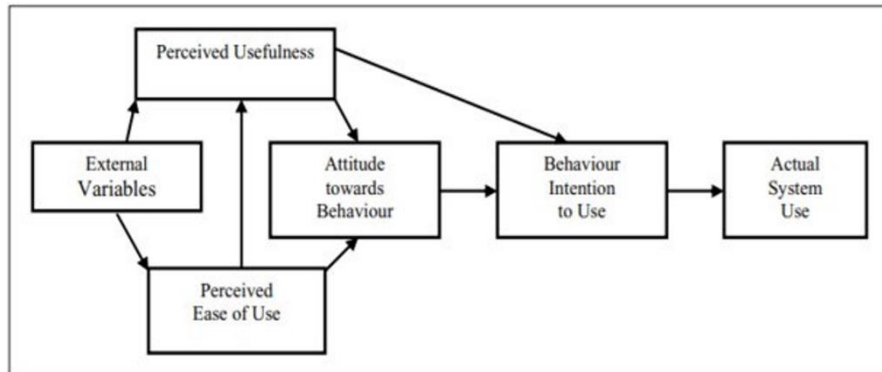


Figure 1. Technology Acceptance Model (TAM) by Davis (1989)

Perceived Usefulness (PU) is one of the primary components of TAM that refers to how users view a specific technology's ability to simplify tasks or enhance job performance. In other words, if users perceive a technology as valuable, they have more tendencies to accept and adopt it. Several research conducted in the past from various fields have proven this claim (Erjavec & Manfreda, 2022; Zhong et al., 2021). This study utilizes the concept of PU to investigate how tertiary educators perceive the usefulness of VR technology and its potential benefits in the context of ROL. These benefits encompass improved student engagement, enhanced comprehension and retention of complex concepts, and the ability to simulate real-world scenarios. Another essential component of the TAM is Perceived Ease of Use (PEOU), which focuses on users' perceptions of the effort needed to comprehend and utilize a technology. If users perceive a technology as user-friendly, they are more inclined to accept and adopt it (Al-Marroof et al., 2020; Yang & Shih, 2020). This might involve considering factors such as compatibility with existing educational technologies, the availability of support and training, and the perceived effort needed to implement VR into ROL settings. As shown in Figure 1, these two components directly impact users' attitudes and behavioral intentions towards technology usage. Attitude towards using a technology is influenced by both PU and PEOU. Consequently, the intention to use technology is influenced by the attitude towards it.

Researchers have expanded upon the TAM model by introducing additional factors like subjective norms and facilitating conditions. These additions enhance our understanding of technology acceptance. In this study, Section B of the questionnaire addresses educators' awareness and preparedness through seven qualitative questions. Awareness encompasses both perceived usefulness and perceived ease of use, which may or may not impact their readiness. Here, readiness refers to the behavioral intention to utilize VR in ROL. The TAM model

has been extensively applied and expanded in various research settings to examine and predict individuals' acceptance and adoption of new technologies. It offers valuable insights for technology designers, marketers, and researchers to evaluate and enhance user acceptance.

## Method

### Research Design

This study utilized a qualitative research design, chosen for its suitability in obtaining insights into the awareness and readiness of Malaysian tertiary educators regarding the integration of VR in ROL (Creswell & Clark, 2017). To accomplish this, the subsequent section will offer a comprehensive account of the employed research instrument, participant demographics, and the analysis conducted for this study.

### Research Instrument

To explore educators' awareness and readiness in utilizing VR within ROL, this study adopted the TAM framework proposed by Davis (1989). A questionnaire consisting of two parts was distributed to participants through Google Form over a span of 4 weeks. Part A comprised demographic information such as age, gender, work experience and other relevant details. The demographic information is useful to provide context and background information on the participants. Part B included qualitative open-ended questions which were designed to gather insights into the participants' awareness and readiness when it came to using VR in ROL. Table 1 below shows the questions that were asked regarding their awareness of VR in Part B of the questionnaire.

Table 1. Part B Awareness of VR in ROL

Question Number	Description
Q1	Do you have any knowledge of using VR? If yes, to what extent?
Q2	Have you ever used VR in teaching?
Q3	List the courses you have used VR for and the VR application you used the purpose and duration (for example: YouTube VR and VR Headset - only 1 lesson about 2 hours during class time OR asynchronous)
Q4	How long did you use VR for? (For example: 2 semesters)
Q5	Do you think students would enjoy learning/ be engaged if VR is used for remote online learning? Why?
Q6	Would you be interested in using VR for teaching? Why?
Q7	What issues do you foresee if VR is used for remote online learning?

Part B's qualitative data provide insight into the educators' awareness and readiness for using VR technology in their classrooms. For clearer understanding, questions 1-5 focus on exploring their awareness, while questions 6

and 7 concern their readiness. These questions were aided by TAM theory. After obtaining both demographic and questionnaire data, thematic analysis was employed to uncover the awareness and readiness of the tertiary educators regarding the usage of VR for ROL.

**Participants**

The target participants of this study were tertiary educators from higher education institutions in Malaysia, with the majority of them from Universiti Malaysia Pahang (UMP), International Islamic University Malaysia (IIUM), and Universiti Teknologi MARA (UiTM) initially. Due to a poor response rate, the selection was extended to include educators from other institutions. This resulted in a total of 26 participants, which are described in Figure 2 below. The demographic data comprises of factors such as age, gender, teaching experience, and institution affiliation.

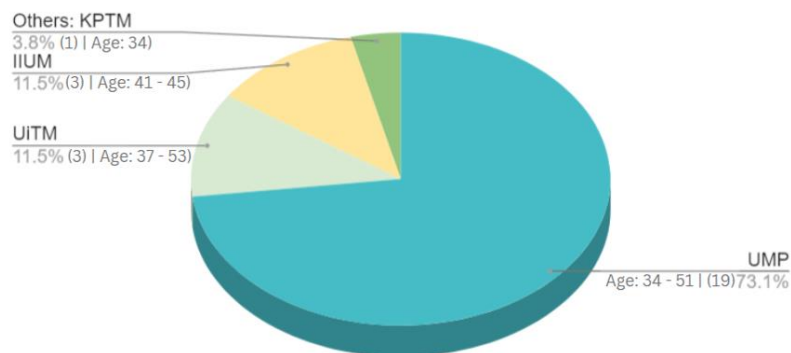


Figure 2. Respondents' demographic information

Figure 2 reveals that 26 respondents participated in the study, 19 of which were from UMP aged between 34 and 51. Three were from UiTM aged between 37 and 53, followed by 3 from IIUM aged between 41 and 45. Finally, there was one respondent from Kolej Poly-Tech MARA (KPTM) aged 34.

**Results and Discussion**

In Part B of the questionnaire, Malaysian tertiary educators' awareness and readiness to use VR for ROL was explored through 7 open-ended questions that were grounded in TAM (Davis, 1989). This section will discuss the findings on educators' VR awareness first. Subsequently, the educators' readiness to use VR for teaching in remote online classes is also examined.

**Malaysian Tertiary Educators' Awareness of VR**

In Part B of the open-ended questions, Questions 1 (Q1) to 5 (Q5) pertained to participants' awareness of VR. For improved comprehension, the findings for Questions 1 to 4 will be presented first. Of the 26 respondents, only seven acknowledged being knowledgeable when it comes to using VR, as depicted in Figure 3. Two of the seven respondents indicated their knowledge level to be "average" (R5) and "only a little" (R12).

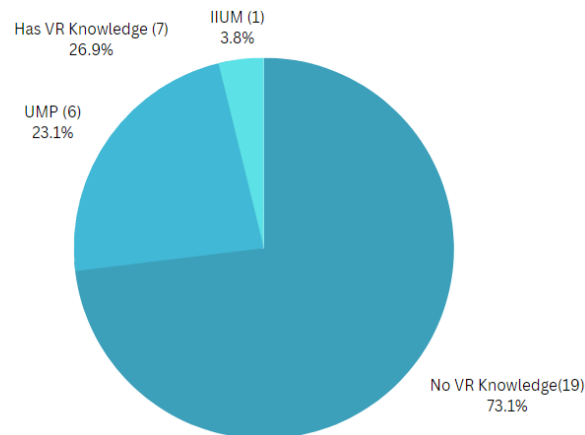


Figure 3. Breakdown of respondents with VR knowledge

Two respondents (R13 and R17) discussed acquiring knowledge through playing VR games and R17 discussed experiencing a virtual tour. Educator R6 stated that VR was applied to evaluate Final Projects while R13 experienced VR in the context of virtual clinic simulation. Two respondents, R9 and R19, used VR for teaching (R9 used VR for 1 semester and 4D Augmented Reality for almost 3 years, while R19 used VR for 2 lessons in the context of research). As illustrated in Figure 3, 6 out of 7 educators who had VR experience were from UMP and 1 from UiTM. The number of educators with VR experience, however, remains relatively low. Additionally, all respondents agreed that students would likely find learning with VR in ROL enjoyable and engaging. Reasons given by those who expressed reluctance to use VR in teaching and learning (Q6) ranged from high costs to technical difficulties.

For Question 5, 3 out of the 26 respondents did not provide reasons for their belief that students would enjoy using VR for remote online classes (R9, R10, R24). The reasons provided by the remaining 23 respondents were analyzed and categorized into four themes. By categorizing the responses into these themes, we gain a better understanding of the educators' considerations and challenges associated with integrating VR into ROL environments. The themes are as follows:

***Theme 1: VR replicates real contexts***

In Theme 1, based on the responses provided, the educators perceived that VR, by replicating real contexts, provides students with opportunities that they would not otherwise have access to within the bounds of traditional tertiary education. This sentiment is emphasized by the comments provided by R22, R25, and R26. With VR, students can engage in various activities, explore different environments, and gain experiences that were unimaginable before (R25). VR also has the potential to transform abstract concepts into tangible encounters and simulate realistic scenarios, such as lab sessions or clinic settings, providing enhanced visualization and a more immersive learning experience (R26). In a different setting, Kocur et al. (2020) investigated the impact of missing fingers in VR to prove how immersive the VR experience is and introduced the concept of phantom pain and avatar realism. Ultimately, VR's ability to replicate real contexts would

empower students by granting them novel experiences, exposing them to diverse environments, and fostering a sense of discovery and engagement that surpasses the limitations of traditional educational settings.

### ***Theme 2: VR increases learners' engagement and enjoyment***

Theme 2 represents how the educators (7 respondents) view VR from the students' perspective, in other words, how they are perceived to feel when they in "immersed" (R24) in VR if it is employed in remote online teaching. When students are exposed to novel experiences offered by VR, it naturally captures their attention and engages them in the learning process by easing their understanding (R16) as it shifts the learning process from passive to active (R5) making learning more interactive (R18). The interactive nature of VR enables students to actively participate and manipulate virtual objects resulting in a more dynamic and immersive learning experience (R24, R13). This finding is aligned with Allcoat and von Mühlénen (2018) that reported about the increase in students' engagement when using VR as compared to conventional teaching methods. Complex concepts can be visualized and explained in a more intuitive and accessible manner through virtual simulations, fostering a deeper level of engagement and understanding. As a result, students become more present, motivated, and invested in their lessons, actively involved in their own learning, and making the learning process more captivating and memorable.

It is also worth noting that VR is perceived to be able to accommodate different learning styles, enabling students to reach their VARK (i.e., visual, auditory, and kinesthetic) potential (R14). Moreover, VR facilitates collaborative activities and discussions within the virtual space, promoting student interaction and peer learning. Students can engage in collaborative projects, exchange ideas, and learn from one another, further enriching their educational experience. Lastly, VR resonates with today's digitally native generation, aligning with students' interests and preferences (R2). VR makes the learning journey more relatable, appealing and engaging for students as it is a technology that can reflect daily digital experiences.

### ***Theme 3: VR creates novelty in learning context***

Within this theme, a group of educators (consisting of five respondents) recognizes the potential of VR as a fresh and engaging method for delivering lessons. They view VR as a new approach, distinct from conventional one-way instructor-led methods, which are often considered monotonous and uninspiring. These educators understand the limitations of traditional online teaching and perceive VR as a more enjoyable and novel instructional tool. Similar to the findings of Dube et al. (2022), the educators believe that exposure to new and unfamiliar experiences, such as VR, can enhance skill development. At the same time, educators caution against using VR solely for entertainment, instead suggesting that it should be properly aligned with curricular objectives to ensure meaningful instructional experiences and meaningful ROL. They are careful to maintain a connection between VR activities and the subject material (R15), as they understand this is necessary to make the most of VR as an educational tool (R18). Consequently, educators need to be mindful when incorporating VR into their lesson plans, being sure it is relevant to the subject and beneficial to students. In conclusion, the

potential of VR to enhance learning should be weighed with its practicality in mind.

#### ***Theme 4: VR overcomes certain learning challenges***

Theme 4 delves into the challenges that educators could foresee when adopting VR into ROL. One of the barriers identified is the availability of VR which R21 stressed that without proper technologies and materials, students will not be able to gain the true VR experience. Additionally, R20 points out the influence of student attitude and learning preferences when the educators tried to adopt VR. In accordance with this, R3 suggests that VR could potentially bring more benefits to those who are more visually inclined in ROL settings. Educators should consider factors such as students' needs and preferences when adopting VR in ROL while ensuring access and alternative approaches so that it promotes positive learning experiences. These concerns are legitimate as there are studies that showed that despite the use of VR, students did not perform well (Hamilton et al., 2021). An example Hamilton et al. (2021) cited is the study by Parong and Mayer (2018) who found that students who used VR during a biology lesson scored significantly poorer than those who learned using a PowerPoint. Another was by Makransky et al. (2017) whose findings show a similar decrease in students' performance. Both studies believed that it was possible that the high-fidelity graphics and animations of the VR applications used could have significantly increased cognitive load, which would have detracted from the learning task at hand. As such, suitability of VR and alignment to the learning outcomes are valid reasons not to use VR if it does not serve the purpose. Hamilton et al., (2021) therefore proposed a well-designed PowerPoint presentation would have facilitated better learning outcomes than the graphically rich VR experience. Ultimately, educators demonstrate a strong understanding of the potential impacts of VR in ROL environments, noting its immersive and interactive qualities, capacity to cater to different learning styles, encouragement of collaboration, and alignment with student interests.

However, educators also acknowledge the challenges associated with implementing VR in remote online teaching, particularly regarding accessibility as not all students have equal access to this technology. By acknowledging both the benefits and limitations of VR, educators demonstrate a balanced understanding of its potential within the educational landscape. This recognition of VR's strengths and challenges paves the way for further exploration and discussion on how to address accessibility issues and maximize the benefits of VR technology in ROL environments.

#### **Malaysian Tertiary Educators' Readiness**

To gauge educators' readiness and willingness to use VR for remote online teaching, two direct questions (Q6 and Q7) were posed. The findings from Q6, which explores educators' interest in using VR for teaching, will be discussed first, followed by the findings from Q7, which explores the issues educators foresee if VR is used for remote online teaching.

Q6 is "Would you be interested in using VR for teaching? Why?" Among the 26 respondents, 22 expressed their

interest in using VR for remote online teaching, while 4 indicated otherwise. Of those who answered "No," one respondent had prior experience using VR for the purpose of research and highlighted that VR would only be considered if it was research-related and if learners had access to the necessary tools and resources. As for the remaining 3 respondents who answered "No," one did not provide any specific reason (R24). R3 mentioned the lack of alignment between the current syllabus and VR as a deterrent for VR application for remote online teaching, while R15 also expressed concerns regarding the required equipment and time commitment.

For the remaining 22 respondents who expressed their interest in using VR for teaching, their provided reasons were analyzed and categorized into 3 themes:

### ***Theme 1: Novelty***

Seven respondents (R1, R4, R7, R10, R18, R20, R25) mentioned that they would use VR because it represents a "new method/new technology" to enhance teaching. They stated that using VR allows them to stay "up-to-date" and "catch up with technology," enabling them to make use of the latest advancements in teaching methodologies. These reasons align with the educators' perspectives on why they believed students would enjoy VR, as discussed in Q5. However, it is important to note Jang et al.'s (2021) findings regarding introducing VR and AR to 292 in-service elementary school teachers in Korea. In their research, it was found that when new technologies are introduced, or even required to be used, teachers can often become reliant on social conventions and organizational prerogatives, rather than adhering to their own educational beliefs. This can lead to teachers making their own decisions, regardless of outside influences.

### ***Theme 2: Positive impacts on students' learning***

Theme 2 reflects the educators' concern for learner engagement and their recognition of the benefits that VR potentially brings to students if employed for remote online teaching. They believe that using VR would enhance the effectiveness and improve online teaching, enriching teaching and learning to make it more interesting (R7, R16, R21). Five respondents mentioned that VR would be interesting, fun, and promising (R4, R10, R11, R13, R22). Three respondents highlighted the importance of VR being able to engage and increase students' interest (R8, R17, R23), as well as retain their interest and enhance teaching and learning (R7, R22, R25). The findings concurred with Cooper et al.'s (2019) findings where most of the pre-service teachers highlighted the positive impacts that VR has on students' learning. One of the reasons given was VR offers students the chance to explore new space without leaving the classroom such as learning about pyramids. The educators in this study also recognized other positive impacts such as that VR could provide an immersive learning experience (R5), enhance knowledge visualization (R6), facilitate the learning of clinical skills and anatomy subjects (R13, R14), and optimize learning during the pandemic and remote learning situations (R22, R26, R9). These reasons demonstrate their motivation to use VR for teaching, driven by the desire to create a more engaging and effective learning environment for their students.



***Theme 3: Personal interest and motivation***

Theme 3 provides valuable insights into the personal motivations and interests of educators regarding the integration of VR in ROL. The respondents expressed that they are fascinated with the idea of using VR, while R21 mentioned doing it "for the experience." Moreover, R12 highlighted their curiosity as a driving factor. These responses indicate that educators are personally captivated and driven by the potential of VR in diverse teaching approaches. The inquisitiveness and eagerness to explore VR originate from the aspiration to embrace this cutting-edge technology, showing their proactive attitude towards improving their teaching methods. These findings highlight that educators acknowledge the potential advantages of utilizing VR in learning; the belief in VR as a novel, captivating, and powerful tool to advance students' learning in remote seminars. The interest in VR is rooted in the anticipation of positive impacts on student engagement, motivation, deepening knowledge, and the ability to adapt to the challenges posed by the pandemic. As stated by Virmani et al. (2022), VR's three basic characteristics are Immersion, Interaction and Imagination. The immersive nature of VR, combined with its interactive capabilities and capacity for stimulating imagination, using VR would certainly impact students' learning positively in the education field. By providing engaging and realistic experiences, promoting active participation, and fueling creativity, VR holds great potential for enhancing educational experiences and empowering students in their learning journeys. Additionally, educators' personal curiosity and interest contribute to their readiness to experiment and implement VR in their teaching practices.

When educators were asked about the potential issues they foresee if VR is used for ROL in Q7, their responses were analyzed and categorized into five themes. These themes provide insights into the educators' readiness to adopt VR in their remote online teaching practices. However, it is important to note that one respondent did not provide a reason (R24). The themes are as follows:

***Theme 1: Relevance and Practicality***

In Theme 1, only one respondent highlighted concerns about VR not being relevant to the course (R15). However, after having responded as such, R15 demonstrated willingness to attempt to use VR if it is cost-effective and not cumbersome for both self and students. According to Hamilton et al. (2021), a study done by Allcoat and von Mühlénen (2018) found that the complexity of VR obstructed learning outcomes due to the unfamiliarity and novelty of the technology. This shows the importance of providing a period of free navigation or extending some time for familiarisation to use a new technology would be helpful for educators or new users of technology (Hamilton et al., 2021).

***Theme 2: Knowledge and Technical Factors***

This theme reflects the respondents' lack of familiarity with using VR. R9 stated that to use VR, one would need to understand the hardware and software involved. Other respondents highlighted the requirement for specific hardware for VR and the need to have expertise in VR content creation (R11, R6). These concerns were valid as

Jang et al. (2021) stated that teachers' knowledge of integrating the technology into their classrooms is one of the four variables that impact teachers' use of that particular technology. The other variables are supportive culture, self-efficacy, and pedagogical belief.

### ***Theme 3: Technology Limitations***

In Theme 3, educators highlighted various challenges associated with the technological aspect of using VR for remote online teaching. One notable concern the respondents raised was the issue of cybersickness (R5, R9). Cybersickness is the motion-sickness-like discomfort such as oculomotor discomfort, eyestrain, and nausea (Yip & Saunders, 2023) experienced by individuals when using virtual reality due to the sensory disconnect between virtual and physical environments (Li et al., 2023). This may affect the learning experience and hinder some students from fully appreciating VR. Additionally, the educators were aware that technical glitches may occur and identified the glitches as significant factors that could impede the adoption of VR in online teaching (R10, R12). Recognising potential obstacles may assist educators to take precautions to smooth VR implementation in remote learning settings. For example, Yip and Saunders (2023) found that the severity of cybersickness can be reduced by minimizing the processing of peripheral motion cues and restricting attention to the central visual field.

### ***Theme 4: Human Factors***

Theme 4 represents the educators' awareness towards concerns related to their age factor and the necessity of convincing 'more senior' educators to use VR (R22, R3). This factor is indeed a primary reason why VR is under-utilised. This is not hard to imagine as instructors were having technical problems with much simpler technology, as reported by Anastasakis et al. (2021). Furthermore, educators also expressed concerns about potential resistance or unwillingness from students to embrace VR (R23).

### ***Theme 5: Accessibility and Resources***

The last theme is the theme with the highest concerns highlighted by the educators. Issues regarding access and resources were prominent within this theme, such as the affordability of VR for students, budget allocation, data usage, the cost of VR devices, acquiring necessary equipment, and the use of head-mounted displays (R14, R26, R15, R8, R25, R20, R5). Educators emphasized the need for adequate tools and monitoring and mentioned the requirement for additional devices (R19, R18).

Additionally, educators expressed concerns about internet stability, connectivity, technical issues, and low connectivity, highlighting the importance of stable internet connections for successful VR implementation (R1, R2, R23, R24, R7). One educator (R3) specifically pointed out the challenge of high-speed internet requirements for students. Another (R13) specifically also pointed out that the issue of device compatibility must be resolved first, only then will the students have equal access to VR. These issues highlighted support the findings by

Anastasakis et al. (2021) who looked at barriers in online learning for undergraduates in Greece. Anastasakis et al. (2021) found among the issues these students faced during the pandemic, technical problems (i.e., internet connection issues while online classes were going on) was ranked first (559 of 2608 responses). Students also faced other issues like not having access (119 responses) to online learning as some students did not even own a laptop and some did not have access to an internet connection. Such problems are common and until these issues are resolved, there will be students who will be left behind.

## Conclusion

The study findings have identified three distinct categories that reflect educators' awareness and readiness regarding the adoption of VR. In Category 1, we have found educators who are ready to embrace VR. These individuals hold positive views on both PU and PEOU of VR, leading them to enthusiastically consider integrating it into their teaching practices. They firmly believe that VR is beneficial and user-friendly. In Category 2, we find educators who are hesitant about using VR. They perceive VR as highly useful, but their PEOU is relatively lower. Consequently, their intention to adopt VR is not as strong. Interestingly, none of the participants in this study disagreed with the PU of VR. This emphasizes the significance of addressing factors related to PU, such as learning requirements, necessary devices and stable internet connectivity. Addressing this concern can play a crucial role in boosting the likelihood of VR adoption among educators in this category. Lastly, Category 3 includes educators who have yet to experience VR firsthand. Since they have not had the opportunity to try it, their PEOU remains unknown. However, they hold a positive view of the PU of VR and demonstrate a readiness to adopt it once they become familiar with its ease of use. This suggests that they can recognise the potential benefits VR can offer and are open to exploring its capabilities once they gain hands-on experience. To summarize, the study findings have unveiled three distinct categories of educators based on their awareness and readiness towards VR adoption via the framework of TAM (Davis, 1989) by looking at PU and PEOU. Within Categories 2 and 3, which consist of educators with high perceptions of both PU and PEOU, we can distinguish two subgroups. The first subgroup are educators who are ready to adopt VR in their ROL despite having no experience using VR themselves. They are willing to explore VR due to the potential it holds as they recognise the benefits that VR will offer in their teaching practices.

On the other hand, the second subgroup are educators who are not ready to incorporate VR in their ROL. Their reluctance is based on the external factors they highlighted which includes age (e.g., too old), time constraints (i.e., need to learn), as well as the perceived unsuitability of VR to achieve learning outcomes. This subgroup could be likened to a group of people who have a strong desire to engage in exercise because they are well aware of and they understand the benefits of exercise for fitness and health, but personal shortcomings and challenges limit them. In considering the categories, educators can decide which group they fit into. It is clear that readiness is indeed influenced by educators' awareness, in particular of the PU and PEOU of VR, and even if VR is perceived highly in terms of PU and PEOU, there are other factors that make educators wary to embrace VR such as how to use VR correctly, or accessibility of VR in terms of suitable technologies and the

opportunities to acquire VR resources, to name a few. As such, the integration of VR in ROL is more as an aspiration than something actually practical.

It can be concluded that while the majority of educators may have limited knowledge or experience with VR, they unanimously recognize its benefits and potential for engaging and interesting students. Educators who have taught using VR are particularly more aware of its challenges. However, they believe that VR could be effectively used for remote online teaching if accessibility issues are addressed.

## Recommendations

Recommendations are usually based on limitations of the study, and this study is not without its limitations. The first limitation would be the sample size, which is relatively small with a sample size of 26 respondents. This limited sample may not fully represent the diverse perspectives and experiences of all educators in the Malaysian tertiary education system. Future research may want to increase sample size as conducting a study with a larger and more diverse sample of educators could enhance the representativeness and generalizability of the findings.

The second limitation would be the generalizability. The scope of research was limited to Malaysian tertiary educators; hence, the findings may not be applicable or generalizable to educators in other contexts or regions. Cultural, educational, and technological differences could also impact the results and limit their broader applicability. Furthermore, future research may want to view it from the students' perspective by examining the actual impact of VR integration in remote online teaching on student engagement, learning outcomes, and satisfaction to assess the effectiveness and benefits of using VR in educational settings.

## Acknowledgements

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## The Effect of Teacher Job Satisfaction on Learners' Academic Success in Biology

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**Abstract:** This study sought to ascertain how job satisfaction affected learners' biology achievement in the New Juaben North District. The study's methodology was a survey design. The participants in the study are head teachers of senior high schools and teachers of biology in the district. To choose the participants for this particular research, purposive and random samplings were used. 84 individuals composed of the sample size, including 4 school heads and 80 biology teachers were used for this particular study. The main tool for data collection was a structured questionnaire, and the data was analyzed using the Statistical Package for Social Sciences (SPSS). According to the data analysis, 72.62% (61) of respondents were of the belief that changing teachers' working circumstances will have a favorable impact on students' academic achievement. Again, half of the biology teachers 32% (40) were of the view that their pay is insufficient and some must be done about it.

**Keywords:** Job satisfaction, Job dissatisfaction, Instructional approaches and Performance

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### Introduction

In spite of the fact that teachers are an essential component of educational opportunity systems, there are worries about their retention in the wake of the recent emergence of the labor market in general and within the educational system in particular, particularly in schools serving underprivileged regions. Studies show that when job satisfaction rises in the teaching profession, attrition falls (Robert, Jones, & Lynn 2004). A recent survey from various developing countries reveals that more than 25% of academics who left teaching did so since they were dissatisfied with their work. The above incidence has been related to a number of causes (Henke, Choy, Chen, Geis & Broughman 1997). There has been a lot of studies done on the topic of teachers' job satisfaction in recent years (De Nobile, 2003). This interest is hardly surprising given the links between job happiness and employee retention, attrition, truancy, productivity, and job stress that have been discovered (De Nobile & McCormick, 2005; Luthans, 2002; Spector, 2000). Zembylas and Papanastasiou (2006) established teacher job satisfaction as the teacher's emotional attachment to his or her teaching profession due to the strong positive association between what education offers and what educators desire from it. We frequently define teacher job satisfaction as a teacher's perceptions, emotions, and sense of fulfilment in light of these concepts.

Dissatisfied teachers who want to switch schools may be underperforming for a variety of reasons, including general motivational factors (Rockoff 2004; Hanushek, Kain, & Rivkin 2005) and the straightforward fact that they are secretly anticipating a move, giving little thought to their current research, and disregarding any longer-term plans for their students. The teachers' motivation is definitely a key element in shaping the pupils' capacity for learning. Those who are motivated are frequently those who made the decision to work at a certain school, as opposed to those who are just waiting to be transferred. Jackson (2010) uses student data from North Carolina to show that teachers' efficiency rises after they switch schools and that teacher-school matching can contribute significantly to teacher quality. If their children demonstrate more achievement development, teachers are less likely to change schools.

These results show that professors can want to change for a variety of reasons, one of which is that they feel uncomfortable at their present schools. Therefore, a better school employment fit could increase teacher productivity and significantly affect their academic success. Efficiency, output, truancy, attrition rates, intention to leave, and ultimately employee well-being may all be impacted by workplace satisfaction. A wide range of workers, including skilled educational professionals, can agree with this assumption. Certainly, teachers' health has a big impact on the quality of the instruction they deliver (Fenech, 2006).

Despite the fact that specialists in organizational behavior have researched work pleasure in great detail, it is noteworthy to point out that elements that affect job satisfaction also have an impact on job performance, which in turn determines the context of the job. Employee actions that increase organizational effectiveness are therefore said to have an effect on "the psychological, social, and organizational environment" of a worker's employment (Reio & Kidd, 2007).

Employees that demonstrate this kind of psychological empowerment might volunteer for additional duties, endure through difficult tasks, assist coworkers in completing their assignments, and support organizational policies and goals even when they don't agree with them (Reio & Kidd, 2007). This study will look at how biology student achievement in the New Juaben North district of the Eastern Region is influenced by teachers' work satisfaction.

## **Methodology**

A statistical survey is used in this investigation. Eighty (80) biology teachers and four (4) school heads served as the accessible population's representatives. The school heads were chosen from the sampled schools while the teachers were chosen at random. Giving out cards to everyone, irrespective of what was printed on them, was the method used to pick the teachers. For anyone whose cards said "chosen" were chosen. Teachers and school heads completed surveys as part of the study. Data was gathered through giving questionnaires to respondents. Additionally, the acquired data were edited, encoded, and analysed using SPSS version 20.0, which stands for Statistical Package for Social Sciences.

My colleagues reviewed the instruments to boost the content validity. The ideas they made for enhancement were implemented after they reviewed the tools. Also performed on the instruments was a face-validation analysis. An evaluation of dependability was performed using Cronbach's alpha. Cronbach's alpha was used to calculate the dependability coefficient, which was discovered to be 0.982.

## Results and Discussion

**Table 1. The Respondents' Gender**

Sex	Frequency	Percent	Valid Percent
MALE	50	59.5	59.5
FEMALE	34	40.5	40.5
Total	84	100.0	100.0

Source: Field work 2019

According to Table 1, there have been 40.5% (34) female participants and 59.5% (50) male participants. Due to long-held stereotypes and preconceptions about the social roles, occupations, and involvement of women, gender issues must be taken into account in both men's and women's education (UNESCO, 2006). This may provide evidence in favour of the widely held perception that particular academic fields, like as science, are typically viewed as "male" disciplines (FAWE, 2004). This made the sex ratio of the study's sample of participants interesting.

**Table 2. The Respondents' Age Groups**

Age Range	Frequency	Percent
23-30years	10	11.9
31-40years	50	59.5
41-50years	15	17.9
above 50years	9	10.7
<b>Total</b>	<b>84</b>	<b>100.0</b>

Source: Field work, 2019

11.9% (10) of the 84 responses came from people under the age of 23 and 30, 59.5% (50) from individuals between the ages of 31 and 40, 17.9% (15) from individuals with ages of 41 and 50, and 10.7% (9) from those above 50. This shows that a substantial majority of the teachers were young (between the ages of 31 and 40), particularly in the study's schools, which may have led to effective productivity. It was thought that a paucity of participants, particularly among biology, was unlikely because so many local teachers had retired. Those who responded also had a better understanding of how teaching methods and teacher inspiration impact students' performance when they are between the ages of (41 years and above 50 years) The participants were prompted to answer questions regarding their marital status. Table 3 provides a data on that.

**Table 3. The Individuals' Marital Status Plainly**

Marital Status	Frequency	Percent
Married	69	82.1
Single	11	13.1
Widowed	4	4.8
<b>Total</b>	<b>84</b>	<b>100.0</b>

Source: Field work, 2019

Out of the 84 participants, 82.1% (69) were married, 13.1% (11) were single, and 4.8% (4) were widowed. This illustrates that married people, especially those who were not involved in a romantic relationship, were seen as being more responsible, mature, and well-adjusted than those who were not married. Considering the aforementioned, it is possible that single persons will face discrimination in hiring procedures because they may be perceived as less committed to their careers and less likely to thrive as employees than married people. The respondents were questioned in-depth about their educational backgrounds.

**Table 4. Levels of Education Of Survey Participants**

Qualifications	Frequency	Percent
Diploma	8	9.5
Bachelor's degree	70	83.3
Master's degree	6	7.2
<b>Total</b>	<b>84</b>	<b>100.0</b>

Source: Field work, 2019

9.5% (8), 83.3% (70), and 7.2% (6) of the 84 participants, respectively, possessed diploma, a bachelor's degree, and a master's degree. All of the respondents had completed some type of formal higher education. Because of their credentials, the respondents were able to comprehend and adequately complete the questionnaire. According to Tremblay, Ross, and Berthelot, students at senior high schools do higher academic achievement when taught by teachers with more than ten years of experience (2001). According to Table 5's findings, teaching experience ranged from one to more than fifteen years. Table 5 shows that the researcher provided the respondents with the opportunity to divulge their employment history.

4.8%(4) of participants have taught for one to five years, 17.9%(15) for six to ten years, 59.5%(50) for eleven to fifteen years, and 17.8%(15) for more than fifteen years, then according Table 5. The majority of those surveyed are probably familiar with respective schools and have relevant employment experience, so they can give reliable information about them. Bandura (1997) asserts that more experienced teachers are more capable of managing the learning issues of their students. Since the majority of the respondents have between eleven and fifteen years of work experience, they are better qualified to share with the researcher their opinions and experiences about instructional tactics and teacher motivation.

**Table 5. The Previous Work Experience of the Participants**

Years of experience	Frequency	Percent
1-5years	4	4.8
6-10years	15	17.9
11-15years	50	59.5
above 15years	15	17.8
<b>Total</b>	<b>84</b>	<b>100.0</b>

Source: Field work, 2019

What effect does a teacher's job satisfaction have on the effectiveness of the biology students?

The biology instructors who conducted the study responded to the questions above. Regarding the relationship between biology students' achievement and teacher job satisfaction, the respondents were questioned. Table 6 displays their comments.

**Table 6. The Association between Biology Learners' Performance and Teachers' Job Satisfaction**

Teacher Viewpoint	Frequency	Percent
i. Students' excellent exam achievement	10	12.5
ii. Wages do not arrive on a routine basis	18	22.5
iii. Insufficient drive	20	25.0
iv. The pay is insufficient	32	40.0
<b>Total</b>	<b>80</b>	<b>100.0</b>

Source: Field work, 2019

Biology teachers had the opportunity to speak on how their degree of job satisfaction affects the achievement of their learners. 12.5%(10) of survey respondents claimed that successful tests are influenced by job happiness. However, 22.5%(18) of respondents claimed that their paychecks do not arrive on time, 25%(20) that they lack motivation, and 32%(40) that their paychecks are insufficient. Job satisfaction is the term we use to describe a teacher's sentiments and views of happiness and fulfilment at work. Additionally, research has shown that attrition decreases as work satisfaction in the teaching profession increases (Robert et al, 2004). The aforementioned scenario has been linked to a variety of factors, but a recent study from a number of developing countries highlighted the fact that more than 25% of teachers who left the profession did so because they were unhappy with their jobs (Henke et al, 1997).

In recent years, there has been a lot of research on the topic of teachers' job satisfaction (De Nobile, 2003). Given the links between job satisfaction and employee retention, attrition, absenteeism, productivity, and work stress, it is scarcely surprise that this topic has attracted so much interest (De Nobile & McCormick, 2005; Luthans, 2002; Spector, 2000). Dissatisfied teachers who want to transfer to that other school might perform poorly because of general motivational factors, the fact that they are secretly anticipating the transfer, paying

little attention to their current work, and the idea that they are disregarding any longer-term plans for their students (Hanushek, Kain & Rivkin 2005; Rockoff 2004). Fenech (2006) emphasised a number of factors that significantly contribute to teacher dissatisfaction, including poor working conditions, low compensation, a high workload, excessive expectations from supervisors, low professional status, organisational conflict, and a lack of autonomy.

The biology instructors and the school heads had the chance to share their ideas on how to maintain and enhance teachers' job satisfaction, as indicated in Table 7.

**Table 7. The Factors That Maintain and Boost Teacher Job Satisfaction**

<b>Respondents' justifications</b>	<b>Frequency</b>	<b>Percent</b>
i. Teachers' inspiration.	10	11.90
ii. Better teacher employment conditions.	61	72.62
iii. Construction of school facilities	3	3.57
iv. Teachers should be offered the opportunity to pursue additional education while on study leave.	6	7.15
v. Both learners and teachers must have access to instructional resources.	4	4.76
<b>Total</b>	<b>84</b>	<b>100.0</b>

Source: Field work, 2019

Out of the 84 survey participants, 11.90% (10) mentioned teacher motivation, 72.62% (61) mentioned that they should improve conditions for workers for teachers, 3.57% (3) mentioned school infrastructure, 7.15% (6) mentioned teachers' need for the chance to pursue additional education with study leave, and 4.76% (4) mentioned the need for materials for teaching and learning for both teachers and students.

## Recommendations

Based on its findings, the study recommends the following:

1. Biology instructors should be supported by senior high school head teachers and the Ghana Education Service by giving them the resources, rewards, and pay they need to do their best work.
2. Head teachers of senior high schools must offer TLMs in order to promote activity-based teaching and learning techniques in biology classes.
3. To improve the academic accomplishment of their pupils and the effectiveness of their pedagogical and subject-matter knowledge, senior high school leaders must provide biology instructors with on-the-job training.

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## The Effect of a Teacher's Qualifications and Work Experience on Learners' Achievement in Biology

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**Abstract:** The study tried to ascertain the impact of instructors' credentials and professional expertise on students' biology achievement in Birim Central Municipality, Eastern Region, Ghana. The study used survey design. The respondents were chosen using simple and selective probability sampling. 80 biology teachers and four head teachers gave us the 84-sample size. A questionnaire served as the main research tool, and the data analysis was accomplished with the help of the Statistical Package for Social Sciences (SPSS). Many respondents (60.7%) firmly agreed that teachers who possess superior knowledge and skills are better able to instruct students. Majority of those surveyed strongly agreed that experienced teachers are more understanding whenever it involves dealing with behavioral issues of children. This study was intended to considerably add to knowledge in order to enhance students' biology performance and comprehension.

**Keywords:** Teacher qualification, Achievement, Experience, Performance

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### Introduction

The convergence of numerous resources leads to education. Among these resources, teachers stand out as being particularly crucial for reaching the good standards that are being stressed in schools and educational institutions across the globe (Rice, 2003). According to Jones (2007), teachers play the most essential role in boosting pupils' academic achievement. This appears to back up previous research by (Rice 2003; Zuzovsky & Libman, 2003).

These studies showed a correlation between teacher education and improved student achievement. Khurshid (2008) conducted a study in Multan, Pakistan to ascertain the association between teachers' socioeconomic qualifications and their pupils' academic achievement at the secondary school level. These studies showed that

instructors' degrees had a favourable effect on student achievement because it was found that students taught by untrained teachers with B.A./B.Sc credentials did better than students taught by certified teachers with professional qualifications like B.Ed and M.Ed.

On the other hand, Zuzovsky (2009) performed study in Israel to reassess the correlation between higher levels of performance and greater levels of education, teaching experience, and active engagement in professional development activities. These features of a teacher's qualification were discovered to be positively correlated with math and science student achievement. Numerous studies have found a strong correlation between teachers' training and expertise in mathematics and students' mathematical achievement (Martin, Mullis, Gregory, Hoyle & Shen, 2000; Hill, Rowan & Ball, 2005; Mogari, Kriek, Stols & Iheanachor, 2009).

According to the Ghana Education Service (GES), teacher qualifications frequently play a direct role in students' inconsistent performance in Senior High School Biology classes, even though there seem not to be any conclusive studies on the topic (GES, 2007). Numerous administrations in Ghana have started various efforts targeted at maintaining academically and professionally prepared teachers in the classroom. Obasi (2010) further asserted that a teacher's professional and academic training and certification can enhance a student's chances of academic success.

This signifies that inexperienced teacher candidates may affect how students are taught and learn because the intellectual ability of those recruited to teach has an impact on the quality of education (Fullan & Stiegelbauer, 2000). To analyse student achievement, Koedel and Betts (2007) used the value-added gains technique. According to them, the qualifications of an instructor—including their experience, the prominence of their undergraduate institution, their degree, and their major—have no bearing on students' academic progress. According to Koedel and Betts' findings, Buddin and Zamarro (2009) came to the conclusion that teacher experience is only tangentially related to student achievement and that teachers' levels of education had little bearing on the learning outcomes of their students. In addition, Buddin and Zamarro (2009) argue that even though instructors with more education, training, or experience may be naturally better teachers (as determined by licencing exams), they may not always perform at their very best in the classroom.

Studies show that less experienced teachers frequently have less success than more experienced ones. The academic development of the pupils in their care will be insufficient if the teacher is inept. According to Yala and Wanjohi (2011) and Adeyemi (2010), the most crucial factors affecting students' academic achievement were the teachers' experience and educational background.

As a result, whether or not pupils perform well on exams, the qualifications of teachers are frequently questioned. Teachers in Ghana have the option of earning certificates, bachelor's degrees, or master's degrees, enabling them to work in secondary education. This investigation will examine how students' biology performance in Birim Central Municipality in the Eastern Region is influenced by teachers' training and experience.

## Methodology

This study employed the survey research design. The respondents included four (4) head teachers and eighty (80) biology teachers. While the teachers in the study were chosen at random, the head teachers were specifically chosen from the studied schools. Questionnaires were distributed to teachers and head teachers of the participating schools as the study's instrument. The statistical package for social sciences (SPSS) version 20.0 was used to edit, encode, and analyse the data that was obtained. My supervisor assessed the instruments to improve their content validity. Following the inspection of the instruments, they provided feedback and suggested improvements, which were adopted. Testing on the instrument's face validity was also conducted. The reliability test was conducted using the Cronbach's alpha. Cronbach's alpha was employed to conduct a reliability test, and the results showed that the coefficient of dependability was 0.982.

## Results And Discussion

**Table 1. Respondents' Sexes**

Sex	Frequency	Percent	Valid Percent
MALE	50	59.5	59.5
FEMALE	34	40.5	40.5
Total	84	100.0	100.0

Source: Field work 2016

Table above depict that 59.5% (50) of the responses were male and 40.5%(34) were female. Gender issues must be taken into account in both men's and women's education due to traditional beliefs and prejudices about women's responsibilities, employment opportunities, and social participation (UNESCO, 2006). This could strengthen the widespread idea that particular academic areas, such as science, are frequently perceived as'male' courses (FAWE, 2004). (FAWE, 2004). Against this setting, the gender distribution of the participants sample was the subject of this study. Table 2 shows the age groups that the respondents were asked to fill

**Table 2. The respondents' Ages**

Age Range	Frequency	Percent
23-30years	10	11.9
31-40years	50	59.5
41-50years	15	17.9
above 50years	9	10.7
<b>Total</b>	<b>84</b>	<b>100.0</b>

Source: Field work, 2016

Table illustrates that out of the 84 responses, 10.7% (9) were over 50, 17.9% (15) were between 41 and 50,

59.5% (50) were between 31 and 40, and 11.9% (10) were between 23 and 30. This reveals that the age distribution, especially in the studied schools, indicates that a sizable majority of the teachers were young (between the ages of 31 and 40), which might lead to effective productivity. Because of this, it was expected that there wouldn't be a lack of responses as a result of teacher retirement in the two municipalities—especially among biology teachers. When respondents' marital status was questioned, individuals between the ages of 41 and 50 had a greater understanding of the ways in which teacher-related factors affected students' performance. Table 3 illustrates this.

**Table 3. Marital Status of the Participants**

Marital Status	Frequency	Percent
Married	69	82.1
Single	11	13.1
Widowed	4	4.8
<b>Total</b>	<b>84</b>	<b>100.0</b>

Source: Field work, 2016

82.1%(69) of the total 84 responses were married; 13.1% (11), were single; and 4.8% (4) were widowed. This suggests that persons who were single were thought to be less responsible, mature, and well-adjusted than those who were married, especially those who were not deeply engaged. The aforementioned suggests that single people can experience prejudice in the workplace because they are thought to be less dedicated to their careers and less likely to succeed as employees. Respondents had the choice to say how much education they have. This is shown in Table 4.

**Table 4. Responses to a Survey on Respondents' Educational Levels**

Qualifications	Frequency	Percent
Diploma	8	9.5
Bachelor's degree	70	83.3
Master's degree	6	7.2
<b>Total</b>	<b>84</b>	<b>100.0</b>

Source: Field work, 2016

Of the 84 survey participants, 9.5% (8), 83.3% (70), and 7.2% (6) had a diploma, bachelor's degree, or post graduate degree(masters), respectively. Each participant has finished a formal higher education programme of some kind. Because of their credentials, the respondents were able to understand and properly complete the questionnaire. Students in senior high school perform better academically when instructed by teachers with more than 10 years of experience, according to Tremblay, Ross, and Berthelot (2001). According to Table 5's findings, there was a range of one to more than fifteen years of teaching experience. In Table 5, it is indicated that the researcher gave the respondents the chance to discuss their former career histories. Of the 84 survey

participants, 9.5% (8), 83.3% (70), and 7.2% (6) had a diploma, bachelor's degree, or master's degree, respectively. Each participant has finished a formal higher education programme of some kind. Because of their credentials, the respondents were able to understand and properly complete the questionnaire. Students in senior high school perform better academically when instructed by teachers with more than 10 years of experience, according to Tremblay, Ross, and Berthelot (2001). According to Table 5's findings, there was a range of one to more than fifteen years of teaching experience. The researcher gave the respondents the chance to discuss their former employment experience, as seen in Table 5, which is displayed.

**Table 5. Working history of the respondents**

Years of experience	Frequency	Percent
1-5years	4	4.8
6-10years	15	17.9
11-15years	50	59.5
above 15years	15	17.8
<b>Total</b>	<b>84</b>	<b>100.0</b>

Source: Field work, 2016

According to Table 5, 4.8%(4) of the respondents answered that they had been teachers for one to five years, 17.9%(15) for six to ten years, 59.5%(50) for eleven to fifteen years, and 17.8%(15) for more than fifteen years. It is reasonable to assume that most respondents have relevant professional experience and knowledge of their schools, making them qualified to offer reliable information about the institutions. Bandura (1997) came to the conclusion that teachers with more experience are more self-assured and self-sufficient in handling students' learning difficulties. The majority of respondents had between eleven and fifteen years of work experience, which puts them in a better position to speak with the researcher about their views and experiences relating to teacher-related topics.

What do teacher credentials affect how well learners perform in biology?

The study's biology instructors and the school head teachers provided responses to this question. The amount to which teacher qualifications affect educational outcomes was a question that the respondents were asked to comment on. The responses of the respondents are shown in Table 6.

**Table 6. Extent to which Teachers' Qualifications Affect Learners' Achievement**

Statement	SA	AA	UC	DA	SD
i. Possibilities for teachers to grow professionally and in their knowledge.	0	8	0	30	46
ii. First-degree holders and higher teachers have strong subject-matter competence.	34	50	0	0	0

iii. My school's headmaster pays for me to go to subject-specific lectures, workshops, and training.	2	48	0	25	9
iv. The professional credentials of teachers have an impact on student progress.	46	38	0	0	0
v. Better instruction is provided to students by teachers having teaching credentials.	51	33	0	0	0

Source: Field work, 2016; SA= Strongly Agree; AA = Agree; UC =Undecided; DA = Disagree; SD = Strongly Disagree

### **Biology instructors and school heads' views on the impact of teacher credentials on learners' achievement**

On the extent to which teacher credentials affect student achievement, the head teachers and the biology instructors were asked for their opinions. Opportunities for teachers to increase their expertise and advance their careers will promote student accomplishment, according to 9.52% (8), 35.71% (30), and 54.76% (46) strongly disagree responses. According to 40.48%(34) and 59.52%, teachers with a first degree or higher exhibit strong topic knowledge at the S.H.S level (50). According to the following percentages: 2.5%(2) greatly agree, 57.14% (48), agree, 29.76% (25) disagree, and 10.71%(9) severely disagree, my head of school funds subject workshops, training, and seminars. The professional credentials of instructors influence pupils' achievement, claim 54.76% (46), and 45.24%. (38). 39.29%(33) disagree, whereas 60.71%(51) strongly agree that teachers with teaching degrees are superior at instructing students.

The level of instruction delivered by schools in every country is directly influenced by the knowledge, intelligence, and academic competence of teachers (UNESCO, 1991). The level of science anxiety among students is influenced either favourably or unfavourably by a biology teacher's professional attributes (Nyongesa, 2010). Teacher quality, according to Buddin and Zamarro (2009), is an essential component in student academic progress. Ruthland and Bremer (2002) make a distinction between conventional and non-conventional teacher preparation programmes. After completing an undergraduate or graduate programme in education, traditional certification is earned. Alternative certification pathways are based on training in pedagogy and subject matter for those without a bachelor's degree in education.

Hardy and Smith (2006) list brief activities including peer reviews, seminars, and mentorship as alternatives to formal qualifications for better teaching. If they are unable to obtain employment right after, a graduate teacher with a first degree is more likely to continue teaching. Despite frequently being paid less than a fully educated teacher, they choose not to participate in the one-year post-graduate professional training, and as a result, lack the principles of teaching. According to Richardson's (2008) research, urban students performed better than those in rural areas. The study concluded that one factor affecting students' achievement must have been the availability of enough qualified teachers. However, in Kenya, several rural schools outperformed their urban

counterparts in terms of academic performance (Owoeye & Yara, 2011). Obasi (2010) asserts that a teacher's training, experience, and qualifications can improve a student's academic performance and accomplishments. This demonstrates that a certified teacher should be well-versed in the subject matter before the students because dealing with biology students' attitudes and science anxiety demands expert expertise. The biology instructors' replies to the topic of whether teacher credentials affect academic achievement are shown in Table 7.

**Table 7. Effect of Teacher Qualifications on Learners' Biology Competency**

<b>explanations from teachers</b>	<b>Frequency</b>	<b>Percent</b>
competent teachers use effective teaching strategies	80	100.0

Source: Field work, 2016

80 Of the biology teachers surveyed concurred that adopting efficient teaching methods by knowledgeable instructors enhances student achievement. Ruthland and Bremer (2002) make a distinction between conventional and non-conventional teacher preparation programmes. After completing an undergraduate or graduate programme in education, traditional certification is earned. Alternative certification courses are based on training in pedagogy and subject matter for those without a bachelor's degree in education. Hardy and Smith (2006) list brief activities including peer reviews, seminars, and mentorship as alternatives to formal qualifications for better teaching.

The first strand of the framework for assessing teacher quality, or teacher inputs, according to Goe and Stickler (2008), concentrated on teacher certifications. They believed that one of the most important resources instructors provided in the classroom was their training. The dependence on paper degrees as indicators of teacher quality appears to be holding sway in modern educational institutions (Goe & Stickler, 2008). (2008) Goe and Stickler. As a result, whether or not pupils perform well on exams, the qualifications of teachers are frequently questioned. In Ghana, secondary school teachers are required to hold a diploma, a bachelor's degree, or a master's degree.

Although there appear to have been no studies on the impact of teachers' highest/lowest qualifications on students' performance/achievement in Ghanaian SHS, this could explain the students' inconsistent output in SHS biology. Instructors enter the teaching profession with a variety of academic credentials. The majority of past research discovered a positive relationship between teachers' levels of certification and pupils' achievement, notably in math and science (Goldhaber & Brewer, 2002; Wayne & Youngs, 2003). Rice (2003) found that there were significant differences in the relationships between instructor characteristics and student achievement across grades and courses.

How does a teacher's professional background affect the biological performance of their students?

Participants in the study, including biology instructors and school heads, provided responses to this question. The respondents were questioned about how much teacher professional experience affects how well pupils achieve in biology. The responses of the respondents are shown in Table 8.

**Table 8. How much teachers' professional experience affects students' effectiveness**

Statement	SA	AA	UC	DA	SD
i. In the WASSCE, students with experienced teachers do well.	29	55	0	0	0
ii. Good teachers have experience.	26	53	0	5	0
iii. Competent teachers appropriately evaluate the students.	27	57	0	0	0
iv. Teachers with more competence are more patient when dealing with student-related issues.	41	43	0	0	0
v. Teachers with more experience are more effective educators	32	52	0	0	0

Source: Field work, 2016

34.52% (29) of the 84 responses strongly agree, 65.48% (55) agree, 30.95% (26) strongly agree, 63.10% (53), and agree—believe that students with experienced teachers perform better on the WASSCE. The remaining respondents—32.14% (27), strongly agree, 67.86% (57), agree, and 48.81% (41) disagree—also hold this belief. This is shown in Table 8. This implies that seasoned educators are capable of handling challenging circumstances and devoting a large amount of time to teaching their students to improve achievement. A teacher's quality is determined by the experience they accumulate over more years of teaching. As a result, it has been discovered that an experienced instructor can increase pupils' performance more successfully than a rookie teacher. Numerous empirical studies that demonstrate a significant and favourable correlation between the amount of years and students' achievement corroborate this (Rice, 2003). As shown in Table 9, the respondents (biology teachers) were given the chance to share their opinions on how the professional backgrounds of teachers affect how well their pupils succeed in biology.

**Table 9. Impact of Teachers' Professional Experience on Learners' Biology Achievement**

Teachers' Views	Frequency	Percent
I. Teaching is improved by experience.	44	55.0
II. Improved teacher evaluations come with experience	36	45.0
<b>Total</b>	<b>80</b>	<b>100.0</b>

Source: Field work, 2016

Out of 80 responses, 55% (44 respondents) thought that more experienced teachers are better educators, which has an impact on students' academic progress. 30 people, or 45%, agreed that teachers with more experience are better at evaluating students.

The aforementioned points to a campaign to promote the idea that an experienced teacher will be more effective



in his instruction and that his students will be more likely to perform academically compared to pupils taught by a teacher with less expertise, these students performed wonderfully in both internal and external school exams.

## Recommendation

1. Ghana Education Service should hire biology teachers who have both professional credentials and great subject expertise.
2. In order to increase the effectiveness of biology teachers' pedagogical and subject-matter expertise and their students' performance, senior high school heads must offer on-the-job training for them.

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## The Development of Teachers' Sustainable Competency on 21st-Based Human Resources in Ensuring School Readiness for Higher Level on PISA (Program for International Students Assessments)

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**Abstract:** The purpose of this research is to review the literature regarding (1) the design of sustainable competency development in the 21st century for teachers, (2) sustainable competency subconstruct design from the perspective of tactical operation, (3) sustainable competency subconstruct design from the perspective strategic operation, (4) construct school readiness in the educational process. The exclusion carried out by this article is reviewed in terms of abstract and research results. Literature Research is limited to empirical articles or research for ten years (2012-2022), and the main book of a theory is not subject to limitations. Two hundred sixty-nine articles were collected, and the inclusion and exclusion criteria were implemented, totaling 84 articles. The results of this study are (1) the design of sustainable competency development consists of two main constructs, namely tactical dan strategic operation, (2) constructs of school readiness obtained by researchers include literacy knowledge and skills, science knowledge and skills, approaches to learning, (3) sustainable competence is considered capable of increasing school readiness in carrying out the educational process following the 4.0 era, and (4) through the development of sustainable competence the PISA ranking can be restored in stages.

**Keywords:** Sustainable Competence, Teachers, School Readiness, PISA

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## Introduction

PISA (Program for International Students Assessments) is part of the OECD in analyzing the performance of 15-year-old students in 3 main areas: science, mathematics, and literacy (Volante et al., 2017). Since 2000 PISA has provided opportunities for all countries to evaluate student learning achievements at the age of 15 as a reflection of developments in the world of education (OECD, 2019). Historically, in the early 2000s, Indonesia was ranked 39th to 41st, then over time, Indonesia also has not experienced significant changes in the mapping of the quality of education from the PISA perspective.

The causal causes of such PISA results in a country are influenced by several factors, namely (1) curriculum, (2) educational facilities and infrastructure, and (3) the competence of teaching staff as the main factor (Govorova et al., 2020). In today's era of the industrial revolution 4.0, digitalization in technology takes on some aspects of human life activities. The opinion of the authors is in line with the opinion of the expert that the era of the industrial revolution was part of an era of disruption with collaboration with technology, resulting in patterns of life in which most of the processes were assisted or taken over by the role of technology (Wrahatnolo & Munoto, 2018). The 4.0 industrial revolution affected various institutions, such as health, politics, government, economics, and even educational institutions, which were also influenced by the 4.0 era. Rationally, in terms of process, implementation, and evaluation in various fields, technology has been utilized for work efficiency. The education sector is also the same; regarding management, leadership, and supervision, it is appropriate to use technology as an intermediary for implementing these activities so that the desired goals can be achieved effectively and efficiently. Chiu further (2021) explains that when it comes to the educational process, technology should only be used to help, not to dominate the process. This is explained in this way because the role of technology cannot completely replace the essence of education; an educator remains the main actor. The era of the industrial revolution 4.0 is where the achievement targets that each individual must achieve are 4C skills, namely creativity, communication, collaboration, and critical thinking (Supena et al., 2021). The era of the industrial revolution 4.0 is a time of disruption and globalization merging into one (Mourtzis et al., 2018). education and the development of the times in the era of the industrial revolution 4.0 are related because, in simple terms, education is defined as a map or direction pointer from a country to develop human resource competence in education (Triwiyanto, 2014).

In the 4.0 era, individuals must have several skills, such as communication, collaboration, problem-solving, and critical thinking (Wardhani et al., 2021). The various abilities mentioned by the compiler are broad generalizations about the extensive abilities a teacher must have to create outcome nature of education link and match with the demands of the times. As educators, in actualizing their various competencies, teachers tend not to meet the optimal word. This is evidenced by the results of the UKG (Teacher Competency Test), which states that the average ability of teachers in Indonesia is 65 out of the minimum standard of 75. Other research also proves that the adaptability of teachers in implementing new learning models is appropriate to project-based learning in the implementation of the 4.0 era curriculum is quite low; the results of the study prove that the

Teacher's ability to adapt to the new curriculum and policies is in category (1) very good 5,7%, (2) good 21,9%, (3) fair 37,6%, (4) poor 27.1%, and (5) very poor 5%. The initial data presentation has proven a gap between the new paradigm, policy and curriculum concepts and the educators' readiness (Saputra & Nuchron, 2019). This research proves that the competence possessed by teachers is still not optimal at the level of forming students who are ready for the times, where one of the indicators is the achievement of optimal levels in PISA. The competence of teachers who are not yet optimal correlates to school readiness, especially in terms of (1) science knowledge and skills, (2) approaches to learning, and (3) literacy knowledge and skills (Tremaine, 2017). The researcher focuses on these three constructs because the theory directly relates to the Teacher. Departing from this idea, the gap in the form of a disruptive change in educational direction and the low level of teacher readiness, whenever there is a change in educating students towards an optimal PISA ranking is interesting to examine through the Development of Sustainable Competency in the 21st Based Human Resources to Teacher in Ensuring School Readiness for Higher Level on PISA (Program for International Students assessments), the assumptions of contemporary researchers can change, but if the Teacher has sustainable competence or sustainable Competency then adaptability and capability to respond to disruption will become easier to actualize.

## Method

The research approach in this study is a systematic literature review from articles on teacher competency development and various studies on PISA, as well as factual data regarding competency achievements that teachers have achieved. The article inclusion criteria as a guideline for this SLR discusses (1) teacher competence, (2) development of 21st-century teacher competence, (3) sustainable competency development, (4) school readiness or school readiness in carrying out integrated educational processes, (5) human resource management, (6) school organizational culture, (7) school climate, and (8) a study of the determinants of factors and antecedents in the PISA ranking. The exclusion carried out by this article is reviewed in terms of abstract and research results. Literature Research is limited to empirical articles or research for ten years (2012-2022), and the main book of a theory is not subject to limitations. Mapping of the database used by researchers is science direct, Eric, and Sage publication. Articles that met the inclusion criteria were compiled and studied systematically.

The preparation of this article uses the identification of how (1) portraits of teacher achievements in carrying out their competencies, (2) the design of sustainable competency 21st on Teacher, (3) the impact of sustainable competency development on school readiness, and (4) the impact of continuous teacher competency development on achievement PISA ranking. The study in this article, through the steps by Harris (2019), covers (1) identification, (2) screening, (3) eligibility, and (4) inclusion so that the research results will be objectively crystallized. Related to this, the researchers produced 84 articles that passed to be used as references and reviewed based on the author's name, year of publication, method, research results, and research objectives.

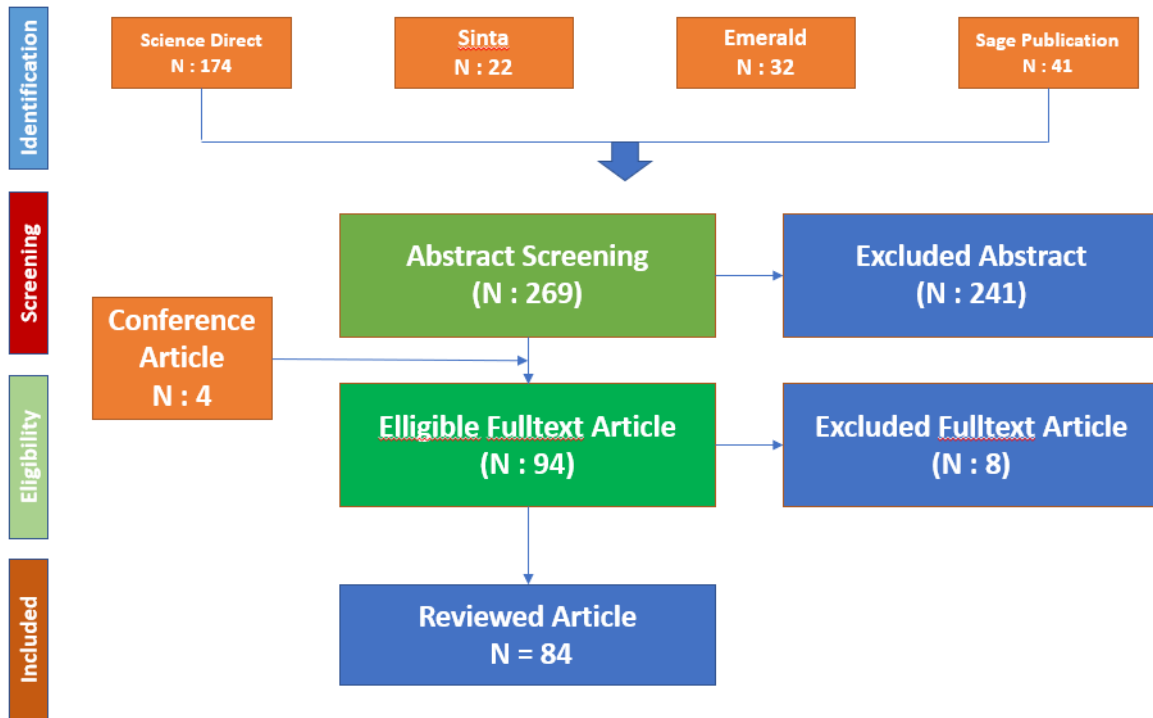


Figure 1. The Research Steps (D. Harris, 2019)

## Results

Based on the collection of articles, 269 articles align with the design objectives of this SLR research by following the current search criteria as stated in the methodology. Of the 269 articles that the researchers successfully screened, 84 articles were collected that entered and passed the criteria which discuss the key constructs in the title of this study, namely (1) sustainable competence, (2) teacher competence, (3) school readiness, and (4) studies on PISA for literacy, numeracy, and Science skills. The 84 articles will be used as extraction material to be compiled in the article manuscript as listed in the writing of this scientific work.

### The Development of Sustainable Competency 21st on Teachers

In this case, the main object is the Teacher because education in the current era leads to disruption. After all, it is in harmony with the times in the digitalization era. This phenomenon can occur this way because education is a tool to prepare students as raw input becomes output and reaches outcomes following the development of the times (Triwiyanto, 2017). Disruptive development of the times causes instrumental input and environmental input in education changes with the development of the times, such as policies, curriculum, the competence of educators and education, and dynamic educational facilities (Shahroom & Hussin, 2018). Curriculum change will affect other components such as funding, educational facilities and infrastructure, teacher expertise, principal expertise, and academic staff because the curriculum is one part of the educational process road map

that is the main indicator of achieving educational outcomes (Ferguson-Patrick et al., 2018). The problems in the current era refer to educational disruption, which leads to the unpreparedness of each academic unit to carry out new policies and achievement targets-output students in an educational institution (Pokhrel & Chhetri, 2021). The portrait of this problem according to the researcher's point of view, the portrait of this problem was created due to the lack of readiness of human resources because the construct of educational human resource development has not yet led to the formation of sustainable capabilities. Sustainable capability development means the high reliability of HR capabilities in the long term. Compiler opinion, if any Sustainable Competency based human resources management on teachers for educators is implemented, high disruption will not affect readiness to deal with continuous change. The authors' opinion is supported by Saboowala et al. (2021) if an institution can develop sustainable competencies, then no matter how hard the changes, the level of adaptation human resources in the education unit will be able to deal with it. The authors assume that if teachers face the dynamics of change with sustainable competency development, readiness to achieve goals will be more optimal because the principal, a leader, will be easy to contextualize old changes with new changes.

The construct of sustainable development referred to by the compiler consists of (1) motivational affirmation, (2) personal skills, (3) organization knowledge, (4) performance management, (5) competency management, (6) learning management system, (7) competency data, (8) organization strategy and development plans.

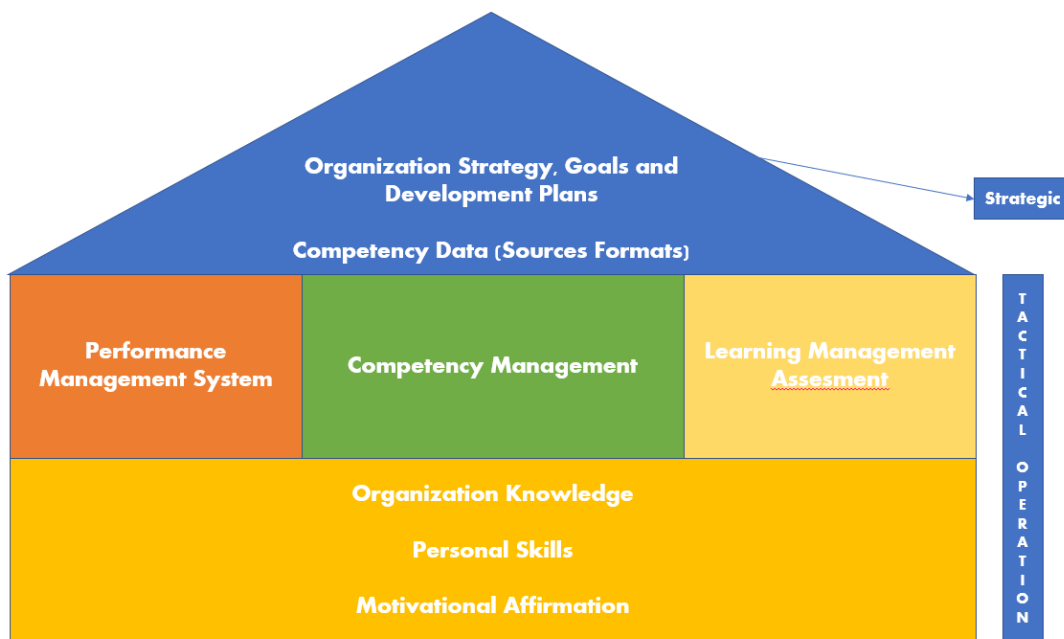


Figure 2. The 21st Century Sustainable Skills Development Construct

The main concept that can be studied from the visualization framework is related to sustainable competence, which is based on actual operation as a foundation for carrying out repetitive activities in educational institutions carried out daily by teachers as their professional duties. Respect to strategic operation is a competency that must be possessed to carry out tasks that are not repetitive every day but need to be carried out

routinely every month, semester, or once every year, which function is for the development of the Institute. The rationale of the compiler to implement (1) motivational affirmation, (2) personal skills, and (3) organizational knowledge as the lowest foundation is an expert's statement which emphasizes that the ability to know organizational characteristics and individual independence as personal skills in completing assignments is a basic competence of teachers in Finland so that independence does not interfere with other teachers' assignments but still has group cohesiveness (Tapani & Salonen, 2019).

The expert's idea can be interpreted as teacher competence in Finland, where teachers are required to have various individual skills or personal skills and knowledge about the characteristics of the Institute so that the process of carrying out the profession is in line with the vision and mission of the institution, and can focus on other teachers to complete their respective responsibilities while maintaining teamwork. The construct of motivational affirmation is a tactic that must be implemented as the main ability of the principal and an extensional ability for teachers. This is based on the theory of motivation from Herzberg (1966), where affirmation of motivation is a manifestation of appreciating all forms of responsibility and work from subordinates through the provision of wages, health insurance, and verbal and non-verbal praise. The principal must carry this out as a form of affirmation for a teacher. In another concept, this is said to be part of transactional leadership, so the results that can be obtained are positive affirmations from members because they feel valued (Baskoro, 2022). So the conclusion of the skills teachers and principals must possess giving subordinates affirmation so they are always motivated to provide more optimal performance in various tasks. At the level above, there are (1) performance management systems, (2) competency management, and (3) learning management assessments. Development of teacher competence in the form performance management system is represented through the Teacher's ability to objectively evaluate himself, colleagues, and institutions through a scientific basis based on data (Kaur et al., 2018). Researchers project that if the Teacher can implicate such a competency, then efficiency monitoring will emerge because accuracy will appear in these activities due to objectivity and scientific foundations.

In the construct, next to it, there is competency management, defined as a teacher who has competence in carrying out management functions in each of their main duties (Ismail et al., 2018). When examined theoretically, this is one of the derivatives of ability instructional leadership because it contains means management engineer. In other countries, such as Serbia, management skills are necessary for teachers to carry out planning and monitoring functions in every school activity (Simonović, 2021). Another construct learning management assessment is the Teacher's ability to utilize digital-based learning media and carry out evaluations of the implementation of learning the management system (Beer & Mulder, 2020). Last, in terms of its nature, the strategic operation is a competency that regulates the organization's strategy until competency data whose function is to manage strategy based on the management of objective numerical data or statistics for decision-making and Teacher implementation as a supporting factor for strategic management in educational institutions. This is based on research by Thao et al. (2022), which states that optimal teacher competency development in Vietnam implies strategic management skills and the ability to manage school decision-making data for teachers to assist school principals in a participatory manner. The researcher provides ideas if any competency data and



skills in strategic organizational management will direct a teacher to sustainable competence, which can help develop schools in a participatory rather than passive manner. Therefore, in the following discussion, the researcher will discuss in detail the concept of tactical operation and strategic operation.

### **Sustainable Competency-based Tactical Operation**

Tactical operation is a concept where the actualization of 21st-century skills is attached to tactical or conceptual and practical activities combined (LeChasseur et al., 2020). The first thing to be the concept of tactical operation is a competency that must be implemented as the main ability of the principal and an extensional ability for teachers. This is based on the theory of motivation from Herzberg (1966), where affirmation of motivation is a manifestation of appreciating all forms of responsibility and work from subordinates through the provision of wages, health insurance, and verbal and non-verbal praise. The principal must carry this out as a form of affirmation for a teacher. In another concept, this is said to be part of transactional leadership, so the results that can be obtained are positive affirmations from members because they feel valued (Baskoro, 2022). For teachers, this must be implemented for students so that students enjoy when carrying out learning because it is given reinforcement in the form of a reward. So the conclusion of the skills teachers and principals must possess giving subordinates affirmation so they are always motivated to provide more optimal performance in various tasks. Such a concept is also provided by non-formal education. Suppose a tutor and mentor in training have their main competence in providing enthusiasm for participants, namely through affirmation and praise. In that case, this is carried out solely not to praise but to foster a high motivational passion. Optimum to achieve stage or the next stage in the form of training because motivation is the main capital in learning. If an individual has the motivation, then the main fuel for enthusiasm in understanding a material will be able to be achieved by an individual (Nyanjom, 2020).

On the other hand, motivational affirmations can be used by the Teacher as a curative action when students violate something, then at another time, the student has improved his attitude, as a form of improving self-discipline (Binning et al., 2019; Schutte et al., 2017; Smith et al., 2021). Wu et al. (2021) explained in more detail that when it comes to giving affirmations to a student, being able to increase student self-confidence and self-efficacy so that they are projected to be able to develop their abilities to obtain achievements according to their fields. It is based on various studies in both formal and non-formal education, and researchers view motivational affirmation must be internalized in teachers' design of sustainable competency development. On tactical operation from the chart, above from motivational affirmation is personal skills. Personal skills consist of several sub-constructs related to 4C skills (Creativity, Communication, Collaboration, Critical Thinking). This is supported by expert research, which states that in the 21st century, for continuous competence, a teacher is required to have 4C skills because students are required, and so does the Teacher because learning initiators must master them first before providing learning that produces 4C outputs (Kim et al., 2019; Mistareehi, 2020).

Teacher creativity is represented through its ability to combine learning methods and classroom management, communication is represented through teaching that is easily understood by the entire class population,

collaboration is represented through the Teacher's skills to coordinate with parents and teacher colleagues in constructing student learning development, and critical thinking is represented through problem-solving on contextual problems in class (Bhayangkara et al., 2020; A. Harris & Jones, 2019; Zilka et al., 2022). In the third case, organizational knowledge is in the bottom chart construct. Knowledge of the organization is a part that covers how an individual can understand (1) work climate, (2) patterns of coordination and communication and (3) ethics and organizational values (Monroe et al., 2019). Rational researchers include these competencies used to prevent conflicts that may arise in an institution or organization. This is reinforced by Monroe et al. (2019) if the ability to understand institutions in terms of culture and communication patterns, as well as ethics, can be used as a guide for an individual to be able to work in a comfortable environment because you are not comfortable it is difficult to complete your professional duties. Researchers understand this as a guide or reference for teachers to avoid non-productive conflicts so that they can work comfortably without any conflict pressure from other individuals or groups within the institution. Organizational knowledge plays a central role because when conflicts arise and cause work discomfort, self-efficacy and motivation to complete their professional duties are also low (Da'as & Zibenberg, 2021).

The next construct lies in the competence performance management system, which addresses the ability to coordinate and implement a holistic system for the performance of each member or division in the institution (Schleicher et al., 2018). Suppose this is taken to imply a teacher. In that case, a teacher must be competent to measure a student's ability in the context of cognitive, affective and psychomotor development, both in formative and summative forms. The expert stated that it is not only in manufacturing institutions that require human resources to understand performance management and control, but in educational institutions, it can be implicated through individual student journals, which include cognitive, affective, and psychomotor development through formative and summative assessments (Gbollie & Keamu, 2017). The essence of the construct performance management system is the placement of the Teacher's function through his competence to closely supervise students regarding their individual development so that there is no lag in student control and self-development.

Details of this are attached in (1) summative assessment by the Teacher, (2) formative assessment by the Teacher, (3) teacher's class journal on student development, and (4) data collection on student self-development and interests (Gbollie & Keamu, 2017). The next construct is competency management, which directs teachers to have capabilities in (1) management functions, (2) time management, and (3) ensuring quality school-based management. This is reinforced by several studies which explain that if the management competence of a teacher is actualized through the ability to carry out planning to supervision for the school management process, then it is also required for a teacher to be able to determine priority scales by prioritizing students in time management and being able to carry out the function as the second person who runs quality assurance in school management (Bostancı et al., 2020; Díez et al., 2020; Sahito et al., 2016). The researcher agrees with the expert's idea because if all management tasks are delegated to the school principal, there will be performance inconsistencies for the school and education system. After all, the school principal, as an academic staff needs to delegate a certain task to achieve goals by optimizing existing human resources. , not charged to one man on

every job. Learning management assessment is another construct that can be described as part of the final construct in tactical operations.

Learning management assessment is part of the learning management system, but more narrowed down to the part of the Teacher's competence, the reason for handling the learning management system. Academic staff in charge of information systems and technology have been implemented in schools. The assumptions of researchers and teachers serve as individuals who can carry out (1) content delivery, (2) collaborative feedback in UI and UX with the LMS planner, and (3) course collaboration. The researcher's opinion aligns with the expert's opinion, which states that the Teacher's role in LMS is to assess, provide input, and implement flowchart dari LMS (Kabassi et al., 2016). The meaning of discontent delivery is the Teacher's capability in channelling material in the school's LMS Collaborative feedback is input with the basis of a teacher who understands the concept of user interface and user experience in a learning application and course collaboration which leads to efficient use of LMS characterized by cooperative learning with students in information systems (Bradley, 2020; Hentati et al., 2021; Moon et al., 2022; Raymond et al., 2016; Wiratomo & Mulyatna, 2020).

### **Sustainable competency based Strategic Operation**

Strategic operation is a concept in 21st-century competencies and skills that discusses strategic capabilities that teachers and principals can implement as the main actors in the field of education. This is supported by previous researchers who stated that tactical managerial skills must be supported by conceptual skills that can implement back up against a variety of tactical skills so problem-solving in tactical problems can be encountered (Demir et al., 2019). This section consists of two main constructs, namely (1) organization strategy and development plans and (2) competency data. Organization strategy and development plans is a competency that answers how individuals can design link and match vision and mission, strategies for continuous quality improvement, and setting individual skills in applying strategic management to condition an optimal work climate (Ertem et al., 2021; Fauzi et al., 2021; Kala & Tee, 2016; Sonia, 2021). This terminological understanding directs the axioms of researcher thinking to the sub-constructs of part point 1 consisting of related competencies (1) link and matches learning to industries through world growth, (2) continuous improvement on the learning process, (3) and applying strategic management and climate at school. In sustainable competency development, education is directed not to go off track for continuous improvement, at least in the learning construct (Lavigne, 2020).

In the last construct in the discussion in this article, especially in sustainable competency development, there are competencies or capabilities about competency data. Competency data is the ability to use statistical data, objective numerical data, and scientific research methods for decision-making in the management process (Ghasemaghaei et al., 2018). Research from information systems science can be used as a basis for application in sustainable competency development because teachers need to be able to implement this in their contribution to decision-making. Based on this theory, the sub-constructs of competency data are (1) applying statistical and graphical techniques data and (2) research and evaluation methods. Researchers place these two competencies as strategic operations because the theoretical concepts in this section have the scope and the intensity of activities

within a certain time frame regularly, but not repetitive or become daily activities. Therefore, it is said to be a strategic competence.

**School Readiness in Achievement Levels in PISA**

School readiness is addressed by existing sustainable competency in achieving the PISA ranking. The construct of school readiness consists of many theories. Here school readiness will be displayed by the researcher in Figure 3.

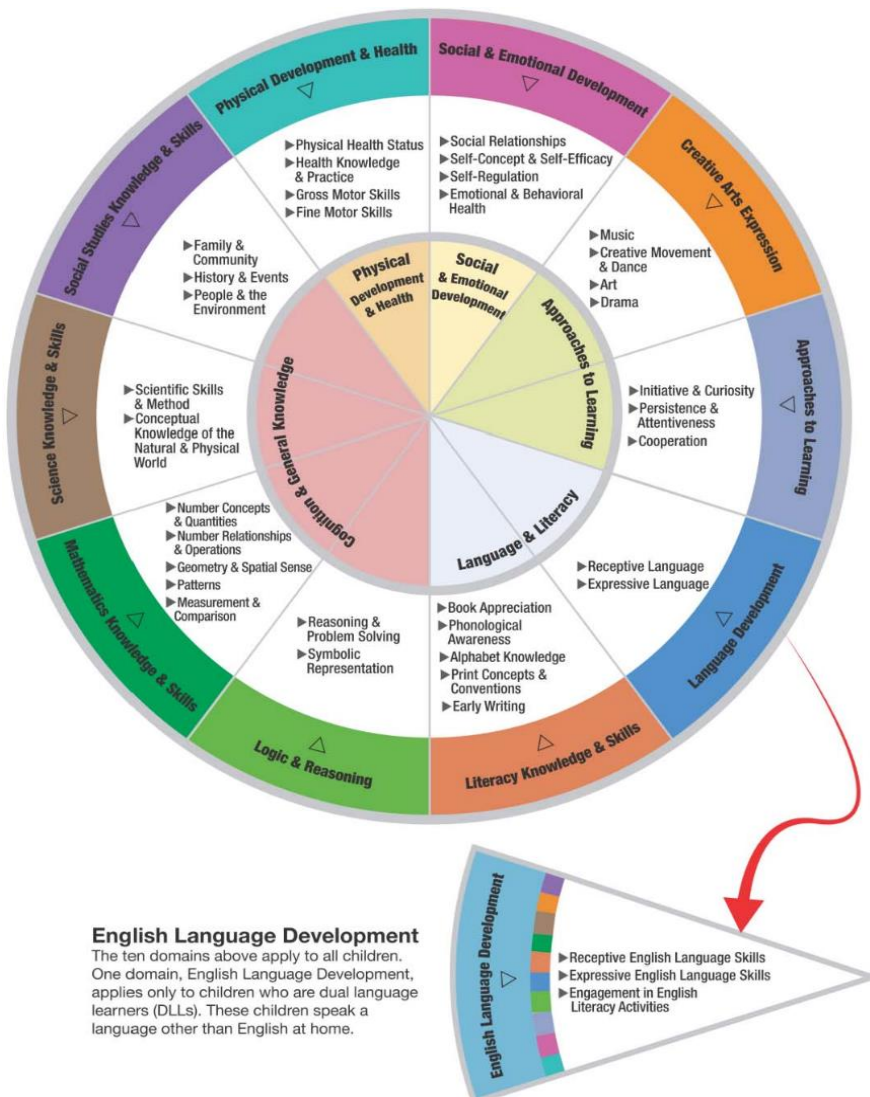


Figure 3. Deep Construct *School Readiness*

Source:(Tremaine, 2017)

In this concept, school readiness in the actualization of sustainable competencies, researchers will be directed to several deep constructs of school readiness, namely (1) science knowledge and skills, (2) approaches to learning, and (3) literacy knowledge and skills. The constructs linked by the compiler do not cover all the indicators contained in school readiness because, in this study, the authors focus on the implications of

sustainable competence, which are related to the three indicators mentioned in the previous description. Science and knowledge skills are the Teacher's ability to implicate knowledge and naturalization in the learning context (Hartman & Morris, 2019; Tremaine, 2017). Approaches to learning are part of persistence, the development of teacher learning models according to curriculum developments, and initiatives on learning innovation. Lastly are literacy and knowledge skills, which include (1) early writing, (2) book appreciation, and (3) phonological awareness. The reason the authors stipulate that these three things are included in the research indicators is that a theory that has a causal relationship to the PISA ranking indicator is numeracy, literacy, and skills in science, Ministry of Education and Culture, which fulfils the link and match on the three indicators chosen by the compiler to examine school readiness or school readiness in the implications of continuing competence which are new and revolutionary.

## Discussion

### Impact of Sustainable Competency Development on School Readiness

Science and knowledge skills from school readiness projected by researchers will increase due to continuous competency development. This is because the construct related to science and knowledge skills is continuous improvement in the learning process. It is said so because it relates to continuous improvement in the learning process and contains a steps plan, do check and act where this has implications for how a teacher can analyze where his teaching deficiencies are so that the PDCA process will be created self-learning. Previous researchers also supported this in the early 2000s. They stated that teachers who were aware of competency to continuous improvement independent learning would arise, through non-official training, reading professional development books, or carrying out independent learning through colleagues (Dinkelman, 2003). This old research still has strong relevance if, in the current era, researchers argue that various independent learning processes from teachers can be carried out through hybrid training, participating in seminars and workshops, and teachers can improve the process-teaching and learn through various platforms and social media. The researcher's opinion is in line with the expert's opinion, which states that the development of teacher knowledge in the current era can be carried out anywhere, anytime, and at a minimum cost if someone can take advantage of social media and scientific facilities that exist on internet networks (Ansari & Khan, 2020; Greenhow et al., 2020; Ibrahim, 2016). On the inner construct, science and knowledge skills be found in scientific skills and methods (Tremaine, 2017). This can be realized through competency data, which is a competence for teachers in continuously applying statistical, graphical, and research evaluation methods. Therefore, regarding science and knowledge easy for continuous competency development to create output in the form of teachers who can carry out research within the scope of the school and make scientific, objective and accountable decisions.

The second point approaches to learning, or approach to learning. Conceptually, in terms of personal competence skills, critical thinking and creativity will be a reference for researchers. Critical thinking has a major role in overcoming class problems through problem-solving efficiently, and creativity will take a role in preparing teacher-creative learning that refers to conduciveness in learning (Kasmaienezhadfad et al., 2015).

The researcher assumes the Teacher's creativity as a stimulus for creating a dynamic learning approach. Dynamic in this idea is not stagnant in the classical learning process. Expert confirms approaches to learning are not only implicated in creating learning. However, willingness to study teaching and learning with their friends is also a sub-indicator (Tremaine, 2017). These sub-indicators can be realized through continuous competence with personal skills and collaboration. Collaboration is the competence of a teacher to be able to coordinate with colleagues, principals, parents, and students to develop aspects that are lacking in their learning because, in the educational context, students are said to be core external customers who are the main customers of the educational process (Sallis, 2014). Another construct in approaches to learning can also be created by persistence and attentiveness through competency management, namely in the sub-construct-assure quality. Quality assurance in learning is intended and directed in the form of certainty of quality presentation and consistency of delivery of quality learning in the long term (Saeed & Saeed, 2018).

The last point is related to literacy knowledge and skills, which is represented in (1) early writing, (2) phonological awareness and (3) book appreciation. The three achievements of these abilities can be accessed or resolved through competence and personal skills in terms of communication. Communication in continuous competence describes a teacher who can explain material easily and relates to phonological awareness. Phonological awareness is an ability to organize language appropriately so that teachers' various communications and authorship in text form become easier to understand but still have scientific weight (Welcome & Meza, 2019). Departing from this, it can be concluded that phonological awareness in a study and school readiness can be created through personal competence skills in continuous competency development. Book appreciation is the Teacher's readiness in literacy by completing their reading, not just reading but not writing the book as a reference in their work, as well as maintaining the literacy materials they have (Tremaine, 2017). Researchers confirm this book appreciation will be represented through competency actualization work ethics and values because one ethics literacy for educators is to refer to books that have been read and store books or reading materials in the right place so that they can be used between generations (Campbell et al., 2020). Such characteristics are competencies not discussed in high quantity by researchers in competency development. Last, regarding early writing, of course, it has been represented. It can be achieved if a teacher has competent data or skills in methods and management of research results as a basic competency for writing scientific papers (Arifin et al., 2020). Based on these various things, it can be concluded that the development of sustainable competency impacts school readiness because every existing sub-competence or sub-construct is always related to the basic theory of school readiness to implement the educational process.

### **Impact of Continuing Competency Development for PISA Ratings**

The description and discussion regarding the impact of continuous competency development on the PISA ranking by researchers will be connected through the antecedents and determinants of factors that influence a country's ranking. The antecedents in the ranking assessment for PISA are (1) numeracy, (2) science or natural knowledge, and (3) literacy (Hopfenbeck et al., 2018). The researchers' assumptions in this discussion regarding the antecedents of the factors that exist unsustainable competency related and have causality in the construct

tactical operations. It can happen that way because numeration is in tactical operations listed in competence numerical knowledge, which is the Teacher's capability to understand basic mathematics and applied mathematics in school management and learning (Hawes et al., 2020). This, if narrowed down, has a close relationship with a numerical assessment concept, where what is a supporting aspect in achieving optimal numeracy when measuring PISA is the ability of teachers, both Mathematics and non-Mathematics teachers, in terms of basic and applied numerical, because teachers have low numerical competence. It will not be easy to collaborate social and mathematical learning in one space correlated curriculum when the basic competencies in mathematical terms are not fulfilled (Hwa, 2018).

On other factors, when discussed, the antecedent factors in the form of science or natural knowledge can be affirmed and recognized by competence and creativity where deep personal skills In this aspect, an aspect that is thoroughly discussed is regarding the Teacher's capability in connecting one subject to another subject through an experience of inquiry in nature or a setting in which students spend time outside of school, this is referred to as project-based learning (Schutte et al., 2017). Finally, the third antecedent factor is literacy, which is deep tactical operations. This can be realized through competence and personal skills in creativity, which examines the capabilities of teachers in building literacy and naturalist skills of students. If associated with the construction of school readiness, which can be achieved through sustainable competency, the literacy assessment problem can be overcome with literacy and knowledge skills, especially deep phonological awareness and book appreciation. This can be achieved because teachers are ready and able to have grammatical awareness. The output that will be achieved is imitating the behaviour of students who speak with coherent, weighty, and always grammatical grammar. When communicating, reasoning at each closing statement (Wrahatnolo & Munoto, 2018). The second is ebook appreciation. If a teacher has competence in book appreciation, then a culture of reading books, reviewing books, and archiving books in the right way as a form of appreciation, as well as a culture of literacy, students will get used to it. The outcome that will emerge regarding this matter, a student will understand the basic concepts in literacy practice directly in everyday conditions.

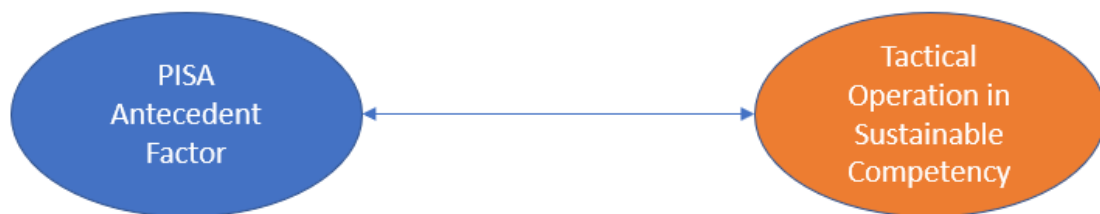


Figure 4. Linkage of PISA Antecedent Factors and Tactical Operations in Sustainable Competency

The second discussion is the determinant factors related to achievement ranking PISA with strategic operation in sustainable competency. It should be noted that the determinant factors that determine the achievement ranking PISA are (1) school culture, (2) quality assurance in school management, and (3) decision-making ability and, (4) action research implemented by the school (Susongko & Afrizal, 2018). Sustainable competency compiled

by the researcher clearly illustrates the relationship between the four determinants of these factors. First, school culture and quality assurance in school management directly relate to organizational strategy and development plans. It can be generalized this way because, in the existing sub-designs, the construct contains a link and match between learning and industries, continuous improvement on the learning process, and strategic management and climate conditioning. Second, decision-making ability and action research have a connection with competency data. Competency data have sub-designs that apply statistics and graphical techniques to make decisions and research and evaluations model. As mentioned in the article in the results, these various sub-designs can allegedly provide sustainable competency development, which can raise Indonesia's ranking in PISA. This is also in line with research conducted by previous researchers in other countries, in which to achieve an optimal PISA for a country, the competence of teaching staff is needed, which is in line with the assessment aspects of (1) numeracy, (2) literacy, and (3) science, as well as being able to overcome institutional problems such as school culture and incompetent human resources to carry out their roles as educators (Hopfenbeck et al., 2018).



Figure 5. Linkage of PISA Antecedent Factors and Tactical Operations in Sustainable Competency

**Conclusion**

Through the development of sustainable competency 21st, several sustainable competencies are studied, which means disruptive changes will not fade them. The assumption is that all competencies may develop, but not all sustainable Competencies. Allocation exists in sustainable competency. This is the achievement of teacher competence link and matches with PISA and global developments, as well as to create high teacher adaptability in managing learning in an era of disruption. Sustainable competency development has two main constructs, tactical operations and strategic operations. Based on the available display, the antecedent factor is related to competence in tactical operations by teachers and strategic operations is related to the determinants of level achievement factors in PISA.

**Recommendations**

For readers, this article should be used as a reference for insights regarding teacher sustainable competence. Researchers should be able to research this theme in depth through qualitative research and quantitative design to examine the influence of each construct accurately and in-depth.



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## Deep Dive into Teachers' Digital Competence to Support 21<sup>st</sup> Century Learning: A Systematic Literature Review

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**Abstract:** Teachers' digital competence (TDC) should be possessed by teachers in the 21st century learning process because learning resources in this era are not only from one source but many sources along with technological developments. This study aimed to provide an overview of the dimensions of TDC, the level of TDC, obstacles, and solutions to improve teachers' digital competence. Data were collected through Sinta, Emerald, Elsevier, Wiley, IEEE, Taylor & Francis, ERIC, JSTOR Journals, MDPI, and Springer. From these, 47 articles were investigated to address the focus of this research issue. The results show that the dimension of TDC widely used was the DigCompEdu 2.0 framework from the European Commission. Based on TDCs' classification using teacher competence as stated in Indonesia's Law No. 14 of 2005, previous researchers tended to discuss the dimensions of TDC which focused on professional competence (46.67%), pedagogic competence (29.33%), social competence (12%), and personality competence (16%). Furthermore, teachers' average digital competence is still low. So, collaboration between the government and the school and organizing teacher training is needed to improve teacher digital competence. This study also revealed that heutagogy and synchronous collaborative learning models could be used to enhance TDC in the 21st century.

**Keywords:** Teachers' digital competence, Teachers' digital competence dimensions, Twenty-First century learning

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### Introduction

Twenty-First Century learning prioritizes the ability to use the internet and access learning technology. Learning

resources in 21st century learning come not only from one source but many sources along with technological developments. Teachers can combine appropriate learning models with technology to achieve learning objectives during the learning process. Research shows that digital tools and software are positioned as learning resources with better results than traditional teaching-learning resources (Reimers & Schleicher, 2020; Uluyol & Şahin, 2016). Chalkiadaki (2018) visualizes 21st century learning as an era primarily characterized by the evolution of technology and ICT, globalization, and innovation, consequently highlighting the need for students to develop relevant skills and competencies. A class dominated by Generation Z (1996-2009) encourages teachers to have adequate digital competence because that generation has the best digital abilities (Basantes-Andrade et al., 2020).

Previous literature has finally begun to develop the definition of teachers' digital competence needed in using technology in the classroom (From, 2017; Krumsvik et al., 2016). From (2017) defines teachers' digital competence as using Information and Communication Technology (ICT) such as digital tools or software. Other researchers define teachers' digital competence as a complex ability, such as teachers' ability when use technology tools and digital resources. Teachers' digital competence considers dimensions, attitudes, strategies, and awareness that enable teachers to effectively use effective technology to achieve teaching and learning goals. European Framework for the Digital Competence of Educators (DigCompEdu) considers digital competence as the technology safely, critically, and creatively to enrich teaching and learning objectives (Redecker & Punie, 2017).

The discussion of teacher digital competence is closely related to using digital learning technology. Digital learning technology tools are currently being developed to support the learning and teaching process in the classroom that promotes the implementation of 21st century learning. Several government policies have made efforts to ensure teachers have used technology in 21st century learning, such as organizing teacher training and empowerment programs. That programs aimed at accelerating the use of technology in education, such as the Lifelong Learning Strategy 2020 in Estonia (2014), the Good School Reform in Italy (2015), the Curriculum Reformation in Finlandia (2016), and Ayo Guru Belajar by the Indonesian Ministry of Education and Culture (2020). Although the government and schools have met the availability of hardware and software, using digital tools in learning practices and digital competence is still foreign to educators (Cattaneo et al., 2022). This condition shows that the completeness of the infrastructure only partially or not thoroughly explains the use of technology (Drossel & Eickelmann, 2017). The International Computer and Information Literacy Study (2018) documented that less than 50% of teachers use technology in their learning process (Fraillon et al., 2018). The Organization for Economic Co-operation and Development (OECD) Teaching and Learning International Survey results show that in training on technology-related skills, only 43% of teachers feel ready to use technology in teaching (OECD, 2019). In fact, due to the increasing demands for the use of technology in education during the COVID-19 pandemic teachers from 64 different countries worldwide are showing a diversity of their readiness to use technology in teaching (Scherer et al., 2021).

A country with big 4 world-population like Indonesia is expected to have gold generation in 2045. Besides, the



Internet users who are at the age of secondary and tertiary education (13-24 years) are 31.61% of the Indonesian population (BPS-Statistics Indonesia, 2021). This opportunity should encourage regulators to make policies regarding the existence of teacher digital competencies in basic teacher competencies that stated in The Law Number (No).14 of 2005 concerning teachers and lecturers. Based on the law, teacher competencies that must be possessed by teachers are pedagogic competence, personal competence, social competence, and professional competence that obtained through professional education. Teacher competency standards cover core teacher competencies which are developed into competencies for kindergarten teachers, Elementary School teachers, Junior High School Teachers, Senior High School Teachers, and Vocational High School Teachers. For vocational education, Sajidan et al. (2016) stated that the ability to operate technology is one of the assets that teachers must have in this digital age. Therefore, teacher digital competence should be included in the teacher professional education curriculum, so that pre-service teachers who graduate have competencies that are appropriate to their era, namely teacher digital competence.

The use of technology by teachers in the teaching and learning process has a significant impact on student learning outcomes. Students will achieve better learning outcomes when their teachers perceive that learning management systems are easy to use and learn (Cobo-Rendon et al., 2021). Using digital is meaningful for self-expression and is part of digital competence (Ala-Mutka, 2011; Eshet-Alkalai, 2004). Teachers who desire and can integrate ICT during the learning process will be better at communicating educational goals and have clear expectations about ICT use, provided they have mastered digital competencies. Meanwhile, teachers who have no desire or are unable to implement ICT in teaching and learning activities may have problems conveying lesson objectives and expectations (Moltudal et al., 2019). Nouri et al. (2020) revealed that digital competence includes advanced skills for creating materials, problem-solving, collaboration, and innovation. The benefits of using technology in the classroom if it is not supported by the digital competence of the teacher cause the learning objectives not to be achieved. Furthermore, the level of maturity in mastering digital competencies is one aspect that has an essential role in supporting the transformation of the learning industry 4.0 (Bergdahl et al., 2020; Rizaldi et al., 2020).

This phenomenon triggers researchers to provide an overview of the teachers' digital dimensions and the latest conditions related to teacher digital competence research in the 21st century. The study has a significant meaning considering teacher digital competence related to 21st century teacher competence, both at the elementary school, high school, and college levels. This systematic research literature review also offers solutions about suitable learning models to improve teacher competence in 21st century learning because selecting appropriate learning models and designs can assist teachers in implementing effective learning and using technology (Conole, 2013). Regarding the researcher's knowledge, no research discusses the four basic of teachers' competence that mentioned in Indonesia's Law Number (No). 14 of 2005 as a basic competence to develop the comprehensive of teachers' digital competence. Besides, this study tries to elaborate the learning models that can improve teachers' digital competence in 21st century learning using a systematic literature review.

**Method**

This systematic literature review study aims to provide an overview of the condition of digital competence in 21st century learning. To solve the problem, the researcher conducted a literature review using the procedure suggested by Cooper (1988) for literature synthesis. Systematic methods help to 1) formulate problem topics, 2) collect data, 3) select data through predetermined criteria, 4) analyze and interpret data, and 5) organize and discuss research results. Based on the phenomenon of teachers' digital competence described in 21st century learning, this systematic literature review is used to answer three questions as guidelines. First, the Author intended to elaborate on the dimensions of teacher digital competence used in relevant current research. Secondly, to investigate the digital competence status of teachers. Thirdly, describe the obstacles faced by teachers in improving digital competence. Last, the Author tried to provide the solution teachers can use to overcome the barriers to increasing digital competence. The next step of this systematic literature review is to identify and explain all the questions above to conduct an SLR study based on the literature that has been collected.

The data collected for the empirical study used a qualitative approach. The keywords used are "teachers' digital competence," "21st century learning competence", "ICT competence," and "teachers' digital competence and level." Other keywords were also used, such as "teacher and technology" and "teachers' perception of digital competence."

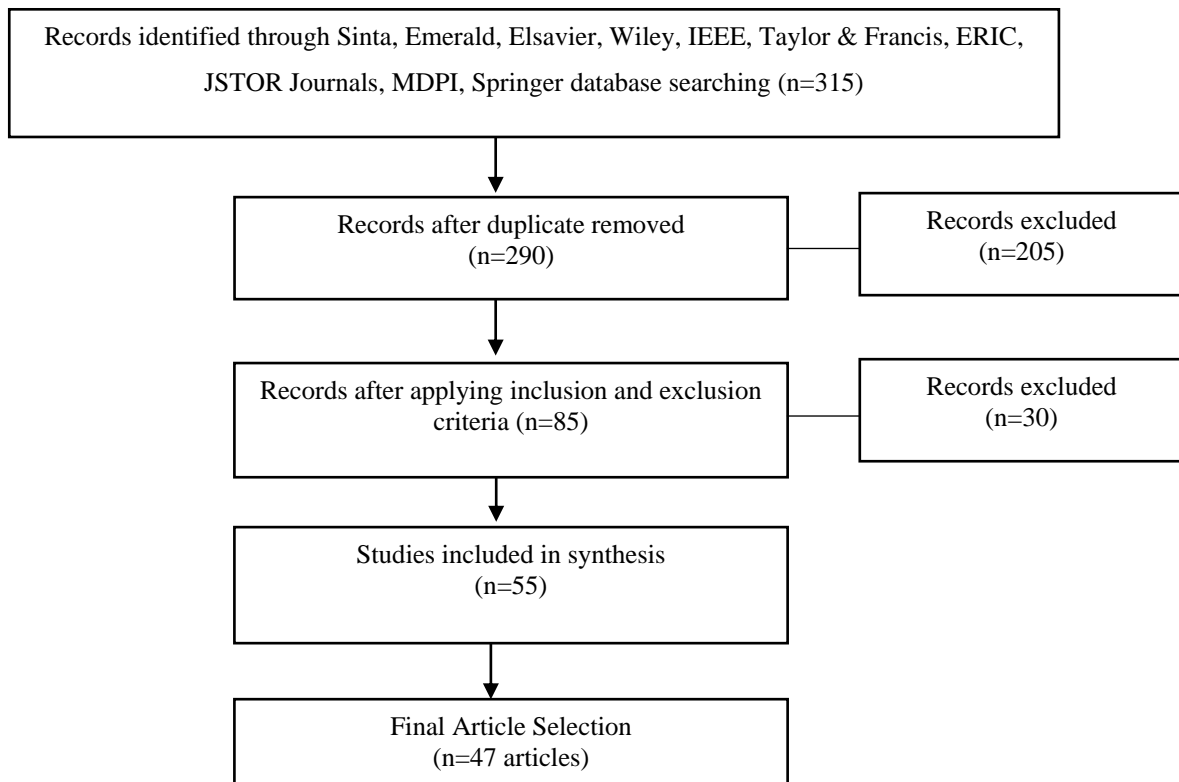


Figure 1. Flow Diagram of the Publication Selection Process

Table 1. Inclusion and Exclusion Criteria

Type of criterion	Criteria	Inclusion	Exclusion
Type of publication	Journal articles	√	
	Conference papers	√	
	Reports	√	
	21st century framework	√	
	Teachers' digital competence framework	√	
	Dissertation	√	
	Books	√	
Access	Online	√	
	Offline		√
Publication period	2009-2022	√	
Publication issue	Are written in English	√	
	Are not written in English		√
	Have been published after being submitted to a peer-review process	√	
	The full version of the publication is available through the subscription of our institutions	√	
	The research follows the appropriate structure of analysis according to the research method	√	
Place of study	Empirical investigation	√	
	Theoretical studies	√	
Research methods	Qualitative	√	
	Quantitative	√	

## Results

The inclusion criteria allow the analysis of publications from 2009 to 2022. Table 2 showed that the most citation article was dominated by 2021 publication or 29,79% of as many as 14 articles.

Table 2. Number of Publications each Year Used in Research

Year	2009	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
n	1	1	2	-	3	3	5	4	3	6	14	5

Forty-seven articles were found and used in a systematic literature review through a predetermined procedure. Of the 47 articles that appeared as samples in this study, the identification results showed 21 countries with Spain as a country that produced many articles related to the problem topics. In addition, one of the articles on Digital Teacher competency by European Framework for the Digital Competence of Educators (Redecker &

Punie, 2017) is not included in the worldwide popular distribution and number of selected studies (Figure 2). 15 articles focus on the issue of the dimensions of teacher competence used in this study, 17 articles focus on the case of the level or condition of teacher digital competence, and 19 articles focus on the issue of constraints and solutions offered to improve teacher digital competence. The same six articles are used on the digital competence level of teachers and the case of obstacles and solutions for increasing digital competence. For clarity, the use of articles can be seen in the Venn diagram (Figure 3). In addition, Table 3 presents the citation of the sources used in the results section.



Figure 2. Worldwide popularity and number selected studies

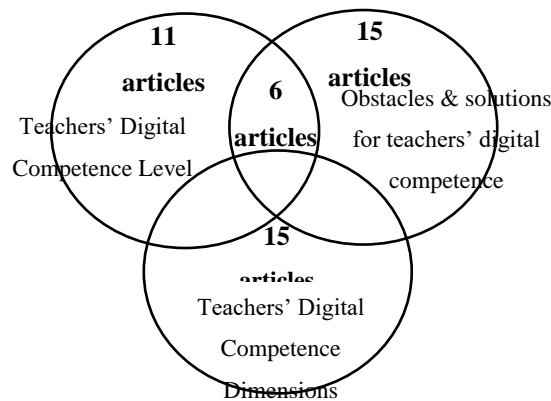


Figure 3. Article Division according to the State of Problem

Table 3. References of Teachers' Digital Competence Dimensions

Focus	Reference
Teachers' Digital Competence Dimensions	Cattaneo et al., 2022; Dervenis & Fitsilis, 2022; Pérez-Calderón et al., 2021; Alarcón et al., 2020; Kim & Choi 2018; Touron et al., 2018; Al Akhateeb

Focus	Reference
(15)	2017; Elstad & Christophersen 2017; Kelentrić et al., 2017; Krumsvik et al., 2016; Redecker & Punie, 2017; Tondeur et al., 2017; Siddiq et al., 2016; Walker & White, 2015; Pavlova, 2009
Teachers' Digital Competence Level	Astuti et al., 2021; Basantes-Andrade et al., 2020; Basilotta-Gómez-Pablos et al., 2022; Benali et al., 2018; Bilbao-Aiastui et al., 2021; Cabero-Almenara et al., 2021; Diz-otero et al., 2022; Fraile et al., 2018; Gámez et al., 2022; Garzón-Artacho et al., 2021; Guillén-Gámez et al., 2020; Hamzah, 2021; Mutohhari et al., 2021; Portillo et al., 2020; Prieto-Ballester et al., 2021; Supardi & Hakim, 2021; Zhao et al., 2021
(17)	
Obstacles and Solutions for Increasing Teachers' digital Competence	Agonács & Matos, 2019; Arredondo-Trapero et al., 2021; Astuti et al., 2021; Basilotta-Gómez-Pablos et al., 2022; Blaschke & Hase, 2016; Blaschke & Marin, 2020; Blaschke, 2012; Conole, 2013; Enochsson et al., 2021; Fraile et al., 2018; Instefjord & Munthe, 2015; Isoda et al., 2021; Kožuh et al., 2021; Lu et al., 2015; Mutohhari et al., 2021; Moltudal et al., 2019; Ortega-Sánchez et al., 2020; Portillo et al., 2020; Supardi & Hakim, 2021; Wannapiroon et al., 2021; Wastiau et al., 2013
(21)	

### Teachers' Digital Competence Dimension

The results of research on the dimensions of teacher digital competence are shown in Table 4. There are 15 models of teacher digital competence along with their dimensions. Furthermore, to make it easier to identify the dimensions of each teacher competency model, the basic Indonesian teacher competencies are used in this study, so that it is known which components are more dominant (professionalism, pedagogical, social, and personality).

Table 4. Model Framework of Teachers' Digital Competence

Model Framework/ Resource	Area/Dimension of Teachers' Digital Competence	Indonesian Teachers' Competence				%
		Profesion alism	Pedag ogical	Social	Persona lity	
Maturity Level using Technology (Pavlova, 2009)	Technological Awareness	√				PF=100%
	Technological Literacy	√				
	Technological Capability	√				
	Technological Creativity	√				
	Technological Critism	√				
Digital competence for linguistic competence	Procedural Competence	√				PF=50%
	Social-Digital competence			√		PD= 25%
	Digital Discourse	√				SC= 25%

(Walker & White, 2015)	Competence				
	Strategic Competence		√		
Teachers' Professional Digital Competence	Elementary ICT		√		PF= 60%
	Basic ICT Skills		√		PD=40%
	Didactic ICT Competence		√		
(Krumsvik et al., 2016)	Digital Learning Strategies		√		
	Digital Bildung		√		
Teachers' Emphasis on Developing Students' Information & Communication Skills (TEDDICS)	Acces Information Evaluate Information Share and Communicate Digital Information	Digital	√		PF= 66,66% SC= 33,33%
(Siddiq et al., 2016)	General aspect of the application of ICT for people with disabilities		√		PF= 100%
	Application of ICT with Motor		√		
(Cabero-Almenara et al., 2016)	Application of ICT with Visual		√		
	Application of ICT with Hearing		√		
	Application of ICT with Cognitive		√		
DIGCOMP-EDU 2.0 (Redecker & Punie, 2017)	Profesional engagement		√		PF= 33,34
	Digital Resources		√		PD= 66,68
	Teaching and Learning		√		
	Empowering Students		√		
	Assessment		√		
	Facilitating Students' Digital Competence		√		
Digital	Self-efficacy for			√	PS= 100%

Competency among Teachers & Christophersen, 2017)	maintaining discipline Student Self-efficacy for (Elstad influencing students' use & of ICT in learning			√	
Pre-Service Teachers' Competencies (Toundeur et al., 2017)	Competencies to support pupils for ICT use in class Competencies to use ICT for instructional design		√		PF= 50% PD= 50%
Common Framework TDC (INTEF, 2017)	IT information and Literacy Information Communicating and Collaborating		√		PF= 50% SC= 50%
Teachers' Professional Digital Competence (Kelentrić et al., 2017)	Topics and basic skill School in Society Ethics Pedagogy and didactics The leadership of learning processes Interaction and communication Change and development		√	√	PF= 21,44% PD= 28,58% SC= 28,58% PS= 21,44%
S.A.F.E Model (Digital Citizenship Scale) (Kim & Choi, 2018)	Self-identity in digital environment Activity in online Social/cultural engagement Fluency for digital tools Ethics for digital environment		√	√	PF= 40% PS= 60%
Eucators' Digital Competence (the DIGIGLO) (Alarcón et al., 2020)	Professional engagement Digital resources Teaching and learning Assessment Empowering Facilitating learners' Digital environment		√	√ √ √ √ √	PF= 18,75% PD= 56,25% SC= 37,5%

	Extrinsic digital engagement			√	
Digital Competence of Educators (Guillén-Gámez et al., 2020)	Duties of the tutor in relation to the student body				√ PF=30% PD= 10% PS= 60%
	Duties of the tutor in relation to the teaching staff				√
	The tutors' role with the family				√
	ICT and transfer		√		
	Use of ICT resources		√	√	
Teachers' Digital Competence for Vocational Education and Training (VET) (Cattaneo et al., 2022)	Communication and collaboration				√ PF= 20% PD= 60% SC= 10% PS= 10%
	Professional development		√		
	Digital resources selection			√	
	Digital resources creation			√	
	Data protection				√
	Teaching and learning			√	
	Assessment			√	
	Students' empowerment			√	
	Media education			√	
	Students' digital competence		√		
Teachers' Digital Competence in Higher Education (Dervenis & Fitsilis, 2022)	Personality				√ PF= 66,68% PS= 16,67% PS= 16,67%
	Professionalism		√		
	Educational		√		
	Scientificity		√		
	Communication				√
	Digitality		√		
	N	35	22	9	12
	N (Total)	75	75	75	75
	%	<b>46,67</b>	<b>29,33</b>	<b>12</b>	<b>16</b>



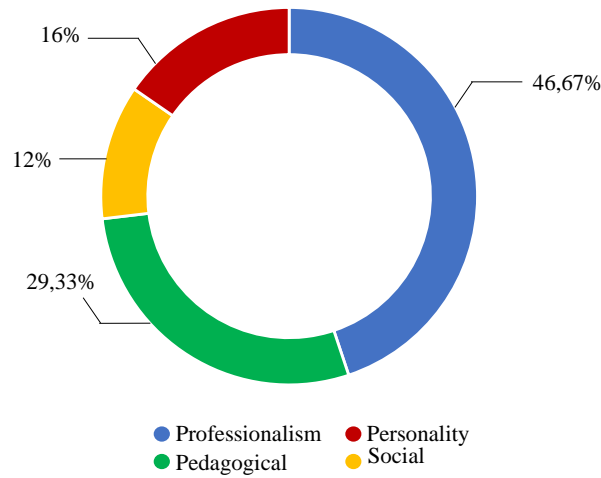


Figure 4. Classification of Teachers' Digital Competence Dimensions

## Discussion

### Teachers' Digital Competence Dimensions

The model that are usually used are DigCompEdu 2.0 (Redecker & Punie, 2017) and INTEF from Ministry of Education, Government of Spain (INTEF, 2017). First, framework model discussed in this section is the DigCompEdu 2.0 framework from the European Commission. The DigCompEdu 2.0 framework model has three main parts: teachers' professional competence, which discusses professional engagement; teachers' pedagogic competence, which includes digital resources, teaching, learning, empowering students, and assessment; and student's competence which provides for facilitating students' digital competence. Several studies adopted this model, namely, Alarcón et al. (2020), Benali et al. (2018), Bilbao-Aiastui et al. (2021), Cattaneo et al. (2022), Lucas et al. (2021), Fraile et al. (2018), and Portillo et al. (2020). Second, model from the Common framework for digital teaching competence model from INTEF (Spanish Ministry of Education), which has five dimensions, namely, information, communication, content creation, security, and problem-solving. This model was adopted by Fraile et al. (2018) and Garzón-Artacho et al. (2021).

Teachers' digital dimensions from 15 articles were designed based on the learning subject or students faced by the teacher. For example, Walker & White (2015) discussed teachers' digital competence in linguistics, Cabero-Almenara et al. (2016) revealed teacher digital competence for students with disabilities, Cattaneo et al. (2022) showed the digital competence of vocational teachers, and Dervenis & Fetsilis (2022) showed the digital competence of lecturers. In addition, each dimension that has been suggested has a tendency to develop teacher digital competence from several sides, such as Guillén-Gámez et al. (2020) which tends to focus on digital social skills, namely on the digital abilities of teachers with students, staff, and student families. Then Elstad & Christoperses (2017) prioritize self-efficacy or teacher internal factors in using technology. Not only that, some researchers also tend to prioritize dimensions related to digital-pedagogic teachers in learning, such as assessment, determining digital sources, teaching, learning, communication, etc.

Teachers' Competence in Indonesia (Based on The Law Number 14 of 2005)

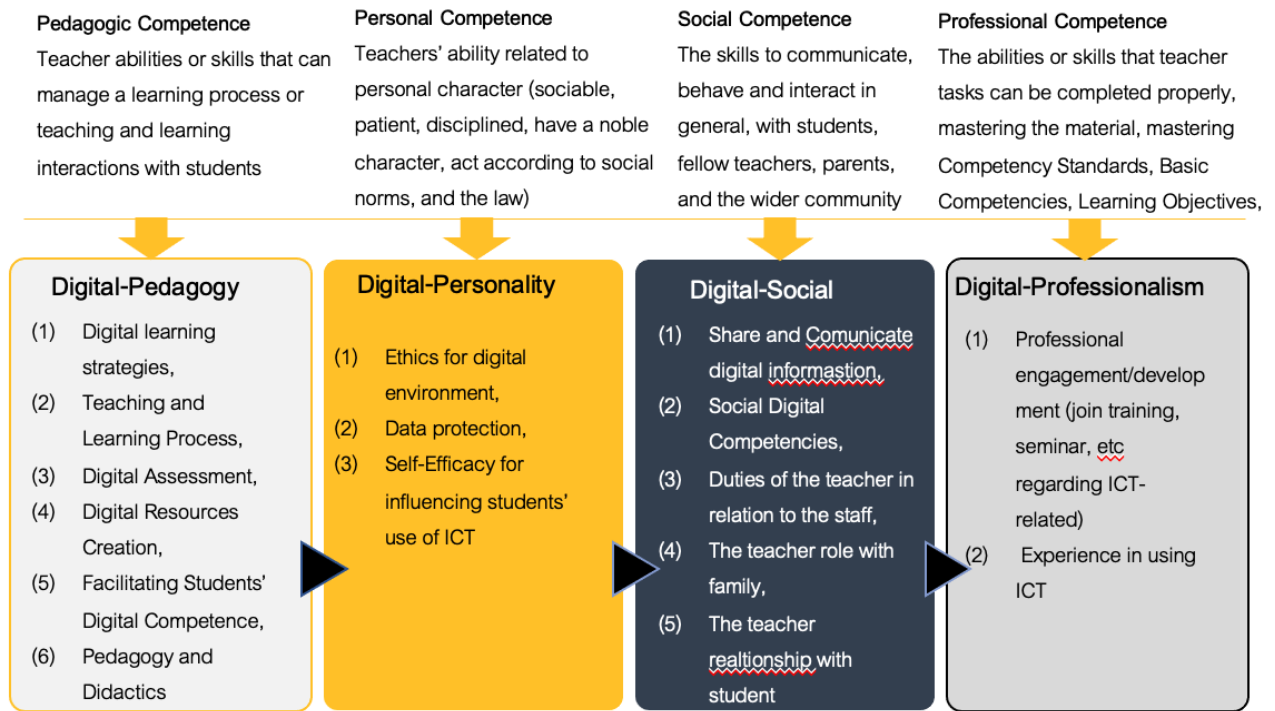


Figure 5. The Extended of Teachers' Digital Competence

The existence of differences in the perspectives of previous researchers in forming the dimensions of teacher digital competence has led to a tendency for the digital dimension of teacher competence in certain contexts, for example in professional, pedagogic, social, or personality contexts. One of the policies in Indonesia, teachers from various levels of education must fulfill the basic teacher competencies, including pedagogic competence, personal competence, social competence, and professional competence (Indonesia's Law Number (No). 14 of 2005). Research result showed on Figure 4, professionalism competence of teacher becomes the most concern of previous researchers in developing teachers's digital competence. This study in line with Dervenis & Fitsilis (2022), from 34 articles out of 39, have addressed the "professionalism", suggesting its necessity. The characteristics of Professionalism is the subject of one's professional activity in relation to how specialized a teacher is and how recognized he/she is in the field in which they teach. It also refers to how well he/she knows and applies methods and principles that govern their field while ensuring the interconnection between theory and practice (Dervenis & Fitsilis, 2022). Besides, Previous researchers did not pay much attention to the social and personality aspects of a teacher when building digital competence. To complete the gap, Figure 5 presents the dimensions of teachers' digital competence which are adjusted to the basic competencies. So, it can produce a more comprehensive dimension of teacher digital competence. Please note, Table 4 has several dimensions with different name but having same meaning. To make sure there are no duplicate words in every teacher competence, this study will choose the word that best represents each competency.

### Teachers' Digital Competence Level

The collected teacher digital competence research was carried out using different dimensions (Table 4). Although using a different dimension, the researchers showed that the level of teacher competence was at a low level (Astuti et al., 2021; Benali et al., 2018; Diz-otero et al., 2022; Fraile et al., 2018; Garzón-Artacho et al., 2021; Mutohhari et al., 2021; Portillo et al., 2020; Suoh iypardi & Hakim, 2021; Zhao et al., 2021). Teachers' digital competence is said to be low because teachers do not understand specific competencies. The author divided two factors that make teachers' digital competence still low, namely internal and external factors. For internal factors, Teachers still have low scores on the ability to create, understand information literacy, and improve their problem-solving skills (Fraile et al., 2018; Garzón-Artacho et al., 2021), to ensure communication security (except for the protection of digital data and digital identity), content creation ability (Benali et al., 2018; Fraile et al., 2018), caring, capability, creativity, critical, and lack of years of experience in using digital technology (Astuti et al., 2021), teachers' knowledge of technology and teachers' using media (Diz-otero et al., 2022). For external factors, teachers only have a short time to attend training in the field of digital skills (Portillo et al., 2020), teachers do not use multi-media technology in the learning process (Supardi & Hakim, 2021), teachers only using low technology quality and the lack of available laboratories (Mutohhari et al., 2021).

The level of digital competence is at a medium to low level (Basilotta-Gómez-Pablos et al., 2022; Cabero-Almenara et al., 2021). Based on the literature study, it can be seen that the average digital competence of teachers is still low. For medium to low level of teachers' digital competence, even though the school is equipped with facilities and infrastructure, there are still digital competencies that need to be improved and that teachers need to understand, namely the evaluation competence of educational practice (Basilotta-Gómez-Pablos et al., 2022). Teachers who do not know digital learning resources fall into the medium to low category.

For medium level of teachers' digital competence (Benali et al., 2018; Bilbao-Aiastui et al., 2021; Guillén-Gámez et al., 2020; Prieto-Ballester et al., 2021), teachers need to improve the components of reflective practice and Learner empowerment and facilitate Students' Digital Competence. Besides, empowering students and ensuring facilities can support students' digital competence. In addition, teachers who do not adequately use ICT tools contribute to the digital competence of medium teachers (Guillén-Gámez et al., 2020).

Teachers identified as having a high level of digital competence can be found in teachers who have the drive to operate technology in learning. Hamzah (2021) stated that after the COVID-19 pandemic, digital teaching abilities were at a high level. Meanwhile, Benali et al. (2018) revealed that teachers with high digital competence have high trust when using technology and teachers with years of experience.

### Obstacles to Increasing Digital Competence

The literature study results show that teachers' average digital competence is still low. The low digital competence of teachers is due to the obstacles experienced by teachers during the learning process and obstacles

that slow down the improvement of teacher digital competencies. The barriers experienced by teachers include the conditions of ICT infrastructure in the school, digital in curricula, and Teachers' motivation to understand digital competence.

### *ICT Infrastructure in School*

Adequate digital competence of teachers in schools can be concluded as a practice in which at least there is an excellent technological infrastructure, teachers with a high level of technological-pedagogical knowledge, and well-functioning technology-mediated communication and administration (Olofsson et al., 2019). The school's ICT infrastructure needed to implement technology-based learning is at least the availability of a desktop computer; mobile devices such as laptops, notebooks, tablets, smartphones, etc.; broadband; school website, email addresses, virtual learning environment, etc.; deployment of equipment in classrooms, computer labs, libraries, etc.; maintenance (Wastiau et al., 2013).

School students who are dominated by a technology-literate generation make students able to operate gadgets more dexterously, especially in generation Z (Basantes-Andrade et al., 2020). These phenomena make students addicted to social media and entertainment content on social media. So, schools and teachers need to make school infrastructure an essential point in creating a digital environment. Moltudal et al. (2019) emphasize that the lack of ICT infrastructure dominates classroom management problems compared to teacher pedagogical problems. Teachers using low technology and schools with few laboratories lead to low teacher digital competence (Mutohhari et al., 2021). Furthermore, it should be noted that school infrastructure in rural and urban areas also affects the improvement of teacher competence. The condition of school infrastructure for teachers who teach in rural areas is different for teachers who teach in urban areas. So, teachers in rural areas are less motivated to develop strategies for using ICT than teachers in urban areas (Arredondo-Trapero et al., 2021). In addition, when teachers already have the motivation to use technology in classroom learning, other obstacles make it difficult for teachers to apply technology in the classroom, namely weak economic resources and the few students who have mobile phones (Enochsson et al., 2021). This condition contributes as an obstacle to increasing teacher digital competence.

### *Digital in Curricula*

One of the obstacles to why digital competence is still low is that there is no discussion of technology in curriculum documents. There needs to be an integration of ICT into the curriculum (Arredondo-Trapero et al., 2021). Therefore, for educational institutions that are preparing digital competencies into the school curriculum, schools should develop awareness about teacher technology knowledge that will be integrated into the curriculum (Instefjord & Munthe, 2015). In addition, obstacles to increasing digital competence can be overcome by efforts to raise capital and social law and regulate one's resilience from an education system related to the SDGs (Portillo et al., 2020).

### *Teachers' motivation to understand digital competence*

Teacher motivation in using digital in learning is one of the factors that can develop teacher knowledge about digital learning resources (Cabero-Almenara et al., 2021). Moltudal et al. (2019) stated that the teacher is the party responsible for facilitating the learning process with ICT. Teachers with less motivation tend not to apply technology in the classroom. Meanwhile, teachers who are motivated tend to use technology in the classroom. According to Kožuh et al. (2021), teachers' digital competence can be assessed by the subjects taught. Science and technology teachers use digital tools more often when learning than social humanities teachers. The existence of collaboration between teachers is also able to trigger teachers to use technology. Enochsson et al. (2021) revealed that teachers who have difficulty finding colleagues to collaborate on teaching and learning using learning technology are a cultural challenge that teachers must solve. Teachers need to have high confidence in using technology because teachers who fear being wrong when using technology can reduce their digital competence (Enochsson et al., 2021).

### **Solutions to Improve Teacher's Digital Competencies**

#### *The role of policymakers*

School ICT infrastructure in urban and rural areas has different ways of implementing it. The proportion of ICT infrastructure assistance for schools in rural areas may be more significant than those in urban schools. The current state of each area can be a consideration for the government as the party making policies to overcome ICT infrastructure problems in rural areas by helping to provide facilities, facilities, and infrastructure that support the implementation of technology-based learning. Furthermore, Lu et al. (2015) showed that ICT infrastructure is essential in using technology-based classrooms. The government needs to determine the number of policies to formulate a tight and optimal budget for providing ICT infrastructure in schools. Wastiau et al. (2013) believe that a country's policies can play a significant role in supporting the above policies and actions needed to realize a digital education system, increasing the number of digitally supported schools and teachers, and students who have confidence in using digital education.

#### *Teacher Training and Empowerment in the Field of Digital Competence*

Concerning preparing digital competencies for teacher candidates currently taking teacher education, Ortega-Sánchez et al. (2020) stated that there is a need for training for prospective teachers or teachers who are already teaching. The training on digital competence given to student-teacher candidates in Spain and France shows differences in self-perceptions about teacher digital competence. The results of this study also indicate a need to improve technological-manipulative and didactic training for teachers in universities and to adapt teachers' digital competencies to the demands of the information communication society. Not only teacher candidates or teacher education students who need to attend training. Teachers who have taught in the world of education also need to improve their digital competence through the implementation of teacher training or empowerment in the areas of digital competence, teacher self-development, and motivation relevant to mastering digital technology

(Astuti et al., 2021; Basilotta-Gómez-Pablos et al., 2022; Kožuh et al., 2021; Mutohhari et al., 2021; Supardi & Hakim, 2021). Kožuh et al. (2021) further agree that teachers often use learning technology tools during the learning process. If teachers desire to follow technological developments and are willing to attend seminars and workshops, they can improve their digital competence.

### *Implementing the Twenty-First Century Learning Model*

Research on implementing appropriate learning models to improve teacher digital competence is rarely carried out in systematic literature research. This study describes the efforts that can be used to overcome teachers' digital competence through the application of learning innovations or learning models. Selecting suitable learning models and designs can help teachers learn and use effective technology (Conole, 2013), one of which is heutagogy learning. Heutagogy is ideal for use with online learning or technology components (Agonács & Matos, 2019; Lapele et al., 2022). Heutagogy is a learning theory that prioritizes student-center. Heutagogy is a model that shape self-directed learning, self-determined learning, complexity, reflective practice, constructivism, self-efficacy, zones of proximal development, and transformative education for student (Blaschke, 2012; Blaschke & Marin, 2020). The existence of a person's opportunity to access technology and social media such as blogs, wikis, and social media (Blaschke, 2014) allows heutagogy to develop through the ability to create and share the content, connect and collaborate with others inside and outside the classroom, share experiential learning outcomes and provide students with opportunities to learn from one another, and to reflect on what was learned and how it was learned thereby making learning more personal, independent, and self-determined (Anderson, 2019; Blaschke & Hase, 2016). So that teachers will have a greater incentive to use learning technology during the learning process, especially in terms of presentation preparation. According to Fraile et al. (2018), it is necessary to integrate ICT by combining relational and didactic aspects. The results of other studies provide suggestions so that teachers can implement synchronous collaborative learning, which involves Information and communication technology. The elements that need to be considered are cross-border contexts, classroom arrangements, and collaborative teaching methodology (Isoda et al., 2021; Wannapiroon et al., 2021). Teachers can implement any learning model as long as it integrates technology in the learning model.

### **Conclusion**

The existence of learning technology in 21st century learning encourages teachers to have good digital competencies. Learning resources in 21st century learning are not only from one source but more than learning resources. In addition, the existence of students (generation Z) who are more sophisticated in using technology increasingly requires teachers to be able to create learning resources through digital technology. Several models of the teacher's digital competence framework determine teachers' digital competence. The DigCompEdu model framework is the framework that researchers use most often. The results showed that the level of digital competence of teachers was still low or at the most basic level.

Furthermore, this is due to several obstacles faced by teachers. This study groups three blocks that cause teachers' digital competence to be still low: the condition of ICT infrastructure in the school, digital curriculum, and Teachers' motivation to understand digital competence. The study's results provide a solution through a systematic literature review. There are three solutions; first, the need for a role from policymakers or the government in creating a digital environment or ICT infrastructure in schools, especially in schools located in rural areas and schools with a high level of education—Economics of students or teachers who are not good. Second, there needs to be training and empowerment of teacher competencies in digital competence to give teachers a better understanding of digital competencies. The third is implementing appropriate learning models in 21st century learning, namely the heutagogy and synchronous collaborative learning models. Heutagogy is a model that integrates technology in it and aims to create self-determined and self-directed learning in students. So, this corresponds to the type of Shiva in the 21st Century.

This research has limitations in its implementation, namely study with research targets at all levels of education, both playground, elementary, secondary, and higher education levels. Further research can focus on only one type of education level to focus more on the problems faced at one level of education. In addition, this study only examined 47 articles collected according to the criteria. Further research can increase the number of articles studied to produce more comprehensive findings.

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## Word of Mouth Strategy Combined Andhab Asor as Problem Solving in Planning and Organizing Problems of Curriculum Development

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**Abstract:** This research aims to describes (1) problems in planning and organizing (2) actualization of curriculum planning updates, (3) actualization of curriculum organization descriptions, (4) "Gethok Tular" word of mouth strategy, (5) description of low self-esteem or low self-esteem strategies. "Andhab Asor". The method used in this study is a qualitative method, through a phenomenological approach with a case study design in the Regional Coordinator of Bantur, Malang Regency. There are 3 data collection techniques used by researchers, namely interviews, documentation studies, and observation. Data analysis techniques used in this study include (1) data collection, (2) data compaction, (3) data presentation, (4) drawing conclusions/verification. The validity data obtained through this study used technical triangulation and source triangulation, with persistence, reference testing, and member checking. The results in this study indicate that (1) the main problems that occur in planning and organizing are the lack of technology, (2) the actualization of curriculum planning planning, using online vark questionnaires to determine the learning model used by teachers with the planned 2013 curriculum design, (3) the actualization of curriculum organization lies on the basis of the patchwork curriculum and the integrated curriculum as the type of organization. (4) the word of mouth strategy is considered capable of overcoming the lack of technology from senior teachers, (5) the "Self Humble" or "Andhab Asor" strategy is considered capable of overcoming the demotivation of teachers in learning to create digital-based media.

**Keywords:** Word of Mouth, Updated Curriculum, Planning, Organizing

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## Introduction

The development of the curriculum in Indonesia from time to time has changed, especially after the pandemic (Munajim et al, 2020). On this basis, various curriculum paradigms and curriculum concepts during the pandemic and after the pandemic underwent various reconstructions and massive renewals. This is allocated to improve the focus of students, especially in learning and learning, because the main purpose of updating the current curriculum during the endemic period is the alignment of learning improvements in all regions in Indonesia (Kemendikbudristek, 2022). The pandemic period that has passed, leaves various historical problems, especially the early days when the pandemic took place. The expert explained that during the pandemic, there was a psychological problem of learning from students, called *psychological cognitive shock* (Kuhfeld et al., 2020). This is a problem that leads to low student ability in learning because they feel *shock*, because learning that was initially carried out directly through various face-to-face learning approaches, was revolutionarily changed to indirect face-to-face learning or commonly known as Online. The revolutionary change due to the pandemic has caused students' enthusiasm for learning to drop drastically.

Research from Azhari & Fajri (2021) shows that students' enthusiasm for learning in Indonesia has decreased drastically, marked by (1) low task collection from students, (2) low parental readiness, and (3) teacher readiness in organizing learners is still not optimal because teacher adaptability has not touched the optimal level. The attitude related to this has received a progressive response from the government in Indonesia, namely the issuance of an independent curriculum and an emergency curriculum as a conceptual tool that is considered capable of neutralizing learning *lag or learning loss* during a pandemic. Research from Baharuddin (2021) explains that schools in Indonesia, especially those that are still far from district and urban centers, tend to choose to use emergency curricula to deal with *learning loss*. The selection of emergency curriculum as a conceptual tool in dealing with *learning loss* is due to the readiness of schools which are considered not optimal in terms of technology and human resources in fully implementing the actualization of the independent curriculum.

The ideas of experts and researchers in the previous paragraph, will be drawn on the conceptualization of curriculum planning renewal and general curriculum organization which will then be drawn according to the background of the research site carried out by the research team. Curriculum planning itself is defined as a projection of the practice of activities grouped into (1) objectives, (2) content, (3) teaching and learning methods and processes, (4) curriculum approaches and (5) evaluations in curriculum activities (Triwiyanto, 2014). Objectives are an outline of the projection of *outputs* and *outcomes* regarding learning and learning which are the main areas of the curriculum. Content is material and subjects that exist at a curriculum level. Method, is a step or way that can be implemented to optimize learning outcomes. Approach is philosophical planning that refers to certain aspects, for example, there is a cultural approach, a technological approach and so on. Finally, evaluation is a step to *recheck* the results of the learning and learning process to ensure quality, or often called quality *assurance in learning* (Sallis, 2014).

In another aspect, there is a study of curriculum organizing which is interpreted as the arrangement of curriculum components like units containing topics, activities in learning, to competency achievements (Insani, 2019). The concept of organizing and planning the curriculum is terminologically almost the same as planning, but in the process of organizing, related to the curriculum is more detailed in a certain construct, such as *correlated curriculum*, *subject centered curriculum*, *broad fields curriculum* and so on. Moving on from this, the existing goal of the concept of an independent curriculum and an emergency curriculum is to improve *learning loss* during the pandemic through a technological approach and optimization of the role of teachers as *science communicators* Rosidah et al., (2021). There is a *gap* that occurs when this is implemented in schools that are actually still far from the city center, which is assumed that the allocation of human resources for technological approaches to learning is still lacking. The meaning of the researcher's idea is a paradox of *link and match* between the provision of policies and the ability of institutions or school readiness (*school readiness*).

The background of the research conducted by researchers faces a problem called the generation *gap*, which means that the ratio of old to new generation teachers is higher in the old generation. This triggered a *lack of technology*, so there was a problem with *school readiness* in Korwil Bantul. The background of the research conducted by the research team, which is located in Korwil (Regional Coordinator of the District for Education) Bantul, carried out unique curriculum planning and organization in preparing *school readiness* so that learning with an emergency curriculum as a tool was able to reduce *learning loss* in educational units. Broadly speaking, the strategy used by the Head of Korwil Bantul is *Word Of Mouth* (WOM) which is represented through young teachers as *agents of change*, communication patterns of "inferiority" or in Javanese commonly known as "andhap ashor", and the use of practical technology for learning efficiency in overcoming existing problems. On this basis, how to update the planning, organization, and strategy of Korwil Bantul in overcoming existing problems is interesting to be examined more deeply in this article.

## Method

This research approach uses qualitative phenomenology in the form of a case study design. Case studies are centralized research to provide concrete meaning and understanding through a single background that includes a single case, which then becomes the level of analysis to generalize an activity or event (Sugiyono, 2019). The results obtained from all these studies used interviews, non-participatory observations, participatory observations, and documentation studies as data collection techniques. The presentation used to attach all data results in the field is field notes, interview transcripts, and documentation. This research was conducted in mid-September to the end of September at the Regional Coordinator Office of the Bantul Education District with the main informants being the Head of the Bantul Regional Elementary School, the Head of SD Negeri Bantul 01, the Head of SD Negeri Bantul 02, the Head of SD Negeri 04 Wonokerto, the *fresh graduate* Class Teacher of SD Negeri Bantul 01, the Javanese Language Teacher of SDN Bantul 02, and the Class Teacher of

SD Negeri 04 Wonokerto.

Interviews conducted by researchers are carried out in depth through *indepth interview* with reference to the snowball technique. Observations carried out by researchers are carried out directly during the learning process, as well as indirect observations during the teacher meeting process. The data analysis techniques carried out in this study using steps from Milles, Huberman, & Saldana (2014) include data collection, data condensation, data presentation, and drawing conclusions. Then the research team used data credibility checking through source triangulation and engineering triangulation. This the results related to this research are accurate, certain, and in accordance with the reality in the field.

## Result

### Results of Actualization of Curriculum Update Planning Update in Korwil Bantul

The actualization of curriculum update planning in this study, provides the main focus on how (1) objectives, (2) content, (3) methods and (4) evaluation and assessment of learning carried out at the basic education level at Korwil Bantul. Broadly speaking, the mapping of the actualization of curriculum update planning in Korwil bantul will be attached to table 1.

**Table 1. Curriculum Planning Structure in Korwil bantul**

Purpose	Intended competence	Contents Curriculum structure	Learning
Preparation for the implementation of an independent curriculum in 2024 and reducing the impact of <i>learning loss</i> within the scope of elementary schools in Korwil Bantul	Basic Competencies (KD) simplified by the Government to focus on essential competencies and prerequisite competencies for the continuation of learning at the next level	Using the Elementary Curriculum Structure in the modified 2013 Curriculum, through internalization of the use of <i>Vark Questionnaire Online</i> as a tool to determine learning models in a particular class scope.	Learning focuses on essential and contextual education and learning so that teachers and students are not burdened with the demands of completing all curriculum achievements and parents are facilitated in learning assistance at home and adjustment of learner models to learning styles in the classroom population

A detailed presentation was put forward by the Head of Korwil bantul, if the purpose of curriculum planning refers to adjusting the direction of the independent curriculum to the abilities and characteristics of elementary schools in Korwil Bantul. The characteristics in question are the ability of human resources and the availability of facilities and infrastructure. The actualization of curriculum planning in Korwil Bantul, said by



the main informant, namely the Head of SDN Bantur 01, stated that the content of the existing curriculum refers to subjects that are separated for grade 1 and grade 4, while the remaining classes refer to learning that is thematic in nature. The difference that shows the practice of modifying the content and learning methods that must be carried out by each basic education unit at SDN Wonokerto 04 is the use of *Vark Questionnaire Online* as a determinant of the learning method implemented in each educational unit. Freshgraduate teachers at SDN 01 Bantur revealed that the allocation of *Vark Questionnaire Online* (VCO) in the learning process at Korwil Bantur, is the main guide in implementing the learning model. *Vark Questionnaire Online*, is a *free platform* that can be used by everyone in determining learning styles.

Technically, the use of VCO in the allocation of curriculum update planning is grouped or broken down into 5 stages according to exposure from *freshgraduate* teachers at SDN Bantur 01. This is done through (1) the translation of the English questionnaire on the *web*, which is written through a *print out page* and before printing the questionnaire is given first to teachers who have English skills so that there are no misinterpretations. The second is (2) *charging one by one* students to fill in the questionnaire through the assistance of a teacher on a *laptop* device. When carrying out the second stage, the teacher holds a *print out page* containing the translation of the questionnaire so that when students fill in, each item of the questionnaire will be explained by the teacher so that students understand the intention of each questionnaire and choose answers according to their preferences. Head of Korwil Bantur explained that the activity of filling one by one students with technical students advanced one by one to the front of the class or precisely the teacher's desk due to the limited *gadgets* owned by the students. Another thing, explained by the head of SDN Bantur 02, confirmed that this activity was carried out at the beginning of the subject meeting. The third is (3) a recapitulation of students' learning styles in one class. The freshgraduate teacher, explained that in this regard, one thing that is carried out is to collect data by students one by one, related to the tendency of their learning styles to be included in *visuals*, *read/write*, *kinesthetics*, or *audio*. Fourth, is (4) generalization of student learning style tendencies in a class group. The teacher when carrying out the fourth process carries out activities by interpreting all the learning styles of students in one study group or class, then it is determined that the majority of learning styles in the scope of the class are included in which learning style. Finally, the fifth step is (5) determining the emphasis of the learning process using which learning theory model, as well as adding media that will be used in the learning process. The following is a table of guidelines used by schools in determining the learning model used by teachers.

**Table 2. Table in Model Determination and Learning Media based on VCO**

No	Trends in Learning Styles in the Class Population	Learning Models and Media
1	Visual	Model : Demonstration, Simulation Media : Vidio, Compact <i>handout</i> in the form of PPT, props, textbooks, <i>quizziz platform</i>
2	<i>Read or Write</i>	Model: Project based learning, lectures, independent

		<p>assignments in the form of small essays.</p> <p>Media : Compact <i>handouts</i> in the form of PPT, textbooks, <i>quizziz platform</i></p>
3	<i>Audio</i>	<p>Model : Lectures, group discussions, collaboration, role-playing</p> <p>Media: interactive video, <i>utilization of youtube platform</i></p>
4	<i>Kinesthetics</i>	<p>Model : <i>field trip around schools</i></p> <p>Media: Utilization of teaching aids and the environment around the school, textbooks</p>

When the researcher asked about the reason for using such a learning model and media as shown in table 1, it was to avoid confusion from teachers whose nature belonged to the old generation, said the main informant, namely the Head of the Bantur Korwil. The comment on this was continued by an expression from a Javanese teacher, who said that during the meeting to determine the model and media, there were many designs from Korwil, but the teacher *enjoyed* and was more happy if the exposure to learning models and media was still thick with elements of the old but varied learning model. So it can be concluded that the method for planning curriculum renewal in Korwil bantur does not lead to learning that is thick with new elements, but still has an impact and is able to make teachers not feel objections in their teaching practice because the teacher's capital only needs to remember the syntax of learning that has been learned in the past.

The Head of SD Negeri 04 Wonokerto emphasized that the foundation used to determine curriculum update planning or specifically in learning methods, a technological approach is used. The technological approach is based on the use of *online questionnaire vark* in determining learning media. The head of SD Negeri Bantur 02 gave an explanation if this was considered effective, because the attention of students, when learning took place, was assessed by informants with a higher level of concentration. Projection from the Head of SD Negeri Bantur 02, it is due to the suitability of the learning model with the learning styles of students who encounter harmony. This is also evidenced by *freshgraduate* teachers where activities in the classroom are generally students easily sleepy, when using *vark questionnaire online* students are easier to provide *feedback* in two-way communication with the teacher.

The final focus, as the research team will explain, is the evaluation of student learning outcomes. In this process, there are two general assessments examined by researchers, namely the Midterm Assessment (PTS) and the End of Semester Assessment (PAS). The planning for curriculum updates related to the evaluation of learning outcomes or student learning assessment is prepared through a special team called KKG (Teacher Working Group) and there is assistance from Korwed (Coordinator of Education Division) for PTS while for PAS explained by the Head of Korwil Bantur compiled by the Education Office. Related to the assessment of student learning evaluation for grade 1 and grade 4 subjects are assessed separately, but for grades 2, 3, 5, and 6 the assessment process is carried out in an integrated manner, except for Mathematics and Javanese lessons

during pts. For the implementation of PAS is carried out separately in each subject.

**Table 3. Allocation of PTS and PAS in Planning for Evaluation of Student Learning Outcomes**

Types of Assessments	Drafting Team	Assessment Concept
Summative Midterm Assessment	KKG Team from the District Coordinator for Education and the Coordinator of the Head of Education	a) Grade 1 and grade 4 are implemented separately for each subject b) Grades 2, 3, 5, and 6 are carried out in an integrated manner, except for mathematics and Javanese subjects
Summative End of Semester Assessment	Malang District Education Office	At each grade level it is carried out separately

The Head of Korwil Bantur, emphasized that the process of pts by the KKG and Korwed teams was carried out according to the table above and related to Mathematics and Javanese language was separated, because to combine the constructs of the two subjects into other subjects was considered difficult, although it was actually capable of being carried out. The informant further stated that this was feasible, but reviewed from the depth of his assessment which was difficult to implement. Therefore, it can be concluded that the planning for curriculum renewal in Korwil Bantur, in content is still the same as the 2013 curriculum, which is different in terms of learning objectives, methods, and evaluations. The objectives emphasize technological preparation for an independent curriculum and emphasize the harmony of student learning styles with learning models and media by teachers. The method used focuses more on optimizing student attention and student passion in recovering *learning loss*, as well as evaluations that are carried out variably for each grade level.



Picture 1. Focus Group Discussion in KKG Team Activities

**Actualization of Curriculum Organizing Updates in Korwil bantur**

Updates in the organization of the curriculum in Korwil Bantur, will be explained the results of the research in

the field by the research team through two points, namely (1) the procedural basis for curriculum reorganization and (2) the type of organization used in the research background. The first point is explained by the main informant, namely the Head of the Korwil, if the reorganization in the curriculum update implemented refers to the patchwork and error studies in the previous period. This was reinforced by the presentation from the Javanese teacher who revealed, if practically, the organization of the curriculum and the implementation of the curriculum in the period before the modification, lies in the direction for an elusive learning model. It was revealed by the relevant informant, if the learning model is like *jigsaw* learning, then there is a learning model that is felt to be new for the old generation of teachers, the guide is abstract and difficult to understand. Through modifications in learning methods as one of the contents of the curriculum, equipped with the help of several strategies from Korwil, all teachers are able to adapt the existing learning process. The head of SDN Bantur 02 argued that the patchwork process in the curriculum that is now being carried out in Korwil Bantur, refers to the process of active involvement of all teachers, because they get knowledge updates, but are not effectively patronizing by new teachers. In this regard, it will be discussed more deeply by the research team in communication strategies and *word of mouth*.

Another core thing that the research team got was in the second focus, namely the type of curriculum organizing organized by Korwil Bantur. The type of curriculum organization launched by Korwil bantur is an integrated curriculum. The Head of Korwil Bantur described the *integrated* curriculum as a new curriculum organization. This is actualized in the presentation of learning materials in units without holding various restrictions between subjects. The results in subjects except Mathematics and Javanese language have no particular restrictions. The head of SD Negeri 04 Wonokerto stated that if there are no such restrictions, there are shortcomings in practice, namely teachers who tend to be lazy when getting supervision, there are often some suboptimal behaviors. This suboptimal behavior is due to the ability to create and innovate in teaching practices is still poor. Low motivation and laziness to combine different constructs in learning became the main problems. However, it was confirmed by the Head of SD Negeri 04 Wonokerto that if this does not happen to all teachers, only a small population will experience this obstruction.

*Freshgraduate* teachers from SDN Bantur 01 also stated that to implement an *integrated curriculum*, it takes a strong will and determination to be creative in compiling various constructs in subjects, so that they are able to be transformed into comprehensive learning so that learning objectives can be implemented. The information obtained from the Javanese teacher is also similar to the *fresh graduate* teacher, but the Javanese language teacher emphasizes more on work patterns in schools, which often Javanese teachers help other teachers to carry out the integrated curriculum. For the various ideas as conveyed, it can be concluded that in the basis of updating the curriculum organization in Korwil bantur using patchwork and the foundation of learning from old mistakes, then for the type of curriculum organization that becomes an update is the *integrated curriculum*.

### ***Word of Mouth* Strategies on Curriculum Planning and Organizing**

The problem that arises due to planning and organizing in curriculum updates in the Korwil bantur area is the

lack of technology, namely the lack of teacher capability in the process of using technology in learning and learning. This was revealed by the Head of Korwil Bantul, if the use of *technology platforms* as a support for the learning and learning process in Korwil Bantul is still bumped by teachers who are not able to operate various technological assistance. The Head of SD Negeri Bantul 01 stated that the problem of "Gaptek" or stuttering technology is represented through (1) the ability of teachers In using *quiziz* is still low for the allocation of variations in the student assessment process, (2) the ability to make *power points* is still poor, characterized by the lack of use of these media in learning in the pre-pandemic curriculum period, and (3) the creation of interactive videos that were still poor before the pandemic. Expressed by the *freshgraduate* teacher as an informant, if one of the reasons the teacher is not able to carry it out, is because every time there is training, the teacher does not feel that the instructor is there as a friend and the learning process stops when the training is over. Javanese teachers explained that in the past, teachers wanted teaching agents in each of their educational institutions, and were given special responsibility to teach by word of mouth without structured training.

It is on this basis that the head of the Korwil bantul allocates teachers under the age of 35 as peer teaching agents for teachers in his school through the provision of definite responsibilities, and the existing teaching process takes place incidentally. Head Korwil Bantul stated that if the old generation of teachers are meant, it is teachers whose age is calculated as of 2022 to exceed the age of 35 years. This is reinforced by a statement from the Head of SD Negeri Bantul 02, if himself and his colleagues who are still teachers also feel the *lack of technology* and feel efficient if the training is carried out through the selection of teachers under 45 years old as individuals who are given debriefing, then transmitted to their school members, so that whenever the teacher wants to consult it will always be able to be carried out without having to wait for training with certain institutions. or waiting for the Korwil program to be implemented.



Picture 2. Pelaksanaan Strategi *Word of Mouth*

Head Korwil Bantul stated, if in English this is called the word of *mouth* but if it is in Javanese concept, this can be called "Gethok Tular", but in the construct of teaching peers word of mouth tentatively. Therefore, the

process of implementing the *word-of-mouth* strategy in Korwil Bantur is carried out through several stages (1) *collecting*, (2) *guiding and building*, (3) *actuating*, (4) *controlling*, (5) *re-building*.

*Collecting*, is a process allocated to screen teachers in any elementary school within the scope of the Korwil Bantur area that is included in the *freshgraduate* category. The head of SD Negeri 02 Bantur, stated that what was declared *freshgraduate* was a teacher who had not touched 15 years after he graduated from his last education. The number of teachers collected will later be included in the *guiding and building* stage. In the *guiding and building* stage, what is carried out is the provision of training using a *workshop* model, which is followed by teachers who are screened in the *collecting* stage. The material provided in the guiding and building process is the management of (1) student test assessment through *quiziz*, (2) making interactive *powerpoints*, (3) *sparkol video animation maker* and (4) "inferior" or "andhap ashor" communication. The training lasts for 6 working days which is carried out in February with an allocation of 2 training days every week. Each training gets an allocation of 10 JP which is divided into 2 days. Related to the communication material "inferiority" allocated 3 JP in 1 day.

*Guiding and building* What has been carried out produces an agent of change in the curriculum process, will be continued by *actuating*, where teachers who have been equipped with these various abilities will transmit their knowledge to the school through activities compiled by the school itself. *The freshgraduate teacher* stated that when it comes to *actuating*, the majority of teaching to other teachers is carried out on a one on one or one on two basis, and a maximum of *one on three*. The number of teachers taught by teachers with curriculum change agents when exceeding three will generally be carried out small group training, but generally schools will carry out training internally which all teachers participate in. The Head of Korwil gave a statement, if teachers who have been equipped with workshops can provide teaching to other teachers through (1) structured training organized independently by the principal and (2) tentatively independent training if needed by teachers from their schools.



Picture 3. Implementation of *Building and Guiding* in *Freshgraduate* Teachers

The *controlling* stage is a step carried out by a school superintendent to check whether teachers have been able to carry out the creation of learning media and technology management as well as the initial goal of the *word of mouth* strategy from the head of Korwil Bantur. The last is the *rebuilding* stage, where an activity carried out is to coordinate what material should be used as *workshop* material for the next academic year. It can be concluded from the various exposures that exist, if the *word of mouth* or "gethok tular" strategy is an activity to overcome the lack of technology of teachers, through the appointment of teachers with *freshgraduate* criteria to become agents of change in the context of neutralization of "Gaptak" from teachers. Head Korwil Bantur stated that it can be called *a word of mouth* because schools more often carry out training individually and are tentative because they are considered more *enjoyable*, and cause an effect if the agents of change are not only teachers who are given *workshops*. Teachers who previously did not know the material, then taught the material by *the freshgraduate* teacher became able to create learning media, which then also taught their friends. Head Korwil Bantur stated that it was because of the domino effect of word of mouth in the context of making learning media that made him give the name *word of mouth* to this strategy.

### **"Inferior" Communication Strategies in Curriculum Planning and Organization**

Explicitly, the informant, namely the Head of SDN Bantur 01, stated that a small problem that generally arises in the process of transforming new knowledge from peers in the school environment is the attitude of senior teachers who tend to feel patronized by their juniors. On this basis, the Head of Korwil Bantur attached a material on low self-esteem communication as a *workshop* that was carried out to reduce these problems. The low self-esteem communication strategy, in the *workshop* was launched through three main things, namely (1) the concept of looking at senior teachers as parents of *freshgraduate* teachers or the concept of "upload-unggah", (2) the main focus of teaching new things, not telling stories about achievements that make other teachers feel less competent, and (3) planting *a growth mindset*. The concept of viewing senior teachers as parents of *freshgraduate* teachers is a step used so that the teaching process individually or independently still internalizes the value of politeness in it. Therefore, *freshgraduate* teachers understand the material by being represented through always respecting senior teachers, placing themselves as children who teach parents, and giving smiles whenever senior teachers have difficulty in implementing the development of learning media for their teaching process in the classroom.

The head of SDN 04 Wonokerto gave his opinion, if the provision of material to focus on teaching, without boasting of themselves from *freshgraduate* teachers makes senior teachers more comfortable when the training is carried out. This is strengthened by the Javanese language teacher, if he explains that if *peer teaching* training is carried out with a communication process from a tutor who always prides himself proud, academic confusion will arise, which will certainly trigger demotivation in learning new things for senior teachers. Finally, with regard to the material on the application of *growth mindset*, it directs *freshgraduate* teachers not to feel more powerful and smart than senior teachers.

The idea of the class teacher at SDN 04 Wonokerto explained that the application of *growth mindset* material

in the *workshop* makes *freshgraduate* understand, although senior teachers are weak in terms of technology, senior teachers have experience in *handling* learning optimally in practice because of high flying hours, so that if you put yourself in the *growth mindset* of *freshgraduate* teachers. Not only does it teach new things to senior teachers, but it also learns new things to senior teachers about their teaching experiences to life experiences that are told generally when individual training is conducted if the *freshgraduate* teacher positions himself as a humble individual. Therefore, the head of Korwil Bantur stated that the embryo of the *word of mouth* was caused by a harmonious self-compaction between a *freshgraduate* teacher and a senior teacher.



Picture 4. Strategi Rendah Diri “Andhab Asor”

**Discussion**

**Actualization Analysis of Curriculum Planning Updates**

Researchers are of the view that all aspects of the curriculum planning renewal implemented by Korwil Bantur contain the characteristics of the institution's self-awareness to develop by utilizing potential and overcoming *existing gaps*. In the realm of implementing the old curriculum towards the new curriculum, it is necessary to achieve short-term goals before entering into long-term goals. The researcher's opinion is in line with the expert opinion, which states that the maturity of an educational institution is represented through the ability to utilize the maximum potential possible through the initiation of a leader (Berkovich & Eyal, 2018). Rationally, when viewed from the existing objectives Korwil Bantur does not convey explicitly about the type of purpose. Research from the research team, constructing when it comes to aspects of goals, Korwil Bantur puts two objectives in its construct. These two things are short-term goals and Long-term goals.

The short-term goal allocated in the curriculum planning update is to overcome *learning losses* within the scope of Korwil Bantur elementary schools, while the long-term goal is to prepare for the implementation of



an independent curriculum in 2024 massively in Indonesia. Theoretically, such a pattern of curriculum objectives is said to be preventive and curative of curriculum problems in the context of future and present considerations (Rosidah et al., 2021). The management process of such curriculum renewal should be able to be adapted to various other educational units so that the short-term and long-term national curriculum can be optimally achieved. With regard to the content and methods as has been applied by Korwil Bantur, it focuses on learning that focuses on the suitability of the learning model with the learning style of a student. This in the renewal of curriculum planning is called a *link and match between context to fields* (Zadina, 2014). The impact that arises due to the *link and match* between learning styles and learning models by teachers will put students in the learning process through the *DNA of peak performance* conditions (Oettingen et al., 2009). The meaning of this is a condition where students are passionate about learning which is characterized by the student's passion for optimal learning in each subject.

With regard to the renewal of curriculum planning from the concept of evaluation and assessment of learners, using a varied model in the results. This makes the assessment more in-depth for the achievement of student competence, because research from Suyitno & Rochmad (2015) states that mathematics learning assessment cannot be combined with other learning contexts, if the learning and learning process can be internalized, but for end-of-semester and midterm tests it is not recommended. The cause of the expert theory is because the philosophical foundation of learning mathematics should indeed be given tests separately from other lessons, so that the development of mathematics *problem solving* can be delivered in depth and complex. Learning mathematics if the test is combined with other subjects, then all competency indicators cannot be implemented (Suyitno & Rochmad, 2015). The research is also in line with other research that discusses mathematics subjects Musdi & Anggrawati (2019) if the assessment in mathematics lessons must contain independent principles, which means not internalizing other disciplines so that *critical thinking* to solve story problems focuses on students' logical mathematical abilities.

With regard to the assessment of Javanese which is also separated like mathematics subjects, there is research that reveals that in Javanese language subjects assessment must be isolated from other subjects, because it discusses culture, word meaning, and habits that cannot be mixed with other lessons, when combined with the assessment test, the local linguistic ability of students will not be seen specifically (Meliana, Sudi Utami, & Sukoyo, 2020). Therefore, it can be concluded that for all existing exposures, in the update of curriculum planning in Korwil Bantur, it was found that the suitability of the context empirically and theoretically to various practices that have been implemented in the research background.

### **Curriculum Organizing Update Analysis**

The results obtained by the research team in this study show that (1) the procedural foundation used for curriculum organization renewal is a patchwork and error study in the previous period, and (2) the allocation of *integrated* curriculum in the type of curriculum organization. In the first point, it can be concluded that the various implementations of curriculum organization renewal in Korwil Bantur are reflective processes. The

reflective process is a completion step that bases evaluation in the previous period to create a new, more guaranteed quality (Ghavifekr & Rosdy, 2015). The meaning of the expert's idea gives meaning that Korwil Bantur in this process is an educational institution that is able to carry out *continuous improvement*, because the leader of the institution is proactive to the various achievements of the institution he leads, so that the movement of subordinates towards optimal quality is easier to achieve. This is generalized to be easily achieved because of the *awareness* of high leaders in terms of responding to the performance of the institution. In line with the expert expression if the leader of the institution who has a high awareness in responding to falling performance, is an indicator that quality development will occur both in the short and medium term (Burhanuddin, 2017).

In the second point, a problem was found that in the implementation of the *integrated curriculum* through the observation of the principal, if teachers with low creativity tend to be lazy to carry out various activities in thematic learning. One thing that can be done to overcome this, is to provide academic supervision in a directive manner. This happens because the teacher is in the quadrant of teachers who *drop out*, meaning that the teacher has low motivation and a poor level of abstraction (Glickman, Gordon, & Gordon, 2013). The principal's role that can be carried out for such case studies is to provide assessment, guidance, and motivation in a directive manner where it is represented through daily observation of the teacher's development. Teachers will feel supervised at the beginning, but this makes teachers moved to change their lazy habits. Problems related to laziness when considered complete, the directive process in academic supervision is then through guidance to improve abstraction, can be included through seminars outside the school, or providing stimulation to stimulate the creative mindset of teachers from a supervisor or principal.

The researcher's opinion is in line with the expert's expression which states that the provision of directive supervision is represented through the perception of teachers who feel supervised but in a positive form, then accompanied by guidance by directing to *details* related to the context of the problem as stimulation so that teachers are able to increase abstraction and commitment in completing responsibilities as educators (Hoque et al., 2020). On the basis of experts and their comparison with the opinions of the research team, it can be concluded that the update of curriculum organization is in accordance with theoretical and practical expectations, but with regard to the implementation of the *integrated curriculum*, academic supervision assistance is needed so that these contextual problems can be neutralized.

### **Word of Mouth Strategy Analysis in Curriculum Planning and Organizing Updates**

Based on the results as stated in the previous section, the main basis for implementing the *word-of-mouth* strategy is the condition of human resources in Korwil Bantur which is more old generation than the new generation (*generation gap*) which then causes problems in the form of *lack of technology*. Analysis related to the condition of human resources, researchers want to convey if the characteristics or identities of educators can certainly affect their teaching patterns. If examined thoroughly, generation X is an individual born between 1965 and 1980 (Lissitsa & Kol, 2016). The advantages of generation X characteristics according to

Yigit & Aksay (2015) a number of advantages of generation x are (1) adaptation to technology that is not too difficult because daily life has been assisted by technology, (2) not wanting everything instantly (3) generation X's intense and high work climate. If these three points are drawn into the context of updating curriculum organization, of course teachers in Korwil Bantur are suitable for implementing *word of mouth*. In the second point, it is a good enough advantage for an implementation of the learning development process, because the advantage of a teacher who does not want everything instantly is the fundamental foundation for the success of various learning innovations, because one of the causes of failure of an innovation and also change is the desire of a leader who wants to innovate and change instantly (Burhanuddin and Zahri, 2016). When connecting from various points, the third or last point is a point that refers to high x-generation workability.

This will certainly boil down to the breakthrough of an optimal comfort zone in the organization. Because it leads to a hard and committed organizational work. In line with the expression Razzaq & Forde (2013), that high work commitment can have an effect in the form of growing the quality of institutions that are positive in nature. Research from Juharyanto et al., (2020) states that if positive word of mouth information without specific direction, then gives implications for the development of a population towards quality improvement then it can be referred to as "Gethok Tular". The research, if connected with the results of research from the research team, the implementation of "Gethok Tular" occurs when structured initial planning is used to form *an agent of change* in the context of neutralizing the problem of *lack of technology* intended for *fresh graduate* teachers in senior teachers, actually developing positively. Namely the formation of *a learning community* from teachers because senior teachers who have gained new knowledge from *freshgraduate* teachers, although not given written responsibilities, he transmits this knowledge to his colleagues through word of mouth. *Learning community*, is a community that is formed both in a structured and spontaneous manner due to the mutual relationship between the giver of knowledge and the recipient of knowledge (Bednarz et al., 2011).

After being given an overall analysis *of the word-of-mouth* mechanism as a strategy to solve problems in planning and organizing curriculum updates, the research team will provide an analysis of the content or content of the existing material. Paparan mengenai konten atau materi yang ada Explained by the informant in the form of the use of *quiziz*, making interactive *power points*, and video animations. In terms of content or content of this strategy in accordance with the needs that exist in the learning process in the 4.0 era. In line with the expressions put forward by experts, when it comes to the allocation of media that is suitable for use now, is a media based on (1) measuring student values based on an *online* system, (2) exposure to interactive material with digital devices, and (3) providing illustrations from animations to strengthen a student's understanding of a certain material (Chick et al., 2020) . Apart from being more interesting because of the large number of colors that are not limited by the whiteboard, providing material through interactive exposure to both *power points* and animated videos can strengthen the memory of a student. Therefore, on the basis of various exposures as explained by the research team, it can be concluded that the implementation of *word of mouth* in overcoming the problems of planning and organizing curriculum updates in general and content-wise is the right step. At the level of planning and organizing the allocation of word of mouth as a conceptual and practical tool to create output in the form of teachers who are able to compile content, methods, evaluation and

learning models in accordance with the curriculum implementation reference, then create outcomes for the preparation of teachers at a higher level related to school readiness for massive independent curriculum implementation in the future.

### **Strategic Analysis of "Inferior" Communication Patterns in Curriculum Planning and Organizing Updates**

The strategies used by the Head of the Korwil bantur in implementing the strategy of communication patterns are communicated through 3 constructs, namely (1) the practice of "uploading, (2) focusing on providing material rather than telling about one's own achievements, and (3) planting a *growth mindset*. Low self-esteem is a psychological condition When an individual feels that he still needs to improve the quality of himself and views the interlocutor or other person as an individual who can be used as an object to improve his personal qualities (Mroczek & Kolarz, 1998). When connected with other things whose nature is out of context, according to Mroczek & Kolarz (1998), *lowkey* or low self-esteem in adulthood can increase life *wellbeing* or happiness in life, because he feels that he is not competing with anyone to cause mild psychological disorders such as *overthinking* and *insecurity*. The practice and implementation of "upload-ungguh" in the strategy of inferiority communication, was assessed by the research team as a behavior that makes the interlocutor or others become appreciative of what is conveyed because the dimension of politeness is fulfilled.

The idea of the researcher, supported by research from experts, if the right *attitude* will make a person with the interlocutor allow the subconscious to obey the apperception and perception of the communicator (Nashori, 2009). Therefore, in some contexts of discussion about leadership, the attitude of the leader can determine the attitude of subordinates in completing the tasks ordered by the leader. Second, it is to focus more on the core of the transformation of knowledge than to be busy telling one's own achievements. On the concept of culture organisasi, hal tersebut merupakan bagian from *toxic* communication that directs the communication opponents of the communicator to a decrease in self-efficacy (Kreitner & Kinicki, 2001). Therefore, the allocation of such strategies to reduce the dominance side of *freshgraduate* teachers can be neutralized using this second method. The last is the cultivation of a growth mindset, an appropriate analogy to describe a *growth mindset* is a half-full cup which is interpreted as an individual's self-awareness to always be willing to learn from anyone regardless of status, age, class, race, religion, or rank (Zilka et al., 2022).

Broadly speaking, it can be considered that there is consistency between the theoretical and practical foundations implemented at Korwil Bantur to neutralize organizing problems and also curriculum planning. The research team wanted to provide other information about this, namely on a cultural basis, "upload-ungguh" reflects the manners of the Javanese community, especially to older people through subtle language and giving smiles (Chotimah, Untari, & Budiman, 2019). This is done in practice, for example, if there is a person whose job rank is higher than that of an older person, so if he uses "upload-ungguh", what will happen is that the superior still calls his subordinate politely by not calling his name directly, because in the context of

Language on "upload-unggah", calling someone directly by name is a misappropriation and comes out of the concept of "upload-unggah". The researcher's assumptions regarding the results of this study, of course, *freshgraduate* teachers have this dimension, so that various implementations of low self-esteem communication pattern strategies can be created in the educational environment of Korwil Bantur.

## Conclusion

Based on the presentation of the results and discussions in this study, it can be concluded that (1) updating curriculum planning in Korwil bantur uses *online questionnaire vark* as a basis in determining the learning model and media used, (2) on curriculum planning in Korwil Bantur using content in accordance with the 2013 curriculum which is modified into an emergency curriculum through the concept of thematic learning methods, (3) the objectives in the renewal of curriculum planning consist of neutralizing the *lack of technology* of a teacher and the allocation of preparations for the implementation of an independent curriculum massively in the future, (4) on updating curriculum planning Korwil Bantur using evaluation of student learning in summative concepts through PTS and PAS which are distinguished between grades 1 and 4 using separate lesson units, while the rest of the classes use integrated summative assessments except in mathematics and Javanese subjects.

Fifth, is (5) the basis for updating curriculum organizations in Korwil Bantur using patchwork and evaluation of errors in the past, (6) using *integrated* curriculum as a type of curriculum organization. An interesting finding of the problem that exists within the scope of the study is the *generation gap* between *freshgraduate* teachers and senior teachers which causes a core problem in the form of *lack of technology* in teachers. *The problem solving* used to overcome these problems is (1) *word of mouth* or "gethok tular" strategies and (2) "low self-esteem" or "andhab asor" communication pattern strategies for *fresh graduate* teachers who are facilitators of senior teacher learning related to the operation of technology problems in learning. Various research findings and problem solving in Korwil Bantur are in line with theoretical and practical foundations, it's just that teachers who are lazy when carrying out integrated learning because their creativity is also low, should be given directive supervision as *problem solving* so that the teacher quadrant is not included in the *drop out* quadrant

## Suggestion

Based on the various reviews in the conclusion, the researcher advises readers to (1) be able to imitate planning and organizing models, as well as *problem solving* as is the case in this article so that the implementation of the curriculum has a strong readiness, which starts from planning and organizing. For other researchers (2) the effectiveness of *such problem solving* should be further studied using a quantitative approach so that positivistic data exposure can be seen clearly measured.

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## An Investigation of Rhetorical Questions in Obama and Cameron's Political Speeches

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**Abstract:** Rhetorical questions (henceforth RQs) are one of the significant linguistic forms used by a politician to achieve effective communication strategies. The present paper aims at investigating the significance of RQs in political discourse by examining Obama and Cameron's political speeches and comparing them to different social, political, and economic dimensions during the period (2014-2015). The study sample includes twenty speeches: ten speeches for each president. The method of research will be quantitative and qualitative in nature so as to examine the strategic use of RQs by Obama and Cameron to achieve their political goals. More specifically, it examines the functions, features, and types of these questions in light of the topic of speeches. The results show that Cameron is more capable of achieving rhetorical effects in his speeches than Obama and both of them use Wh-questions more than other types of RQs. Besides, the use of RQs in social topics is more than in political and economic topics.

**Keywords:** Rhetorical questions, Ordinary questions, Syntactic functions of RQs, Pragmatic Functions, and Political goals.

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### Introduction

Rhetoric has been considered one of the significant linguistic forms used to affect the minds of an audience. Yankah (1994, p.3568, cited in Abioye, p. 290) defines rhetoric as "The art of effective argumentation with the view to influencing opinion". Since many years, scholars attempted to investigate it from different areas so it has gained some various definitions and labels. However, this reason makes rhetoric, which represented by RQs, more confused linguistic device. Functionally, QRs could achieve some effective communication strategies. Thus, politicians have taken advantage of them to play on the emotions of their audience to persuade people to take their sides. As, result, we see that RQs have been widely exploited in political, social, and cultural situations to convey an implicit message to the audience so as to win their agreement. They are often used to strengthen and support spoken assertions or send the implicit message to listener (Alleton, 1988). In this paper, the researcher aims to examine the use of RQs in selected political speeches conducted by Obama and Cameron during different celebrations in 2014 and 2015. It also examines the functions, features, and types of

these questions in light of the topic of speech.

## Research Objectives

The topic under the study investigates RQs in President Obama and President Cameron's speeches on various occasions in (2014 and 2015). Thus, it aims to achieve the following objectives:

- To examine how Obama and Cameron exploit the various types of RQs according to achieve various functions.
- To examine the strategic use of RQs by Obama and Cameron to achieve their political goals.
- To investigate how Obama and Cameron use RQs in their speeches (in the years 2014 and 2015) on different economic, political, and social issues.

## Literature Review

Many scholars have defined RQ differently. Richards & Schmidt (2002, p.459) defines it as "a forceful statement which has the form of a question but which does not expect an answer". According to this definition, the distinction between a statement and an RQ is nonexistent. Wales (1990, p.370) introduces RQ as "This is a question which does not expect an answer, since it really asserts something which is known to the addresser, and cannot be denied". In this case, the speaker can employ it as a tool to make an implicit claim or denial. Pope (1976, p.47) identifies that "RQs are questions that exhibit opposite polarity; a positive RQ is like a strong negative assertion, while a negative RQ is like a strong positive assertion". According to this definition, an RQ is functionally used to emphasize a point by using opposite polarity. In this respect, Han (2002, p. 213) adds that "an RQ has the illocutionary force of an assertion of the opposite polarity from what is apparently asked". Here, both of pope and Han highlight on the difference between the form and function of RQs. Abioye (2011, p. 291) stats that "RQ is used to admonish, make a plea or request, commend, pay tribute, condemn or vilify". According to this view, an RQ can be used for different purposes and it is difficult to define it in one definition because of its various functions. Balogun (2011) argued that the interrogative clause shows the attributes of a powerful statement. The assertion may be either positive or negative. This means that an RQ is similar to question in form but statement in function. The speaker is ready to tell the reader or listener the answer. As viewed from the above definitions, we can conclude that the gap between the forms of QRs and multi functions of QRs on other made the QR difficult to label to unified definition.

## Rhetorical Questions and Ordinary Questions

RQs are formally different from information-seeking ordinary questions (OQs). OQs can be used in a situation if the answer is known only by the addressee, while an RQ is employed when both the speaker and the addressee are aware of the response. Moreover, with OQs, answers are obligatory and are given or decided by the addressee whereas the speaker or the addressee can offer responses to RQs. Sadock (1971; as cited in Han 2002,

pp. 203–204) highlighted the following points to demonstrate the difference between RQs and OQs:

- The expression “after all” can occur with RQs but not with OQs.
- RQs can be followed by a clause beginning with “yet,” but this is not possible with OQs.
- The phrase “by any chance” can occur only with OQs, as shown in the following example: “Are they winning the match, by any chance?”

As the speaker can use RQs to implicitly assert a particular point, some scholars have suggested that yes/no questions can functionally be RQs when they are used for emphasis.

### *Types of RQs*

There are four syntactic structures in English that can be used to form RQs.

#### *Yes/No Questions*

According to Quirk et al. (1985) discuss that whereas a negative rhetorical yes-no question is equivalent to an intensely positive assertion, a positive rhetorical yes-no question is equivalent to a strongly negative assertion. Mosgavi (2009, pp. 38–39) stated that “Yes-no were identified as rhetorical if they serve as implicit assertion with a polarity opposite to that of the question that yes-no questions”. However, she emphasised that some yes/no questions may not exhibit opposite polarity. The following question: “Is that you, Henry?” (Mosgavi, 2009, p.38). We anticipate the response to be ‘yes’

#### *Wh-Questions*

According to Han (2002)and Swan (2005), negative wh-questions contain meanings that reflect the speaker's anticipation of a positive answer, have implications that convey the speaker's expectations of a positive answer”. Consider the following example, in which the teacher thinks that most students completed their tasks and wants to know who did not: “Who didn't finish the homework?”. In contrast to Quirk et al. (1985, p. 826), Bolinger (1957, as cited in Koshik, 2005, p. 52) indicated the following to be the most prominent types of rhetorical wh-questions:

*Why / How Should....?* These types can be used to reject suggestions, requests, and instructions (Swan, 2005, p. 467). For example, “why should you follow me ”

*Why....?* Such questions can be used to complain, criticise, or make a suggestion – for example, “Why do you waste time with trivial things?”

*Who Cares....?* This phrase often implies that nobody cares – for example, “I can run faster than him, who cares?”

*How Could....?* This phrase is used to convey denial or criticism – for example, “How could you think I did that?”

Mosgavi (2009, pp. 38–39) shows the difference between RQs and exclamations “RQs are semantically

questions, while exclamations do not express a question even on the semantic level and are therefore not answerable. For instance, how will this fellow save us? implies that (This fellow cannot save us) while (How awesome is this place!) implies that (This place is very awesome)".

### *Alternative Questions*

This type of RQ presents two alternatives to the audience. Two forms can be used for this: yes/no questions and wh-questions (Quirk et al., 1985). Hamzah (2011, p. 26) states that "The syntax of a yes/no alternative question is that of a yes/no question, but instead of a final rising tone, a rise occurs on each alternative of the question, followed by a fall on the last alternative indicates that the list is complete". However, in some contexts, such questions are biased because the speaker tries to guide the audience to choose the response that reflects the speaker's goal (Van Rooy & Šafářová, 2003). Thus, politicians exploit this type of RQ to make their audience pay more attention to the desirable alternative.

Balogun (2011) argues that the speaker's attitude is employed to either confirm or dispute the point stated. The speaker makes some assumptions that may seem true to them with the intention of making the listener further clarify the matter, as in the following example: "She dances well, doesn't she? He doesn't wear his uniform, does he?"

### **Syntactic Functions of RQs**

Many speakers use RQs more than statements because of the discrepancy between RQs' form and function. This discrepancy leads to variations in the application of RQs in the language. The functions of RQs vary according to the purpose and goal of the speech. They can be stated as follows:

- To express and emphasise strong feelings using a series of RQs
- To start a new subject using a leading question
- To express a request using a command question
- To express a rebuke
- To express surprise
- To confirm something in the mind of the listener
- To express doubt about something

### **Pragmatic Functions of RQs**

Niazi and Gautam (2010, p.270) pointed out that "RQs are similar to indirect speech acts, as there is a discrepancy between their forms and communicative functions. Ibid (2010, p.270) also stated that "RQs "may or may not have the illocutionary force of questioning but always bear the force of an indirect assertion". Thus, the primary or major functions of RQs are those behind the questions constituting the speaker's aims and purposes.

Ilie (1994, p. 46) argued that RQs can achieve more than one function simultaneously, such as expressing reproach (blame), promises, protest, and self-exemption. Abioye (2011) indicated that the aim of an RQ is to establish or deny a statement implicitly”. Therefore, RQs can fulfil many functions at different levels in the same context. The following are some of the basic functions of RQs:

#### *Challenge*

Koshik (2005, p. 21) divided challenges into two types: “a challenge to a prior turn from the present party (e.g., How could you do that?) and a challenge to a prior conversation from the non-present party (e.g., How can she say that?)”.

#### *Complaint*

RQs can be used to complain about unfair treatment – for example, “Why did you put so few vegetables?” (Koshik, 2005, p. 53).

#### *Criticism*

RQs are used for criticising (i.e., finding faults or evaluating and pointing out merits or demerits). Consider the following example: “Do you believe the work was done well?”

#### *Denial*

RQs are used to express denial – for example, “How could I do something like this?”

#### *Persuasion*

Blankeship & Graig (2006, p. 112) show that “RQs are used to “increase persuasion and message processing (via generating questions about the topic) when the topic of the message was not initially involving to participants”. RQs perform various functions in political discourses (as seen in the section on RQs in political speech); However, persuasion is commonly used by politicians to garner the audience’s support. For example, consider the following sentence: “[the] Republican Party would get 60 percent more votes than it received eight years ago, who would’ve believed this, who would’ve believed this? (Tramp, Cleveland, 2016)”.

#### *Assertion*

RQs can have two types of assertions: negative and positive.

Negative Assertion. RQs can be used as negative assertions, as in the following example: “How could you think I did it?” (Abioye, 2009, p. 4).

Positive Assertion. A negative RQ can be used as an affirmative assertion, as in the following example: “Why can’t you boys play well?” (Chen, 2006, p. 611).

#### *Accusation*

An accusation entails asserting that someone is responsible for a particular state of affairs that is bad (Searle & Vanderveken, 1985), as in the example, “Do two wrongs make a right?” (Hackstein, 2004, p. 169).

#### *Command*

RQs can be used as commands. Commanding indirectly through RQs can help avoid the use of direct threats(e.g., Shouldn’t you join the class?)

#### *Reproach*

RQs are used to express reproach (to criticise or blame someone’s behaviour) – for example, “Why are you so bad?”

### *Suggestion*

RQs can be used to make a suggestion, as in the “Why don’t you ask her for a help?”

### **RQs in Political Speech**

One of the major verbal strategies in political speeches is the use of RQs to achieve one or more of the following functions:

#### *Persuasion*

RQs aim to persuade the audience to win their approval and support for a general or specific case (Nguyen, 2010).

#### *Challenge*

RQs are used for challenging an opposite party “by inducing mental recognition of its obviousness and its logical acceptability” (Ilie, 1999, p. 28).

#### *Self-Promotion*

RQs are used by politicians to gain political authority and credibility (Edward, 2007).

#### *Doubt-Inducement*

RQs are employed to create doubt in the minds of the listeners to consider the implicit message, while the speaker plays a neutral role by avoiding the use of more leading or value-loaded declarations (Behdahmane & Mac Bonald, 1984).

### **Method**

The research includes twenty sample speeches: ten speeches by Obama and ten by Cameron. The method adopted to carry out the data analysis will be a juxtaposition of quantitative and qualitative aspects so as to achieve a better understanding of the political speeches. Analysis of the data will depend upon the following:

- The frequency of RQs in each speech
- Analysis of the type of RQs in speech
- Finding out RQs in both presidents’ speeches according to the following topics:
  - Politics
  - Economics
  - Society
- Classifying each RQ sample according to the function of RQs as follows:
  - Self- promotion
  - Persuasion
  - Challenge
  - Doubt- inducing

The statistical method is used to analyze data and find out results.

### Analysis of RQs in the Selected Speeches

- (1) “Where, after all, do universal human rights begin?” (Obama, 24 September 2014, New York)
- (2) “how can we allow the dark tactics of the 20th century to define this new century?” (Obama, 4 June 2014 American Rhetoric).
- (3) “The question is how we uphold that commitment” (Obama, 17 December 2014, The White House).
- (4) “Is whether we are going to help or hinder this progress?”. (Obama, 28 January 2014, Capitol, the US).
- (5) “Are we a nation that tolerates the hypocrisy of a system where workers who pick our fruit and make our beds never have a chance to get right with the law? Or are we a nation that gives them a chance to make amends, take responsibility, and give their kids a better future?”. (Obama, 20 November 2014).
- (6) “What the hell’s the presidency for?”. (Obama, 10 April 2014 Taxes).
- (7) “Oh well. Assume that it was funny. Does this happen to you, Joel? It does? Okay”. (Obama, 3 May 2014, Washington).

The first part of the analysis includes seven samples of RQ questions in Obama’s ten speeches (2014-2015) and the same thing applies to Cameron’s speeches on the second part.

In utterance (1), Obama uses the same question of Eleanor Roosevelt, a champion of the UN, to criticize human rights. Wh-question-RQ type is one of the RQs used to make a criticism accordingly (Monzoni, 2008). He says that it cannot be seen on any map of the world. He tries to explain that the world needs more freedom and peace. The question here motivates suspicion about application of one of important global essential conventions. Then, Obama uses Wh- question RQ type in utterance (2) speech. The answer of this RQ shows the complete refusal of the USA to this negative action (Chen, 2006). So Obama sent a clear message to the audience about the challenges of the of Russia's violation of Ukraine’s sovereignty and how to face these challenges by the national community, the USA. Furthermore, the question is used as a proposal, as a common starting point to open discussion (Quirk et al, 1985).

The declarative question in utterance (3) is one of the RQs that are used by the speaker to convey his truthfulness in doing things. Therefore, Barak Obama expresses his view of the inability to keep these commitments and to do the same thing for over five decades expecting to get a different result. Semantically, this RQ is understood as a negative assertion (Balogun, 2011). Yes-No question is one of the RQs used by politicians to be able to follow up on detailed information to persuade addressee about his view. Obama uses this alternative question in utterance (4) to start a discussion about his strategies for carrying out the most basic functions of his democracy and how to achieve it. He tries to garner the support of his audience. While utterance (5) applies a series of questions that help Obama to emphasise his implied expectations towards the answer to these questions (Han, 1998). He tries to win the audience’s agreement to his side and push the Congress to get this administrative reform. In utterance (6), Obama expresses his criticism because he believes that the president should not waste his time and authority on fruitless issues. The role of the president and the presidency says that A president should fight to achieve his political goals. He exploits this RQ for the function of self-promotion. (Edward, 2007).

The speaker can resort to another type of RQ such as yes-no question when he only expects the audience to accept or reject the proposition. It is positively biased. Here, Obama first uses a yes-no question in utterance (7)

to ask Joel if that also happens with him. Then, he uses another type of RQ (Declarative question) to ensure this fact (see Table 1).

Table 1. Frequency of RQs in Obama's Speeches

Issue	Total	Yes-no RQ	Wh-RQ	Alternative RQ	Declarative RQ
Economic	0	0	0	0	0
Political	4	1	1	2	0
Social	13	4	8	0	1
Total	17	5	9	2	1

### *Analysis of Rhetorical Questions in Cameron's Speeches*

(1) when you look at all the central questions facing our country – whether Britain can compete, and grow, and create jobs, and pay its way in the world the answer is a resounding yes. (Cameron, 10 February 2015, Queen Elizabeth II Conference Hall, British Chambers of Commerce).

(2) But what about the role of our military? (Cameron, 25 September 2014, the UN General Assembly 2014).

(3) Scotland is right at the heart of that vision. Why? (Cameron ,29 August 2014, Prime Minister's Office, 10 Downing Street).

(4) That's the question next may. Do you want to go back to square one – or finish what've begun? (Cameron,1 October 2014, Birmingham).

(5) So where do we want to take our country? where do I want to take our country? (Cameron,1 October 2014, Birmingham).

(6) How dare they suggest I would put that at risk for other people's children? how dare they frighten those who are relying on the NHS right now? (Cameron,1 October 2014, Birmingham).

(7) who do you really trust? When it comes to your job...do you trust Labour – who wrecked our economy – or the Conservatives, who have made this one of the fastest-growing economies in the West? (Cameron, 1 October 2014, Birmingham).

In excerpt (1), Cameron starts his speech in the chamber of commerce with a declarative question to establish the known fact of developing and growing the major economic plans in Britain. He tries to make the audience agree with his assumption (Balogun, 2011). Pragmatically speaking, this RQ carries the illocutionary force of persuasion. The speaker aims to persuade the audience to win the approval and support of listeners in a general or special case (Nguyen, 2010). Cameron shows the big challenges in excerpt (2). He explains the role of the British army, with the western military in facing Islamic extremists in Iraq and Syria, and the role of the Royal air force in helping millions of people who have fled from ISIS (the Islamic State of Iraq and Syria). Here Wh-question encourages to suggest some possible answers and makes the listener observes the implicit meaning (Monzoni, 2008). Moving to excerpt (3), the RQ aims to create doubt in the minds of the audience and convey the speaker's knowledge and shows his assertion of the constituent parts of the United Kingdom can achieve together – the power of collaboration and what they'd lose if they pull apart. Scotland's strength cannot be built



alone (Quirk et al, 1985).

According to Han (1998), yes-no question is used when the speaker asks the listener to accept or refuse the proposal. Therefore, in excerpt (4), Cameron tries to get the support of the British people on his side in political and economic strategies and refuses the separation of Scotland from the kingdom. Cameron uses two direct wh-questions in example (5) with two different subject pronouns (We-I) respectively to win the emotions of the audience. He tries to say that we have a strong nation and we do all that in a coalition government not by what he wants to do. He is a British man and hopes that the British understand his political strategies. Cameron emphasises his idea by repeating the same question with two different pronouns; for instance, he attacks the Labour Party and their criticisms of the NHS system by repeating RQ twice. He challenges them by saying that they do not dare to say anything about this health system and are used for challenging an opposite party. This can be done by creating mental perception and logic acceptance (Ilie,1999). It is important to all families and children. So he hears the similar ridiculous things about the conservative and NHS. Again Cameron criticizes his opponent by asking direct wh-question. It is clear in utterance (7). He aims to say that no one trusts the Labour party. They do not make any development on political and economic levels. They have made an economic system comedown (see Table 2).

Table 2. Frequency of RQs in Cameron's Speeches

Issue	Total	Yes-no RQ	Wh-RQ	Alternative RQ	Declarative RQ
Economic	2	0	1	1	0
Political	2	0	2	0	0
Social	25	1	15	6	3
Total	29	1	18	7	3

## Discussion and Results

The number of RQs for the economic issues in Obama and Cameron's speeches is too small to make a meaningful distinction on the scale as compared with the other two types of issues, so our analysis would be focused on political and social issues. Cameron used more RQs than Obama on social issues with (25-13) different types of RQs, respectively. However, both tended to use more Wh- type RQs. While Declarative questions are less preferred in the political and social speeches of Cameron and Obama. This may indicate that they are more confident in their political and social decisions and strategies (see Figure 1 and 2).

Wh –questions are observed dominating out of total RQs (29); Obama had 53% and 62% for Cameron's speeches. There is a noteworthy use of Wh- questions. Generally, they adopted this stronger strategy in their speeches to distinguish themselves as worthy challengers. There is a meaningful distinction between the use of Yes- No type questions as RQs by Obama and Cameron having 29% and 3%, respectively. This suggests that Cameron is more self-determined and offensive in social problems that his government faces than Obama.

Cameron used more alternative-type RQs as compared to Obama (24%-12%), respectively. This would show that David offers more options than Obama. There is no remarkable distinction in the use of declarative type RQs between the speeches of both presidents. It is obvious that both presidents do not offer options to their listeners to select (see Table 3).

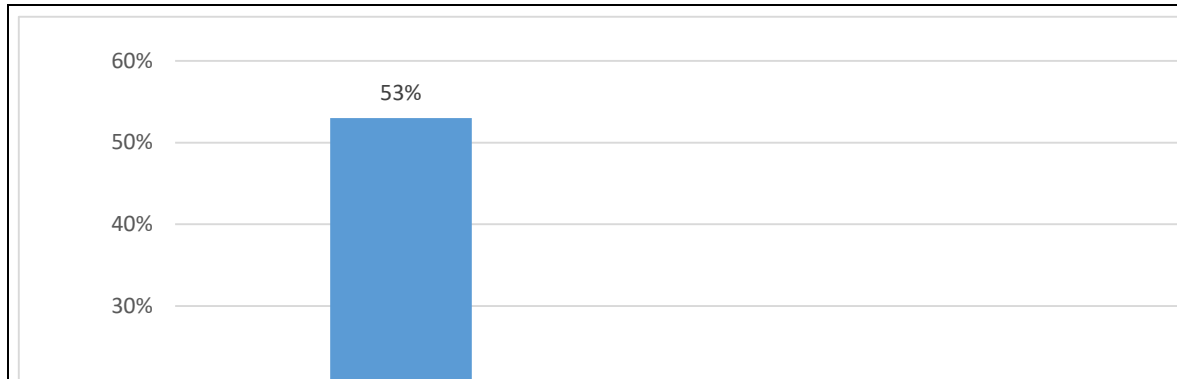


Figure (1) RQs in Obama's Speeches

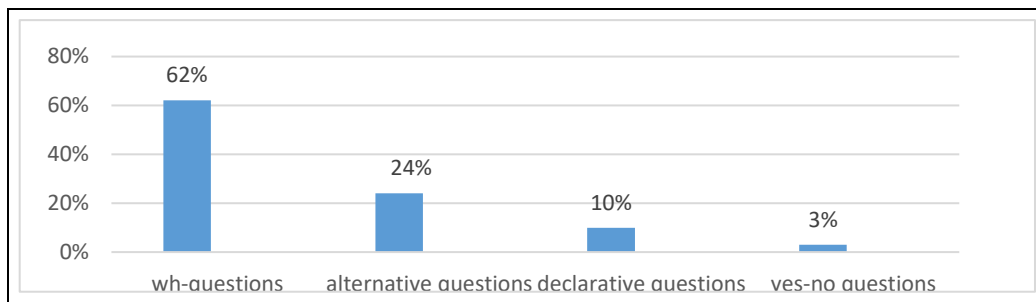


Figure (1) RQs in Cameron's Speeches

Table 3. Functions of RQ in Obama's and Cameron's Speeches

Functions	Obama	%	Cameron	%
Challenge	7	41%	11	37.93 %
Self-promotion	3	18%	2	6.89%
Persuasion	3	18%	8	27.58%
Doubt- Inducing	4	23%	8	27.58%
Total	17	100%	29	100%

It is note here that there was no large difference in the percentage of using RQs for the function of challenge between Obama and Cameron (41%-38%), respectively. These questions enable both Obama and Cameron to throw challenges that they and their governments face such as terrorism and at the same time they aim to criticize their opponents with great explicitness. Then, the second highest frequency was the use of the Doubt Inducing RQs which accounted (4-23%) and (8-27%) for the function of doubt inducing. This reflects that they both try to throw incapacity of their opponent to get political and economic success. However, Cameron is here more likely to attack the others than Obama. Regarding the function of self-promotion RQs, it is noted that

Cameron had more self-promotion RQs to have self-promotion than Obama at (3-18%, 2- 6.89%), respectively. He exploits them to send a clear message that his government can solve problems and lead the country toward the best future.

## Conclusion

As observed above, Cameron uses more RQs than Obama in the selected political, economic, and social issues. Therefore, Cameron is more practical politician to use language devices achieve rhetorical effects in different issues than Obama. Both of them use Wh-question more than other types of RQs. This suggests that they are strong challengers and they fight for their strategies at the level of political, economic, and social actions and indirectly put blame on opposing parties. decisions and also induce doubt in rival parties in a more indirect manner. Generally, the topic being discussed affects the kind and frequency of RQs employed since the use of RQs in social topics is more than in political and economic topics. This means first that the type of RQs used in the speeches of both presidents may also depend upon the type of audience. Second, they both more focused to garner the emotion of their people. Cameron has a stiffer and more self-determined personality on social issues than Obama as he employs less indirect Wh- type RQs than Obama to first generalise the negative responsibility of the government or the Labour Party in social issues. Second, he wisely follows this new political strategy for electoral purposes. Cameron is more offensive than Obama to face his rival parties and win debates by inducing doubt.

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## Emoji as a Means of Communication-Derivation from Use of Albanian Language

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**Abstract:** Language is a tool of communication. Communication is a process of conveying messages. Language changes dynamically, as new words can be created. Communication is considered static, as its basic steps remain unchanged. But the basics of communication do not change. However, new words enter the dictionary/vocabulary language almost daily. Communicating with others is a basic human need. Healthy living involves interacting and engaging with others. And our primary means of doing so is through shared language. Language is a system of communication that relies on verbal or non-verbal codes to transmit information. Communication is a way of exchanging messages or information between two or more people, focusing on the message. Over the last years we have witnessed the evolution of communication through emoji. This type of communication consists in these aspects:

1. Linguistic economics
2. Fast communication
3. Skipping grammatical rules
4. Failure of language evolution
5. Concealment of emotions

The results of the study will be derived according to the qualitative and quantitative method, through a questionnaire directed to a sample of 100 students in different study programs. The answers to the questionnaire will be analyzed by coming up with conclusions and recommendations.

**Keywords:** Communication, Albanian Language, Emoji, Language System

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### Introduction

Language is a system of communication that relies on verbal or non-verbal codes to transmit information:

- Communication is a way of interchanging messages or information between two or more people, focusing on the message.
- Emoji have a widespread impact on multiple human science areas such as psychology, sociology, linguistics, and business. However, emoji might be translated into different meanings based on the

context and on the respective platforms they appear on. Thus, it is important that emoji have text attached to the context in which they appear to make sure there is no misunderstandings.

In digital communication, emoji help represent the human gestures, voice tones and physical expressions people do when communicating vocally. As such, people read emoji as emotional information, which help articulate the meaning of digital messages that can sometimes differ depending on the individual personality and on the individual social context.

Furthermore, some researchers argued that emoji have three linguistic functions: emotional indicators directly correlated to facial expressions, non-emotional indicators directly correlated to facial expressions and as indicators not correlated to facial expressions but to deep intention.

## Method

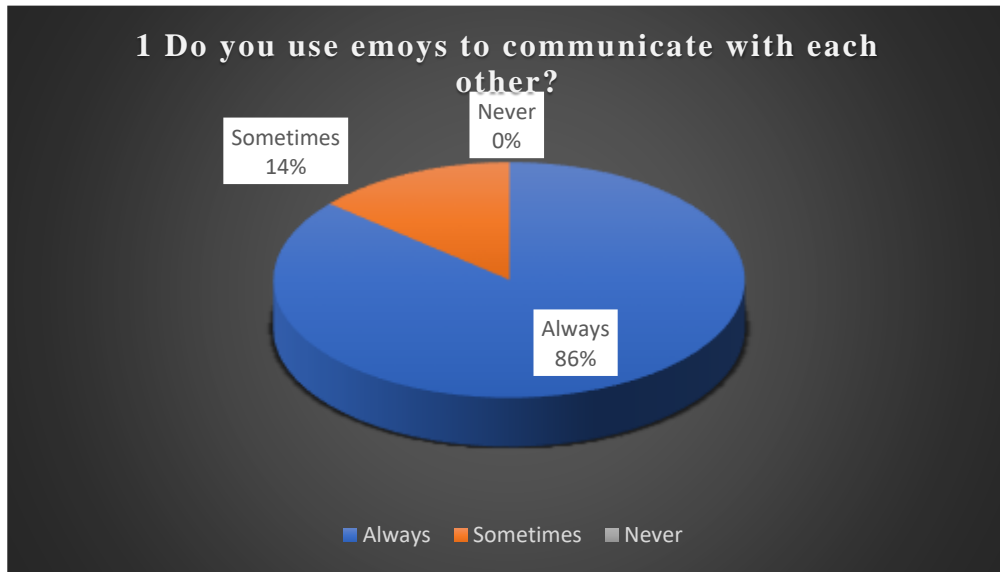
Methodological aspects of this paper: Observation and research. Descriptive analysis is both quantitative and qualitative. The questionnaire was conducted in a target group of 100 students. Data are based on statistics, both in tables and graphs, analyzed in %.

## Analysis

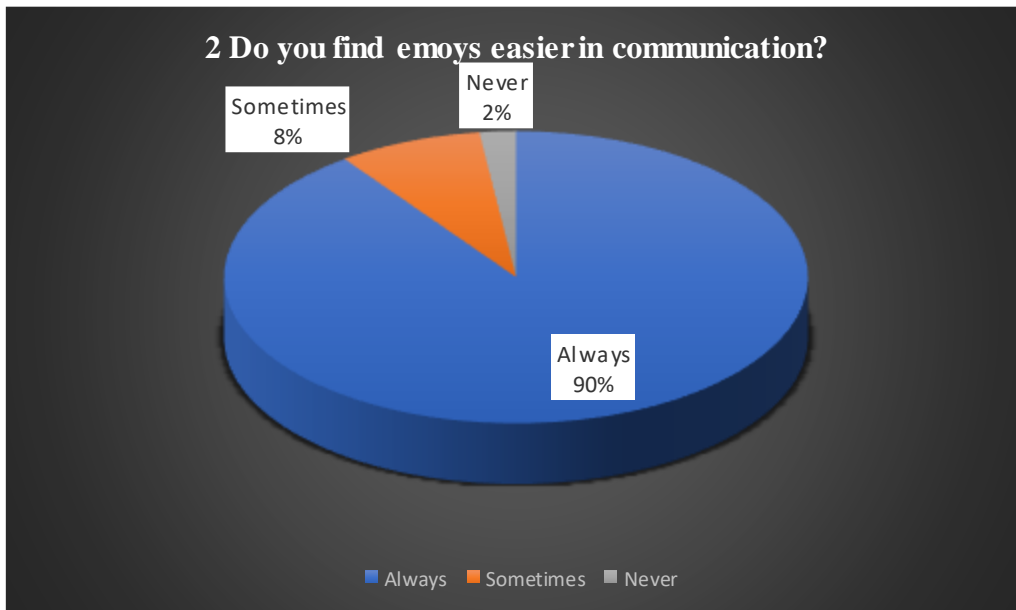
According to the study, emoji help facilitate non-verbal communication, such as facial expressions and gestures, across various digital platforms. These small icons convey an easily identified thought or emotion and allow us to add clarity and tone to our daily digital interaction.

- the digital equivalent of body language. In face-to-face communication, only 30% of our communication relies on actual words. The rest consists of our body language.
- improve digital communication by replicating what we do when we communicate in person: our gestures, voice, and body language.
- are used to inject emotion into a simple sentence, or they can be "sentences" themselves. Emoji seems like a new language that has entered and is now embedded in our digital social life.

Nr.	The instrument used for evaluation	Always	Sometimes	Never
1	Do you use emojis to communicate with each other?	86.20%	13.80%	0%

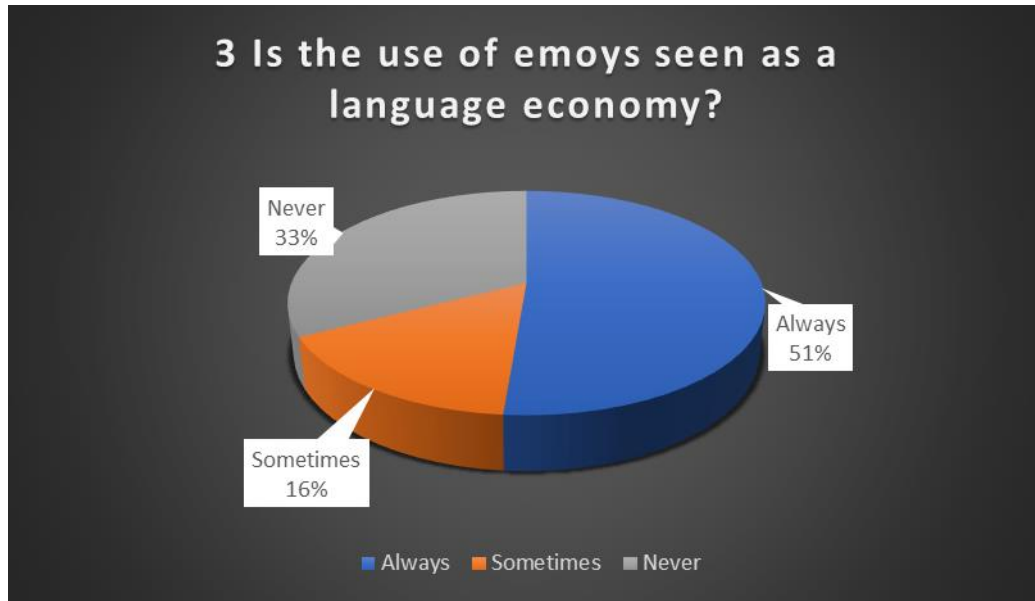


Nr.	The instrument used for evaluation	Always	Sometimes	Never
2	Do you find emojys easier in communication?	90%	8%	2%

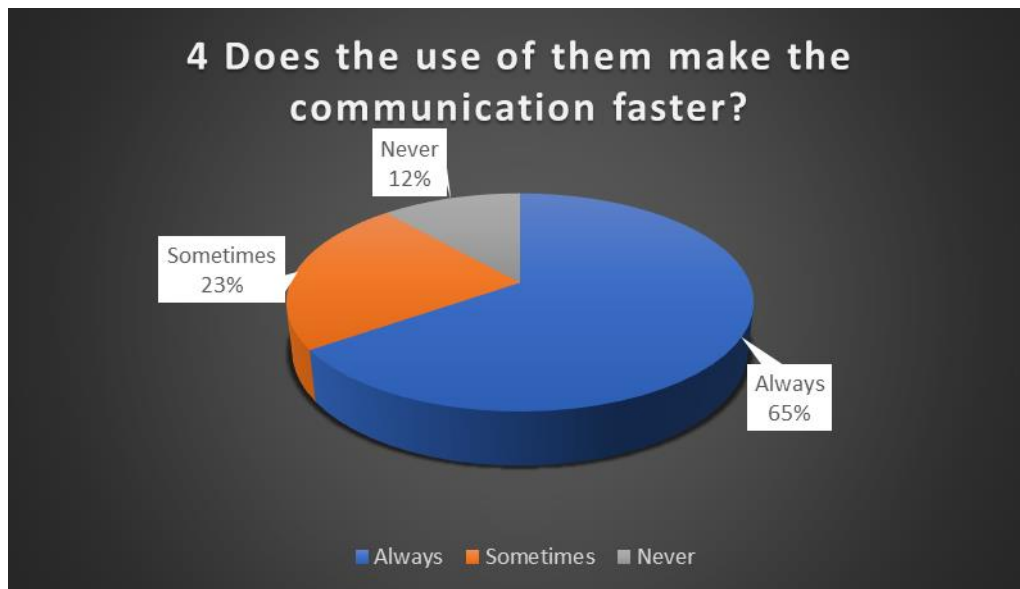


Nr.	The instrument used for evaluation	Always	Sometimes	Never
3	Is the use of emojys seen as a language economy?	51.30%	16.10%	32.60%





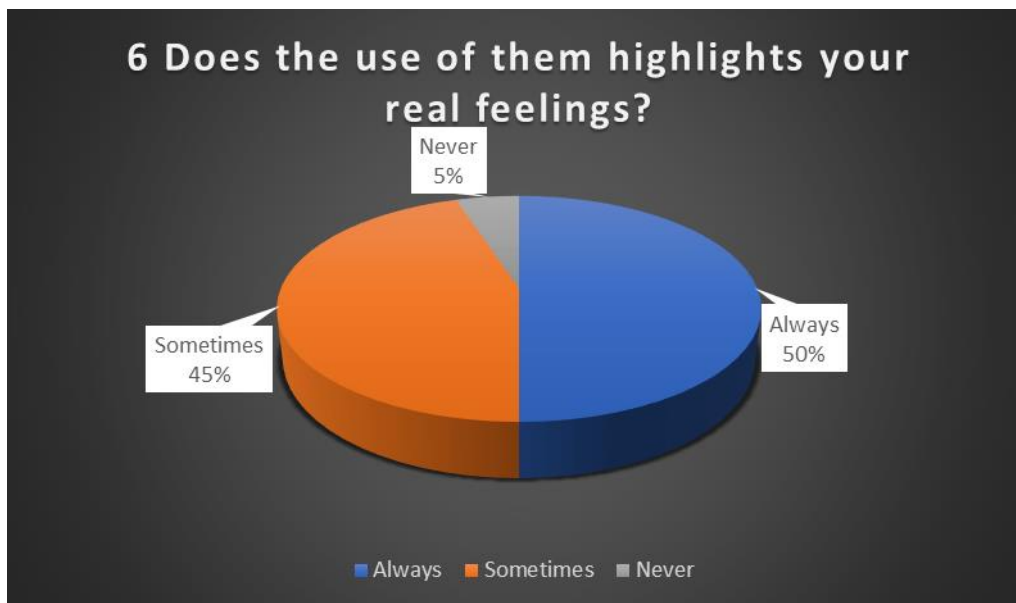
Nr.	The instrument used for evaluation	Always	Sometimes	Never
4	Does the use of them make the communication faster?	65.30%	23.20%	11.50%



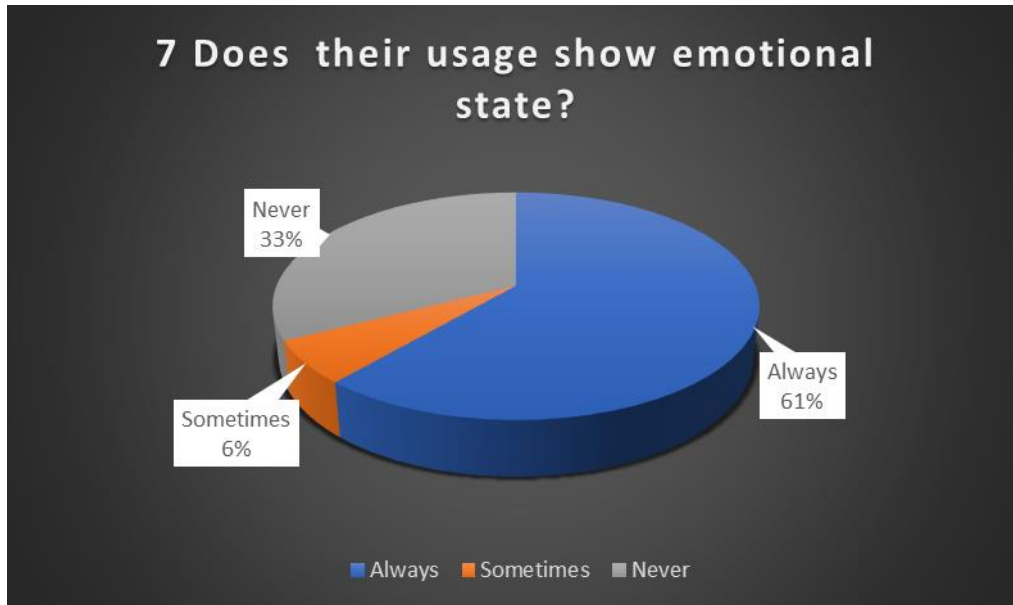
Nr.	The instrument used for evaluation	Always	Sometimes	Never
5	Is the use of them made to avoid the grammatical rules of language?	12.00%	20.00%	68%



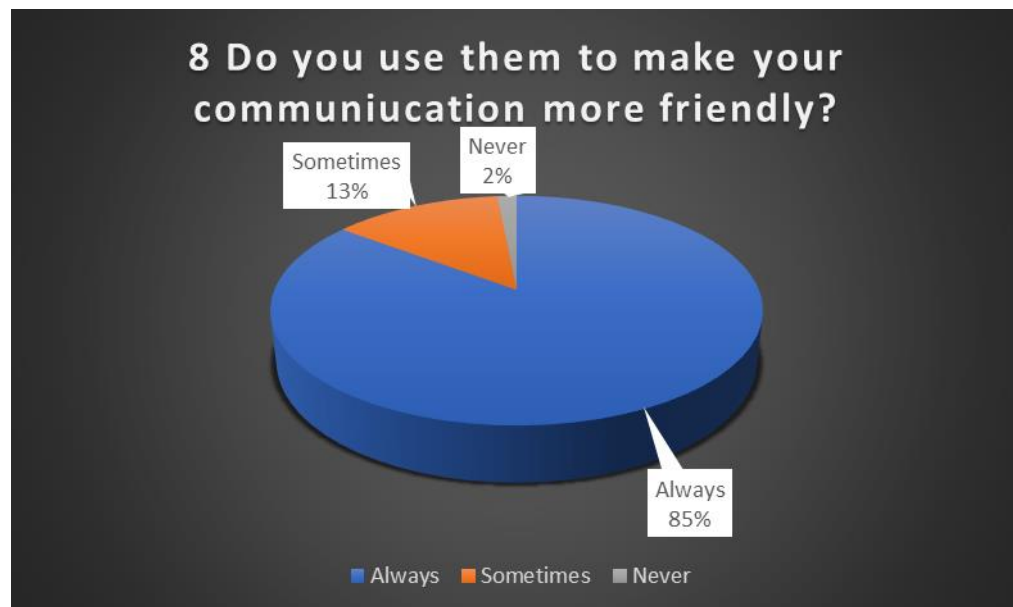
Nr.	The instrument used for evaluation	Always	Sometimes	Never
6	Does the use of them highlights your real feelings?	50%	45%	5%



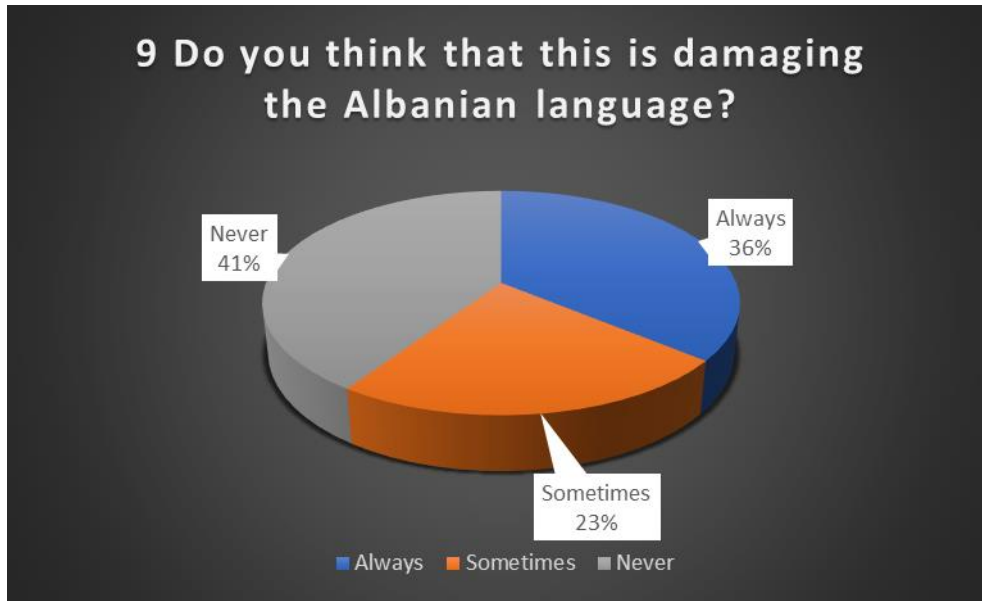
Nr.	The instrument used for evaluation	Always	Sometimes	Never
7	Does their usage show emotional state?	61.30%	6.10%	32.60%



Nr.	The instrument used for evaluation	Always	Sometimes	Never
8	Do you use them to make your communication more friendly?	85.30%	13.20%	1.50%



Nr.	The instrument used for evaluation	Always	Sometimes	Never
9	Do you think that this is damaging the Albanian language?	36%	23%	40.60%



The summary of the results is given below:

Nr.	The instrument used for evaluation	Always	Sometimes	Never
1	Do you use emoyos to communicate with each other?	86.20%	13.80%	0%
2	Do you find emoyos easier in communication?	90%	8%	2%
3	Is the use of emoyos seen as a language economy?	51.30%	16.10%	32.60%
4	Does the use of them make the communication faster?	65.30%	23.20%	11.50%
5	Is the use of them made to avoid the grammatical rules of language?	12.00%	20.00%	68%
6	Does the use of them highlights your real feelings?	50%	45%	5%
7	Does their usage show emotional state?	61.30%	6.10%	32.60%

8	Do you use them to make your communication more friendly?	85.30%	13.20%	1.50%
9	Do you think that this is damaging the Albanian language?	36%	23%	40.60%

## Conclusion

On the personal level young people are social beings, they are part of a social circle, community, school club etc. They interact with each other...and this is the reason why communication with emoyos is something human. Human communication is complex; It's a deep topic to understand and evolves over many years to find the right form:

1. Emoy contains a wide range of emotions that young people can understand just by seeing one of them. Communication is not just some articulated words , but its more than that, is body language, movement, mimic, vision etc. Using emoyos , young people add layer of emotion to communication .
2. Young people are often part of one or more groups, tend to adapt , change some behaviors ,remove old ones ,learn new ones which over time they tend to become similar to those of the group. Therefore, if the friend will start using emoyos in communication, there will come a time when other young people who are part of the group will do the same .
3. We have to admit, emoyos are very cool. One of the things young people know is to follow trends to look cool ... smart (but they want to look cooler than smarter).And that's how it happened :once emoyos became a trend, we had a great desire to follow them . If the prime minister, the mayor or the president use them, why not young people?
4. Using emoyos comes as faster communication with each other . Does not refer to the use of Albanian language or the grammar.

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## The Attitude of Malaysian East Coast Early Childhood Educators towards English and Their Language Support Practices

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**Abstract:** English proficiency is advantageous for any graduate. In Malaysia, despite English being formally introduced around age 5, proficiency in the language is still lacking in some graduates. English should be introduced to children during their formation years so they can be proficient. However, in many private preschools, English proficiency is not a priority in the hiring criteria of early childhood (EC) educators despite the introduction of the Malaysian English Language Education Roadmap 2015-2025. With EC educators being a primary provider of input in the system, it is essential to investigate their attitudes towards English, particularly on the East Coast of Malaysia, where English usage is not as extensive as on the west coast, and how these attitudes translate into their practices with the children. A questionnaire of 29 questions was distributed to 114 EC educators. Findings reveal that positive attitude leads to EC educators using English with the children. Although knowledge of the language may be limited, the positive attitude spurs them to find alternative ways to expose English to the children. The findings hence provide insight to how we can upgrade the quality of existing English language education provided in preschools, mapping it to the Roadmap 2015-2025 for the reform to succeed.

**Keywords:** Attitude, Practice, Early childhood educators, ESL, Preschool

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## Introduction

It is advantageous for any graduate to be proficient in English as it is a lingua franca, and perceived as a socially prestigious language (Mourão, 2021). Mourão, (2021) states that it is vital to provide early exposure of the English language to children, for it impacts the mastery and proficiency of the target language of the children. Thus, English should be introduced to children during their formation years (0 to 4) to increase proficiency and provide a head start to children to be employable graduates in the future. According to Mistry and Sood (2020), the first three years are the best opportunity to teach children a language as children's minds are known to easily and quickly acquire what they heard and learned compared to adults. In Malaysia, the Ministry of Education Malaysia has included the preschool years (5-6 years old) as part of the English Language Roadmap 2015-2025, acknowledging the importance of developing young children's English language for their success in the school years. Upon leaving preschools, the children are expected to achieve CEFR A1 (English Language Roadmap 2015-2025). Earlier in 2010, the National Preschool Standards-based Curriculum (NPSC) was introduced. In NPSC, all Malaysian preschool teachers were urged to use English to expose and prepare the children to master the target language before entering primary school.

However, even though English is being formally introduced at the ages of 5 and 6, proficiency in the language is still lacking. This is a gripe many industries have with the local graduates, stating that many local graduates lack communication skills in English (Ong et al., 2022) when English proficiency is among the top five skills that employers look for when hiring as revealed by the 2021 Malaysian Employers Federation (MEF) Salary Survey for Executives and Non-Executives (Menon & Rajaendram, 2022). Similarly, in Saudi Arabia, great emphasis has been placed on learning English as a foreign language as English has been assigned prestige and high status to those fluent in it (bin Towairesh, 2021). In Germany, Hahm and Gazzola (2022) shared that the more proficient German natives are in English, the higher their salary. This suggests that English proficiency is important to get a head-start and despite our current efforts, desired outcomes have not been achieved, which warrants more proactive measures. According to Al-Yaseen (2021), an early exposure to English language which is seen as a global language, could provide better opportunities in terms of education and employment in the future and this notion is supported by Kuwaiti kindergarten teachers who have a strong belief in exposing and teaching English to Kuwaiti children in kindergarten. Therefore, it is imperative to introduce English to children at an earlier stage, ensuring that the primary sources of language input, namely early childhood (EC) educators, possess a high level of proficiency.

Despite the emphasis on English usage by the NPSC, not all EC educators are sufficiently proficient in the language, particularly in private Malay medium preschools, where many lack qualifications to teach English. This becomes evident from the findings of Masturi, Kosnin, and binti Zainudin (2022) who highlighted the challenges faced by teachers in carrying out their teaching responsibilities due to their lack of familiarity with the language they are expected to teach. One contributing factor is that English proficiency is not prioritised in



the hiring criteria of EC educators, despite the introduction of the Malaysia English Language Education Roadmap 2015-2025. English proficiency becomes even less of a priority for children under the age of 4, as the emphasis on NPSC primarily targets preschool children between the ages of 5 and 6. Unless explicitly advertised as an English medium preschool, the primary language of instruction in most preschools will be Malay (Kong, 2023; Ting & Jintang, 2022; Yussof & Sun, 2020). Furthermore, in rural areas, English is perceived as a foreign language rather than as a second language as it should be in Malaysia due to students hardly using English for interactions outside the classroom. As reported by Rosli and Radzuan (2020), there is relatively less extensive use of English on the East Coast of Peninsular Malaysia compared to the west coast.

The aim of this study is to explore the attitudes and practices of EC educators in the East Coast region of Malaysia regarding the use of English language in early childhood education (EC education) settings. Despite the increasing importance of English proficiency in a globalized world, there is a significant gap in the literature concerning the specific attitudes and practices of educators in this region. Existing research has predominantly focused on larger cities such as Kuala Lumpur (Nordin et al., 2022; Goh & Luen Loy, 2021; El Masry & I Alzaanin, 2021), resulting in lesser understanding of the unique socio-cultural and linguistic characteristics of the East Coast. Furthermore, a considerable proportion of private sector preschool teachers in Malaysia possess minimal qualifications and experience (Foong et al., 2018), with English proficiency not being the primary hiring criterion. In Malaysia, the requirement to become a private preschool teacher is set as minimum as to having Malaysia Certificate of Education (MCE/ SPM). In some cases, some private preschools accept Form 3 Assessment (PT3/PMR) candidates to become a part of the workforce. The priority of hiring preschool teachers is not directed to those who are proficient in English but to those who have skillful experience in taking care of children (Foong et al., 2018).

However, recent initiatives, such as the Malaysia English Language Education Roadmap (2015-2025), have placed greater emphasis on the educational background of EC educators. As a result, more teachers possess ECE qualifications but may not be proficient in English. Similar challenges have been observed in Kuwait, where teachers' lack of confidence and proficiency in English, particularly in pronunciation, have led to the use of the first language as a teaching medium (Al Yaseen, 2021). While Al Yaseen (2021) also reported that the use of first language provides a feeling of security and validation allowing children to express themselves better, the researcher asserts that the teachers could have used pictures, posters, picture books and videos as teaching aids to facilitate learning so that the target language becomes more comprehensible to the children. Since the intention behind this approach was primarily to prevent the children's target language from being compromised or distorted, it is important to investigate how these attitudes and practices impact language learning outcomes, specifically the attitudes and practices of EC educators towards English in the East Coast region of Malaysia.

### **Attitude**

Attitude plays a crucial role in shaping human behavior, influencing perceptions, and guiding decision-making processes (Grimley & Burnard, 2021; Moreno et al., 2021). It holds particular significance when examining

individuals' attitudes towards specific objects or concepts, such as the English language in educational contexts. Understanding the factors that shape these attitudes and their impact on teaching practices and learner outcomes is of utmost importance. This paper aims to explore the concept of attitude, specifically focusing on attitudes towards English in the context of EC education. By delving into relevant literature and research findings, we seek to uncover the relationship between EC educators' attitudes and teaching practices.

According to Fishbein (1961: p. 233), “An individual’s attitude toward any object is a function of his beliefs about the object (i.e., the probability that the object is associated with other objects, concepts, values or goals) and the evaluative aspect of those beliefs (i.e., the attitude towards the related objects)”. When considering attitude towards English, it is “a collection of feelings (good, bad, neutral) regarding language use and its status in society” (Ahmed, 2015: p.7). According to Conderman and Johnston-Rodriguez (2009) who examined teachers' perceptions of their preparedness in inclusive education, as well as the teachers’ views on the significance of related skills, attitude towards the teaching of English includes elements such as “liking, enjoyment, enthusiasm for teaching English, and confidence in their own teaching abilities (Ernest, 1989: p.25)”. Attitude, therefore, affects practice, affects the children’s interest and attitudes to English and its learning.

### **Language Support Practices**

Activities in preschools should encourage children to develop their skills in life holistically, namely language, thinking, social and creativity skills. The NPSC developed by Ministry of Education Malaysia (2017) emphasizes children’s growth in terms of communication, spirituality, attitudes, and values as well as creativity, critical thinking and innovative, to name a few. Similar to Malaysian EC education aims, the preschool curriculum designed by the Ministry of National Education Turkiye also focuses on children’s learning by discovery and some of the activities listed and proposed involves language, art, drama, music, movement, play, science, mathematics, early literacy and field trip (Dere, 2019). Dere (2019) conducted a study with the children investigating their creativity after spending time in preschool. Findings from the analysis done from Torrance Creative Thinking Test (TCTT) which was developed by Torrance (1966) shows that the duration children spent time in the preschool impacts the creativity of the children positively. In other words, children were found to be more creative when they have spent a full day taking part in all the activities conducted in the preschool compared to other children who spent a half-day.

Activities in a preschool can be categorized into 2 categories: cognitively stimulating high-yield activities and least stimulating low-yield activities (Smidt & Embacher, 2020). Examples of cognitively stimulating high-yield activities are role-playing, oral communication, and constructive games, while napping, care-taking routines and circle games are examples of the least stimulating low-yield activities. In developing children’s proficiency and mastery particularly in oral communication, read-aloud is one the teacher-led activities that is expected to be conducted with the children at preschools. However, the Sweden preschool teachers reported that read-aloud was difficult to organize due to some reasons (Alatalo & Westlund, 2021).

In conclusion, attitudes towards English in EC education should have a profound impact on teaching practices and children's attitudes towards language learning. The various dimensions of attitude, including beliefs, and the language support practices, highlight the complexity of this topic. To address such a gap, following research questions were asked in this research:

- (1) What are Malaysian East Coast early childhood educators' attitudes towards English language?
- (2) How do these attitudes translate into their language support practices with the children?

**Theory of Planned Behavior (TPB)**

Ajzen (1991) developed the Theory of Planned Behavior (TPB) which is a psychological theory that aims to explain how attitudes, beliefs and perceptions effect an individual's behavior. Through the context of this study, the TPB is used to assess and comprehend an EC educator's thought process and emotions towards the teaching of English to young children, along with how such thought and emotion influences their actions. The TPB hypothesizes that three factors determine a person's actions; their attitudes, subjective norms and perceived control. Attitudes encompass the opinion and emotions for a behavior such as teaching English, subjective norms pertains to the social pressure and expectations experienced from peers or guardians and perceived control reflects the level of faith in the individual's ability to carry out the action (in this case, teaching English to young children). Figure 1 portrays the theoretical framework of the TPB.

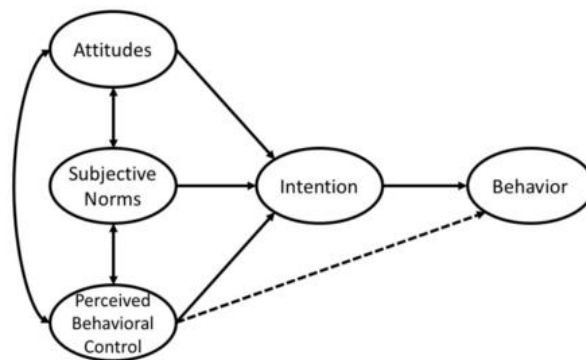


Figure 1. Theory of Planned Behavior (TPB) Framework (Ajzen, 1991)

By utilizing the TPB, this study was able to understand the EC educators' attitudes to teaching English, the expectations of them from others, and their confidence in being able to do so, in order to assess and facilitate the intentions and practices they had in English instruction. This framework shed light on why some educators exhibit more enthusiasm and confidence in teaching English, while others may feel uncertain or less motivated. Phuong et al. (2023) conducted a study that utilized TPB to examine how teaching beliefs influence the selection of techniques by English instructors for teaching young language learners. Similarly, Ateş and Yilmaz (2023) employed TPB to investigate the intentions of both pre-service and in-service teachers regarding the use of mobile-based assessment in their classrooms. Additionally, Kim and Jeong (2023) utilized TPB as the basis

of their research, focusing on the acceptance of coding education among kindergarten teachers. These studies share a commonality in recognizing TPB as a crucial theory for understanding teachers' attitudes, intentions, and decision-making processes. Overall, TPB helped in understanding how the thoughts, emotions, and perceptions of EC educators regarding English teaching impact their instructional practices, which, in turn, can have implications for children's language learning outcomes. In this paper, the focus will be only on the attitudes and how they are translated in language support practices.

## Research Methodology

To measure preschool teachers' attitude based on their beliefs and practices in using English, this study employed an Early English Beliefs and Confidence Survey (EEBCS) that was adapted from a questionnaire developed by Chen et al. (2014) called Early Math Beliefs and Confidence Survey (EM-BCS). The decision to employ this questionnaire as the quantitative data collection instrument was based on its efficiency in gathering comprehensive responses from respondents within a short timeframe (Sekaran & Bougie, 2016). The adaptation of the EM-BCS questionnaire was deemed suitable because its design aligned with the current research focus, although Chen et al. (2014) primarily emphasized early mathematics beliefs among preschool teachers. In this study, the questionnaire was modified to address beliefs and confidence specifically related to the English language rather than mathematics. Several modifications were made to the original EM-BCS items. Examples of the modifications are shown in Table 1, which presents selected items from the original EM-BCS alongside their adapted versions.

Table 1. Original Items from EM-BCS (Chen et al., 2014) and Adapted Items in EEBCS

Original Items	Adapted Items
Most children in my class entered preschools with little Mathematics knowledge.	Most children in my class entered preschool with little English knowledge.
I am confident in my ability to plan activities to help children learn Mathematics.	I am confident in my ability to plan activities to help children learn English language.
I can easily convert fractions into percentages and decimal numbers.	I can translate Bahasa into English and vice versa easily.
I am confident in my ability to plan activities to help children learn Mathematics.	I am confident in my ability to plan activities to help children learn English language.

The questionnaire was administered personally by the researchers as it provides the ability to establish a relationship and motivation with the respondents as doubts can be clarified, it is less expensive, can achieve almost 100% response rate, and anonymity of respondents is high (Sekaran & Bougie, 2016). The questionnaire consisted of 3 parts: Part A – Demographic details, Part B – Attitude (14 items) and Part C – Practice (15 items). For Part B, respondents were to rate their agreement with the statements on a five-point Likert scale (Likert, 1932) with a value of 5 associated with a *Strongly Agree* opinion and a value of 1 for *Strongly Disagree* and for Part C, the value of 5 was associated with *Always* and 1 for *Never*. The Cronbach Alpha for the questionnaire is

0.92 which is considered high validity value (Cronbach, 1951). Table 2 shows the interpretation of mean scores for this study.

Table 2. Interpretation of Mean Scores

Mean scores	Interpretation
1.00 – 2.00	Low
2.01 – 3.00	Moderately low
3.01 – 4.00	Moderately high
4.01 – 5.00	High

For the Likert-type items in the questionnaire, we utilized the interpretation of mean scores based on Oxford's (1996) approach. This provides us with information on the strength of the EC educators opinions on the items in the questionnaire. Means ranging from 1.00 to 2.00 indicated low agreement and 2.01 to 3.00 indicated moderately low agreement. While those ranging from 3.01 to 4.00 were interpreted as moderately high and 4.01 to 5.00 indicated as high agreement.

### Participants

In this study, purposive sampling was utilized to select the participants. One of the criteria for selection was that the respondents had to be EC educators teaching in the East Coast region of Peninsula Malaysia, specifically in Kelantan, Terengganu, and Pahang. The selected respondents were provided with a set of EEBCS questionnaires, which had been adapted from Chen's et al. (2014) EM-BCS items. The demographic data collected from 114 EC educators who returned the questionnaires are presented in Table 3.

Table 3. Early Childhood Educators Experience, Qualification and Age

Teachers Experience	N	Highest Qualification	N	Age	N
<1 Year	17	PT3/SPR/PMR	2	<20	2
1 - 3 Years	34	MCE/ SPM	45	21 - 25	40
4 - 6 years	36	Diploma	44	26 - 30	29
7 - 9 Years	6	Degree	22	31 - 35	17
10 Years>	21	Master	1	36 - 40	12
				40>	14
Total	114		114		114

Based on the responses as illustrated in Table 3, 36 educators had 4 to 6 years of work experience, followed by 34 educators with 1 to 3 years of experience and 21 educators with more than 10 years of work experience. In addition, 17 educators had less than 1 year of work experience and 6 educators had 7 to 9 years of work experience. It is believed that teachers with different years of experience have different personalities, beliefs, and methods of teaching, and this increases the depth and opulence of the data obtained (Singh et al., 2018). The

expectation is that the varying amount of teaching experience would reflect different (if not the same) beliefs and practices.

In terms of respondents' education qualifications, the data revealed that the highest qualification was a Master's degree, which was reported by 1 respondent. 45 educators were Malaysian Certificate of Education (MCE/SPM) holders, followed by 44 educators with a Diploma and 22 educators with a Degree. The lowest qualification reported was Form 3 Assessment (PT3/SRP/PMR), which was indicated by 2 respondents.

Table 3 also includes data on the age distribution of the respondents. The largest group consisted of educators between the ages of 21 to 25, with a total of 40 respondents. There were 29 educators aged 26 to 30, followed by 17 educators aged 31 to 35. Additionally, 14 educators were above 40 years old. Lastly, only two educators were below 20 years old.

## Results and Discussion

In Part B of the questionnaire, an exploration of the EC educators' attitudes towards English on the east coast of Malaysia is conducted and the effects of these attitudes on their practices are considered. The discussion of findings for Part B is followed by the discussion of findings for Part C.

### Early Childhood Educators' Attitude based on Beliefs

In Part B of the questionnaire, EC educators were asked to rate their confidence in their English language skills such as pronunciation, vocabulary, and proficiency. The responses were analyzed using SPSS and the statements were arranged in decreasing order of Mean values for better understanding. Table 4 presents the findings of Part B, which gauge the attitudes of EC educators towards their overall English language competence and their proficiency in using English with the children in their kindergarten.

Table 4. Early Childhood Educators' Attitude based on Beliefs

No.	Items	N	Mean	SD
1	I am confident in my ability to incorporate English language into learning during daycare activities (e.g., art or role play).	114	4.05	0.66
2	I am confident in my ability to plan activities to help children learn English language.	114	4.03	0.72
3	I am confident in my knowledge of the best practices and strategies for helping children to use English.	114	4.02	0.77
4	I am confident in my ability to improve children's English language knowledge when they make spontaneous English comments.	114	3.99	0.69
5	I am confident in my knowledge of the best way to assess children's command of English language.	114	3.9	0.74
6	I am confident in my knowledge of reasonable English goals for the children (able to	114	3.89	0.73

	read and write).			
7	I am confident in my ability to make sense of children's confusion when they learn English language.	114	3.89	0.73
8	I am confident in my ability to evaluate the children's knowledge about English language.	114	3.79	0.78
9	I am confident that it is easy for me to name objects in English.	114	3.76	0.69
10	I am confident that English was one of my favourite subjects in school.	114	3.53	0.77
11	I am confident that I can construct English sentences easily.	114	3.5	0.88
12	I am confident in my knowledge of the children's English language proficiency level when they enter the daycare.	114	3.42	0.80
13	I am confident that I can translate Bahasa Melayu into English and vice versa easily.	114	3.4	0.77
14	I am confident that I am good at pronouncing English words.	114	3.30	0.78

Based on the results, the EC educators demonstrated a moderately high attitude in which the minimum mean score was 3.30 and the highest mean score was 4.05. The three (3) items with the mean score above 4 are *"I am confident in my ability to incorporate English language into learning during day care activities (e.g., art or role play), I am confident in my ability to plan activities to help children learn English language and I am confident in my knowledge of the best practices and strategies for helping children to use English"*. With a mean score of 4.05, it shows that majority of the EC educators are very positive and confident in their knowledge to incorporate English learning into common preschool situations (such as art or dramatic play), which are considered cognitively stimulating high-yield activities (Smidt & Embacher, 2020). They even plan activities to help the preschoolers learn English (Item 7), with the mean score of 4.03. Furthermore, they are so positive that they have the knowledge of the best practices and strategies for helping preschoolers learn English (with the mean score of 4.02, Item 3).

In addition to that, with the mean score of 3.99, Item 8 shows that these EC educators strongly believe that they have the knowledge to further preschooler's English language acquisition when they make spontaneous English comments or discoveries. The lowest mean score is 3.3 which is *I am very good at pronouncing English words* (Item 14). It means that out of all the items, they are least confident in their English pronunciation. The next lowest is Item 12 with the mean score of 3.4 where these EC educators indicated that they lack the confidence in translating Malay to English and vice versa. It can be interpreted that these EC educators exhibited moderately positive attitude towards the use of English in teaching and learning to the children at their kindergarten. The findings of the current research are supported by the findings of Kouba et al. (2020) who found Lebanese preschool educators understand their role in developing language in the children. The findings are also supported by Goh's (2019) study in which the EC educators admitted the need and importance to have better language knowledge to assist children's language development and to perform more effectively in the classroom.

Additionally, the findings presented in Table 4 are aligned with the TPB by Ajzen (1991). According to TPB, attitudes play a crucial role in influencing behavior. In this study, the results indicate that the majority of the

educators demonstrated a positive attitude, as reflected by the moderately high mean scores. These positive attitudes can be interpreted as an indication that the educators believe in their ability to effectively teach English to young children and incorporate it into various preschool activities. This aligns with the TPB's notion that attitudes influence behavioral intentions and subsequent actions. In this case, the positive attitudes of the educators may lead to an increased intention to teach English and the implementation of language learning activities in their classrooms. It is evident that EC educators in the present study understand their role to develop children's language competence and they have moderately high confidence in their knowledge and competencies in English language. To sum up, the EC educators have positive attitudes towards the use of English language in their teaching practices.

### The Practice of Early Childhood Educators in Using English

Table 5 presents the findings regarding the language support practices implemented by EC educators in preschools

Table 5. The Practice of Early Childhood Educators in Using English

No.	Items	N	Mean	S.D
1	I tell stories to the children	114	3.20	0.95
2	I read English storybooks to the children	114	3.09	0.98
3	I do outdoor activities in English	114	3.07	1.08
4	I do artwork in English	114	3.04	1.10
5	I correct their English language mistakes (implicit e.g. plural vs singular, tenses, pronunciation) in English	114	2.94	1.05
6	I do writing activities in English (e.g. postcards, speech card)	114	2.89	1.11
7	I give learning session instruction in English	114	2.82	0.96
8	I discipline the children in English	114	2.77	1.04
9	I do Circle Time activities in English	114	2.71	1.11
10	I give daily routine instructions in English	114	2.66	1.01
11	I sing English songs/ nursery rhymes with the children	114	2.64	1.06
12	I use English in my everyday greetings	114	2.51	1.86
13	I let children watch English cartoons	114	2.21	1.95
14	I praise the children in English	114	2.20	1.03
15	I count in English	114	1.97	0.89

Notably, the results indicate that a majority of EC educators engage in storytelling sessions with the children, achieving a commendable mean score of 3.2. Furthermore, they actively read English storybooks to the children, garnering a respectable mean score of 3.09. Additionally, outdoor activities conducted in English received a mean score of 3.07, showcasing the educators' efforts to incorporate the language into various settings. Another noteworthy practice with a mean score above 3.0 is the incorporation of English into artwork, indicating the educators' recognition of the language's role in creative expression. Conversely, the most unexpected finding



pertains to the infrequent use of English for counting, as reflected by an average mean score of 1.97. This observation may be attributed to the prevalent use of the native language when interacting with children in preschools, including counting activities. However, it is important to acknowledge that counting in English, or any other language, is fundamental to language learning.

Another unexpected finding that emerged from the study, was that the EC educators seldom praise children in English or allow them to watch English cartoons in kindergarten. The mean scores for these aspects were notably low, at 2.20 and 2.21 respectively. The use of English expressions like "Very good!" or "Great job" does not seem to be commonplace among these EC educators. Interestingly, the children were also not given frequent exposure to English cartoons at the preschools, making it unexpected that the EC educators were not utilizing this resource to help children acquire the English language. From the low mean scores of between 1.97 to 3.20 in the items, it can be interpreted that these EC educators seldom interact in English with the children nor do they incorporate English much into their teaching practices. These findings contradict the positive attitude towards English reported in Part B, where the EC educators expressed confidence in their English proficiency. However, when it comes to applying this knowledge in everyday interactions, English usage with the children is infrequent.

Based on the results, it can be concluded that some of the EC educators in preschools did utilize English to a moderate extent (i.e., those who scored their practice high), which is commendable considering that English is not compulsory in their curriculum. August et al. (2014) asserted that explicitly teaching reading skills to English language learners such as phonological awareness, phonics, and oral reading fluency is beneficial for children. Although many of the EC educators might not explicitly have taught these skills, reading storybooks to children exposes them to new vocabulary and correct pronunciation.

In Goh's (2019) study, EC teachers acknowledged frequent code-switching between English, the Malay language, and the children's mother tongue. The authors' personal observations in kindergartens also revealed frequent instances of code-switching. Hansen and Broekhuizen (2021) argue that the quality of the language-learning environment positively impacts toddlers' vocabulary development. This environment was measured by the educators' responsiveness, both verbal and non-verbal, their ability to expand children's ideas and vocabulary, and their encouragement through questioning and active listening. For EC educators to achieve this, they have to be proficient in the target language and to consistently use it with the children. To support their confidence in using the language with the children, Fauzi et. al (2021) recommended to use an application called Kindy Talk Application which was specifically developed to assist EC educators in their English communication in preschool context. However, native English speakers and specialized English teachers were still voted as the best instructors for teaching English in Catalonian kindergartens (Waddington, 2021). While adopting similar recommendations in the Malaysian context is feasible, careful consideration is required in multiple aspects.

The findings also shed light on the language support practices employed by EC educators in preschools and their

alignment with TPB. The results indicate that EC educators engage in certain language support practices in their preschools. When analyzed through the lens of TPB (Ajzen, 1991), it suggests that despite positive attitudes and beliefs, external factors or barriers influence educators' behavior. These factors include the prevalent use of the native language in kindergartens, code-switching practices, and limited exposure to English children's programmes and cartoons. Consequently, educators demonstrated a moderate level of English language support practices in their interaction and activities with the children. The findings imply that although EC educators demonstrated a moderate level of English language support practices, there is room for improvement in terms of consistent and effective language usage. Understanding the factors influencing their behavior can inform the development of interventions and strategies to enhance the integration of English language learning in the preschool environment, aligning with the principles of TPB.

## Conclusion and Recommendations

The present study has several limitations. Firstly, the studies only involved EC educators from Malay medium private kindergartens located in the East Coast of Malaysia. Therefore, the findings should be cautiously interpreted as these are the reflections of these specific participants only. Future studies might include Chinese and Tamil medium private kindergartens in the East Coast or perhaps covering the whole of Malaysia to comprehensively examine the attitude and practices of the EC educators in terms of English language teaching and learning. Next, this study employed quantitative research design. More comprehensive findings can be achieved through data triangulation from both quantitative and qualitative approaches.

Despite the limitations, the findings of this study shed light on the use of English language and language support practices by EC educators in private Malay medium preschools in the East Coast of Malaysia. The study reveals that EC educators possess positive attitude towards English language and their ability in using the language, even though it is not fully reflected in their practice with the children in the preschools. Those who used English with the children used English even though it was not part of the curriculum. Hence, the use of English was moderate; and in several areas, improvement is needed.

One key finding is the infrequent use of English praise and limited exposure to English children's programmes and cartoons. This indicates missed opportunities for children to develop their English language skills through positive reinforcement and engaging educational content. Therefore, EC educators should be encouraged to incorporate more English language usage and praises in their interactions with children. This can enhance children's exposure to English and create a supportive learning environment.

Additionally, code-switching practices between English and Malay, the children's first language were observed, suggesting a need for clearer language boundaries and consistent language usage. Professional development programmes should be offered to EC educators to enhance their proficiency in the English language and provide them with effective strategies for language support. Furthermore, clear language policies and guidelines should

be established in preschools to minimize code-switching and promote consistent language usage. Perhaps, there should also be opportunities to collaborate with native English speakers or specialized English teachers. This would be beneficial in providing language input and modeling correct English usage.

On the whole, the results ultimately highlight the importance of a high-quality language-learning environment in fostering children's English language development. EC educators should strive to be proficient in the target language, actively engage children in verbal and non-verbal communication, expand their vocabulary, and encourage children through active listening and thoughtful questioning. By implementing these recommendations and addressing the identified areas for improvement, Malaysian preschools can create a more conducive environment for English language learning, ultimately benefiting the language development and future academic success of young children.

Most importantly, recognizing the significance of fostering positive attitudes towards English among educators and learners is crucial for creating an effective language learning environment. By nurturing favorable attitudes, we can enhance teaching practices, stimulate children's interest in English, and promote their language development. The findings, hence, provide insight to how the quality of existing English language education provided in preschools can be upgraded and mapped to Malaysia English Language Education Roadmap 2015-2025 for the reform to succeed. It is recommended that the Malaysia Education Ministry should make it compulsory for private preschools to use English as their medium of instruction and communication because the educators are actually quite capable of using English with the children but they do not do so because it is not compulsory. Furthermore, early English language exposure has been found to profoundly contribute to a more proficient mastery of English over the long term.

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## How Glosses in Academic Texts are being Read?

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**Abstract:** A gloss refers to a short definition or explanation of the meaning of a word in a text that can assist learners in reading comprehension and vocabulary learning. This study aims to investigate how glosses in English academic texts affect the reading behaviour of ESL undergraduates while reading is taking place. In addition, it also examines the effects of gloss on the learning of the glossed target words. Twenty ESL first year undergraduates who were grouped into proficient and less proficient learners based on their MUET (Malaysian University English Test) results participated in a reading experiment using the eye tracking device. Eye movement data (i.e. fixation duration and scan path) obtained from the eye tracker, retrospective interviews and three vocabulary tests were analysed. The glossed target words were selected from Coxhead's Academic Word List (AWL) and were placed in the same line with the target word in the texts, in right margin of the texts. Eye movement analyses showed that the position of the gloss either at the top, middle, or bottom of the page influences how and when participants read the gloss. Participants who read the gloss before or after reading the texts were high unlikely to regress to the text to infer to the target words in the text. However, participants who read the gloss while reading the text mostly regressed to the text and read the target words in the text. The fixation duration data revealed that proficient participants looked at more glosses than the less proficient participants. The retrospective interview confirmed the fact that the participants did not read the gloss in each encounter as they have become familiar with the target words in the gloss. Nonetheless, they agreed that the presence of glosses in the texts helped them to learn unknown words, particularly in noticing the form of the words. The finding suggests that the use glosses need to be emphasized in language teaching and learning, particularly in reading comprehension and vocabulary learning.

**Keywords:** gloss, eye movements while reading, vocabulary learning, reading academic text

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### Introduction

By having a robust vocabulary, learners can grasp ideas and concepts better, which will positively affect their academic achievement. Therefore, learning a word is important for the receptive use (listening and reading) and the productive use (writing and speaking) of language. In the academic context, vocabulary knowledge plays a vital role to facilitate learning. University students need to equip themselves with sufficient vocabulary knowledge for them to read and fully understand academic material independently (Laufer & Ravenhorst-Kalovski 2010; Rahman, Yap, & Darmi 2018) to achieve academic success. In addition, one of the ways to

expand learners' vocabulary through reading is by modifying the reading input so that it becomes more informative to the meaning of the target word, thereby facilitating the lexical inferencing process (Godfroid, Boers, Housen 2013). Modification of input (i.e., target words) such as input enhancement can be done through the use of gloss, manipulation of frequency of exposure, and the presentation of contextual information for the target words. Such enhancement can increase the saliency of the target words so that they will be noticed and are more likely to be acquired by learners.

A number of studies have investigated the effects of different types of input enhancements on incidental word learning from reading, for example, repeated exposures (Teng 2016; Godfroid et al. 2017; Mohamed 2017), contextual clue (Webb 2008), and gloss (Boers et al. 2017; Jung 2016; Ko 2012), to name a few. Glosses refer to the definition of meaning, synonym, or translation that is provided for a target language item, to facilitate reading comprehension. Rather than modifying a text which may affect the authenticity of the text, glossing can be used to modify the input to resolve lexical difficulty, and assist readers to understand the text better. However, the findings were inconclusive on the effects of glosses on reading comprehension and target word learning as glosses tend to be skipped most of the times. Hence, this study investigates how glosses in English academic texts affect the reading behaviour of ESL undergraduates while reading is taking place.

## **Gloss in Reading**

Many studies in gloss studies examined the effect of different types of glosses on learning outcomes such as vocabulary acquisition or reading comprehension. The common ground of these approaches is that it helps to flag target language input so that learners can allocate their attention to the form and meaning constructions of target words while they read for the purpose of meaning comprehension (Godfroid & Uggen 2013). However, the modification of input does not guarantee the retention of target words.

Glosses refer to the definition of meaning, synonym, or translation that is provided for a target language item, to facilitate reading comprehension. Various input in the form of glosses have been investigated and compared, such as the use of first language (L1) versus second language (L2) in glosses (Ko 2012; Vela 2015; Ertürk 2016), the translation of target words in L1 (Rott 2007; Jung 2016), and the use of definition or synonym of the target word in L2 (Guidi 2009; Nowzan & Baryaji 2013; Gosssen, Camp, Verkoeijen, & Tabbers 2014), just to name a few. In addition, the type of glosses also differs across the studies: computerised versus paper based glosses (Bowles 2004), multimedia glosses (Hulstijn & Laufer, 2001; Guidi 2009; Boers, Warren, He, & Deconinck 2017), computer mediated gloss (Hu, Vongpumivitch, Chang, & Liou 2014; Marefat, Rezaee & Naserieh 2016), and multiple choice glosses (Hulstijn 1992; Rott, William, & Camero 2002; Duan 2018). In addition to the different input and types of glosses investigated across the studies mentioned above, the methods of L2 vocabulary learning assessment employed in these studies also vary, such as multiple-choice vocabulary test, meaning recall in L1, cloze tasks, and meaning recall in L2 to measure the form and meaning construction of the target words learned.



Another noteworthy difference seen across these studies is in terms of glossing condition, whereby several studies boldfaced the target word in the text (Ko 2012; Ertürk 2016; Danesh & Farvardin 2016; Warren et al. 2018; Duan 2018) while a few other studies did not bold the target word in the text (e.g. Boers et al. 2017; Jung 2016). Bolding may increase the chances for learners to notice the target word. However, boldfacing the target word in the text does not guarantee that it will attract readers' attention to read its iteration in the gloss (Warren et al. 2018). In a nutshell, the divergent of methodological approaches to glossing employed by these studies highly contribute to inconclusive findings in the effects of glosses on L2 vocabulary learning.

When reading for comprehension, readers probably dismiss unfamiliar words, or in other case, they might incorrectly infer the meaning of those unfamiliar words. In both cases, the learning of those unfamiliar words is highly unlikely to happen. According to Ko (2005), the use of glosses for unfamiliar words in the text will prevent learners to make wrong guessing and in doing so, it will ease the reading process itself. Moreover, glosses increase the opportunity for learners to read the target words more than once (Watanabe 1997). After the learner read the target word in the text, he/she would probably read the target word in the gloss, and probably go back to the text and read the target word again. The provided meaning plus repeated encounter of the target word would enhance incidental learning of the word. A considerable amount of past studies have shown that, overall gloss has a positive effect on vocabulary learning, compared to no gloss condition (Watanabe 1997; Ko 2012; Danesh & Farvardin 2016; Jung 2016; Duan 2018). However, the contradicting notion that gloss might deprive the learner's mental effort to search and infer the meaning of the word may cause in a less affirmative result on vocabulary learning (Huang & Lin 2014).

In addition, with regard to the effects of the different types of glosses, such as multiple-choice gloss, pictorial glosses, and computer-mediated glosses, the findings vary; for example, the findings of Boers et al.s (2017) study on the effects of multimodal glosses over text-only glosses on L2 vocabulary learning. In their study, two groups of participants read a narrative text containing six pseudo words glossed with textual information or textual information plus a picture. The study found no significant difference between the two glosses, claiming that picture may hamper participants' initial uptake of word form and meaning. This is evident in the results from three vocabulary tests posed to the participants, in which gloss with picture group showed the poorest performance in almost all the three tests (i.e., meaning recognition, form recall, content questions). The use of gloss is beneficial as it may compensate the lack of contextual input; however, this may diminish reader's chance to infer and hence reduce the effort in processing, which might affect the retention in long term memory (Watanabe 1997).

On the other continuum, one might suggest that new words will be effectively and efficiently learnt by making learners infer the meaning of unknown words using the information obtained from context (Hulstijn 1992). Burcu Varol and Gülcan Ercetin (2019)'s study investigated the effects of gloss type, position, and working capacity on second language comprehension in electronic reading. The findings demonstrated that the effects of gloss content rely on the type of task used to facilitate comprehension, while the effects on gloss position were still ambiguous. The main effect of the gloss position was significant in pop-up conditions compared to separate

window conditions in terms of frequency of access. Ko (2012)'s study investigated the effect of gloss and no gloss texts on L2 vocabulary learning. The findings demonstrated there was significant differences between glossed and no glossed conditions on L2 vocabulary learning. The result from a survey of the study revealed that participants preferred glosses in their reading materials and they looked at the gloss when they came across unknown words with the purpose to understand the text. While Ko's study only examined the effect of glosses on vocabulary learning, Jung (2016)'s study investigated how glossing in L2 texts affect learners' reading comprehension, L2 grammar and vocabulary learning. The results indicated that glossing significantly facilitated learning of the target constructions while having no influence on reading comprehension scores.

Many studies on glossing employed pre-test and post-test to investigate the effect of glossing on learning outcomes (Ko 2012, Vela 2015, Jung 2016, Boers, Warren, He & Deconinck 2017). Only a few utilised eye tracking and investigate the effect of glosses on reading behaviors and learning outcomes (Warren et. al). However, these studies do not address how glosses are being read and process specifically. Jung and Révész (2018) and Warren et. al (2018) were among the latest studies on glossing the used eye tracker as a research tool. Warren et. al (2018)'s investigated the effect of gloss types on learners' intake of new words. The findings showed that glosses have little effect on the distribution of attention (based on fixation duration) and gloss with definition and picture yielded better result in form and meaning recognition of the target word, while text only gloss tend to be skipped most of the times. On the whole, glossing has been found to facilitate vocabulary learning and ease reading comprehension. Nonetheless, different assessment methods and types of glosses investigated may entail different outcomes.

## **Methodology**

### **Participants**

A total of 20 first year Malaysian ESL undergraduates at a research university in Malaysia were chosen as participants for this study. All participants had received similar number of years of English language education before entering university, and attained Band 3 or Band 4 for the Malaysian University English Test (MUET) results. They were in the same field of study (i.e. social science) but from two different academic specialisations for their bachelor's degree programme namely, Bachelor of Social Science in Psychology and Bachelor of Education in Teaching English as a Second Language (TESL). To ensure the similarity in terms of familiarity and knowledge of the structures of the academic text, the participants chosen were those had not taken any preparatory courses related to English for Academic Purpose (EAP). Hence, they had not been formally taught the structure, types, and the language skills associated with academic discourse. The data of these participants were derived from a larger sample of participants which consisted of 41 participants from the TESL programme and 38 participants from the Psychology programme. All of the participants underwent the same research procedure set by this study. However, to gain more information regarding the reading processes involved when reading English academic texts, data (i.e. total fixation duration, analysis of scan paths, retrospective interview) were elicited from 20 participants, 10 from each undergraduate programme, for a detailed analysis.

## Reading Materials

Three academic texts (labelled as Text A, Text B, and Text C) were adapted from the introduction section of three journal articles. The introduction section of a journal is deemed suitable to be used as a stimulus (reading material) for this study as the section generally provides relevant information about the topic and does not usually contain any methodological terms that may be unfamiliar to the participants. Since content familiarity eases reading comprehension (Pulido 2004), the content of journal articles was carefully selected to ensure that the participants will be able to understand the texts. The fact that the participants were from the social sciences and humanities cluster, the journal articles chosen were on research in social sciences and humanity, and are related to university students in general. The texts were on workplace writing, technology in education and skills among graduates. Each text had four paragraphs and each paragraph was displayed on a single screen. Glosses of four academic words were inserted on the right margin of the text. The glosses were placed in a box with blue outline, in line with the academic word in the text. The target words in the glosses were chosen from the least known academic words by ESL undergraduate students based on a study conducted by Sulaiman, Salehuddin and Khairuddin (2018). The words were derived from Academic Wordlist (AWL) by Coxhead (2000).

## Instruments

The current study used TOBII TX300 Eye Tracker to investigate the participants' eye movement patterns (namely their fixation duration, fixation counts, reading time, and scan path) when reading academic texts. The eye tracker has a sampling rate of 300 Hz and a large head movement box which enables less restricted movements and more natural position for the respondents. The heat map displays the participant's degree of attention on certain stimuli. Areas that receive longer fixation durations or a higher number of fixations known as the "hot" zones are highlighted with warm colours (e.g., red), whereas areas that receive shorter fixation durations or fewer number of fixations known as the "cool" zones are highlighted with colder colours (such as green), and no colour reflects areas of no looks or no fixations (Conklin & Pellicer-Sanchez 2016).

Scan path is another form of visualization that encloses fixation positions that tells the sequence of the eye movements while looking at the stimuli. The numbering in the circle indicates the sequence of fixation and the line indicated the direction of the eye movement. The scan paths can be exported as image files or as animated visualization that show the recording of the participants from the integrated camera and speaker. The three academic texts were presented on a computer screen in regular Consolas font, size 18, double spaced. Each text consisted of four displays; each display contained 10 to 12 lines of text. A total of 12 displays were presented to the participants. In addition, to support the data obtained from the eye tracker, a retrospective interview was conducted on each participant right after they completed reading the three texts. The questions asked on the participants' comprehension of the texts that they have read, their reading behaviours (based on scan path recording) and the text in general.

## Findings and Discussion

Ten participants from the high proficiency group were labelled as H1 to H10, while ten participants from the low proficiency group were labelled as L1 to L10. All three texts consisted of gloss of four target words namely, ‘confer’, ‘albeit’, ‘amend’, and ‘notion’. The words ‘confer’ and ‘amend’ appeared three times whereas the words ‘albeit’ and ‘notion’ appeared four times throughout the three texts. Table 1. presents the number and position of the gloss for each page in each text. The glosses provide meaning of the target word. The gloss of the target academic words appeared on the right-side margin of the screen. The gloss was placed in a box with blue outline, in line with the target word in the text. The number of glosses varies per screen, from zero to three.

Table 1. Number of gloss on each page

Text(Page)	Number of Gloss	Position of gloss on page
Text A (1)	1	Bottom
Text A (2)	2	Top, bottom
Text A (3)	-	-
Text A (4)	1	Top
Text B (1)	-	-
Text B (2)	3	Top, middle, bottom
Text B (3)	1	Middle
Text B (4)	1	Top
Text C (1)	1	Top
Text C (2)	2	Top, middle
Text C (3)	1	Bottom
Text C (4)	1	Bottom

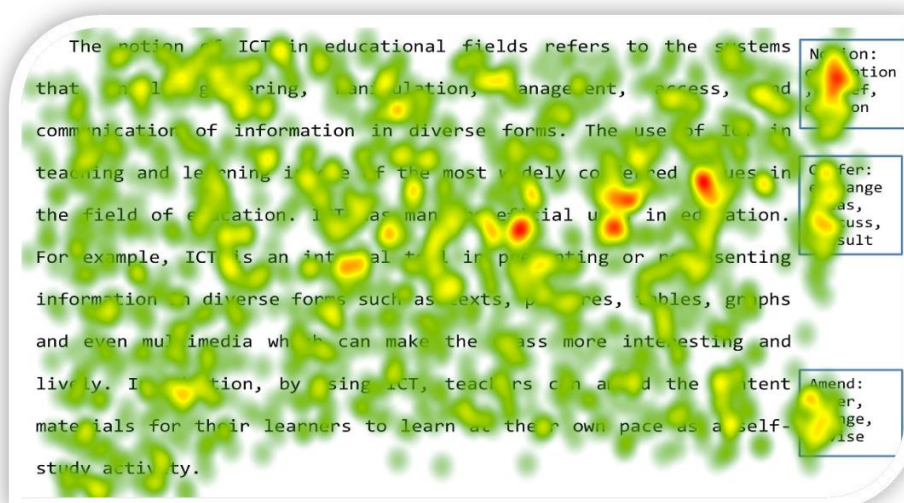


Figure 1. Sample of Heat Map

From the recording of the participants' scan path and heat maps, while reading the texts, it was noticed that the position of the gloss is one of the factors affecting how the participants read the gloss. Figure 1. shows the sample of heat map and Figure 2. illustrates the sample of scan path from one of the participants. Warm colour (red spot) was seen mostly on the first or top gloss that appear on the text. This reflects that gloss attracted the participants' attention.

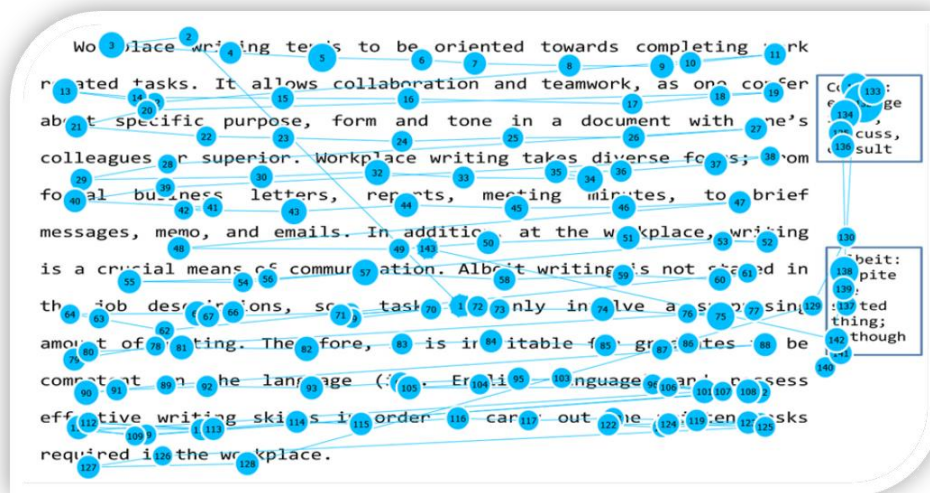


Figure 2. Sample of Scan Path

In addition, if a gloss is located at the top of the page, the participants would most likely read the gloss before or while reading the passage. For example, the gloss on the fourth page of Text A is located at the top of the page. Among the five proficient participants that read the gloss on page four (Text A), three participants read it while reading the passage, while four out of six less proficient participants who read the gloss also read it while reading the passage. On the other hand, a gloss that appeared at the bottom of the page is most likely to be read after the participants have read the entire passage. For instance, the gloss on page three (Text C) is located at the bottom of the page. All of the participants from the less proficient group who read the gloss on page three (Text C) read it after reading the whole passage, and a majority of the proficient participants who read the gloss also read it after they had completed reading the passage on that page. Most of the participants from both groups that referred to the gloss after they had read the passage did not go back to read the passage or search the target word (in the gloss) in the sentence. Most of the time, after reading the gloss, the participants would move on to the next page. In contrast, the participants who read the gloss while reading, either upon or before encountering the target words in the passage, mostly regressed or went back to the sentence in which the target words appeared, after reading the gloss.

Based on the percentage of glosses looked-up on each page as shown in Table 2., more participants from the proficient group referred to more glosses on almost all the pages compared to the less proficient participants. For both groups, Text C shows the lowest percentage of glosses looked-up. Almost all participants in both groups referred to gloss on the first page of Text A. This is most probably because it was the first gloss they

encountered while reading the passage. The second page of Text B which consists of three glosses also resulted in high percentages of glosses looked-up among the participants from both groups.

Table 2. Percentage of looked-up glosses on each page

Text (Page)	% of Glosses Looked-Up	
	Proficient	Less Proficient
Text A (1)	90%	100%
Text A (2)	60%	60%
Text A (4)	60%	50%
Text B (2)	90%	70%
Text B (3)	80%	50%
Text B (4)	70%	50%
Text C (1)	50%	30%
Text C (2)	70%	60%
Text C (3)	60%	40%
Text C (4)	40%	50%

Regarding of percentage of glosses referred as seen in Table 3., more than half of the participants from both groups looked at more than 70% of the total glosses provided. Three out of the ten participants from the less proficient group looked at less than 50% of the total glosses provided. Among the three participants, two participants only referred to two out of fourteen glosses provided in all texts. A similar pattern was seen in one proficient participant who only read two out of the fourteen glosses.

Table 3. Number of participants based on percentage of glosses looked-up

% of Glosses Looked Up	Number of participants	
	(Proficient)	(Less Proficient)
90-100	3	2
70-89	3	4
50-69	3	1
30-49	-	1
0-29	1	2

H6 was one of the proficient participants who looked at more than 90% of the glosses provided. Based on his/her scan path, H6 read the target word and the definition for all the glosses on Text A; however, she/he only looked at the rest of the glosses on other texts and merely read the target word. Nevertheless, H6 was able to recognise two out of the four target words in the gloss condition and successfully provided the meaning of three of the target words. Based on the interview transcript, H6 stated that she/he knew the meaning of the target words presented in the glosses and did not have to read the definition provided in each gloss thoroughly.

In the same vein, H8 who looked at all of the glosses was able to successfully recognise all four target words and provided the meaning of two target words correctly. During the retrospective interview, H8 asserts that she/he read the glosses after reading the text. This is in accordance with H8's scan path which revealed that he/she read all of the glosses after she/he had read the text on that page and did not go back to the passage. When H8 was asked why he/she referred to the gloss after reading, H8 said that *"because I want to know the gist of the text first, and then, I only refer...to the definition"*. Besides that, H2, who looked at more than 70% of the glosses, was able to recognise and recall the meaning of all the target words placed in the glosses. Based on H2's scan path and interview, it was apparent that H2 read the target word and the definition in the glosses while reading the passage. H2 went back to the passage to reread the lines that contained the target words in some of the glosses. Nevertheless, in some cases, a high percentage of glosses looked up does not necessarily lead to better recognition of target words. For instance, H7 has the least percentage of glosses looked up among proficient participants. However, he/she was able to recognise all of the target words and recalled the meaning of one target word. H7 stated that *"if I couldn't understand one word..i will refer to the gloss..then I just go back to the sentence...and start to reread"* indicating that he/she only refer to the gloss if there are words whose meaning he/she did not know.

On the other hand, L1 who only looked at one gloss (7.1%) while reading the texts failed to recognise any of the target words. In his/her retrospective interview, L1 asserted that he/she would search for the definition of unknown words if the content of the text is difficult to understand. L1 further added that he/she would reread the contents of the text or guess the meaning of the unknown words. The findings also revealed that the position of the gloss influenced how the participants read the gloss. According to Ko (2005), using glosses for unfamiliar words in the text will prevent learners from making wrong guesses and, in doing so, will ease the reading process. This was reflected in the current study, whereby, those who looked at the glosses while reading were better at recognising the target words and recalling the meaning of the target words compared to those who read the glosses after they have read the text. Even though, the participants did not fixate on the gloss in each encounter, they still agreed that gloss helped to know the meaning of unknown words. This is probably due to the fact that they have grasped the meaning of the words presented in the glosses and chose to ignore it in the following texts. Nonetheless, all the participants agreed that glosses had assisted them to cope with unfamiliar words while reading, and this corroborates the claim made by Duan (2018), Jung (2016), Ertürk (2016), and Ko (2012). However, it may not warrant comprehension of the text in general and target word learning in specific.

## Conclusion

The use of glosses need to be emphasized in language teaching and learning, particularly in reading comprehension and vocabulary learning. In addition, the findings revealed the provision of different input enhancements in reading material that can be adapted for second language vocabulary learning and teaching. Gloss has shown to enhance the noticeability of target words that leads to successful form recognition of the words among participants in the current study regardless of their language proficiency. The use of typographic enhancement

such as highlighting or bolding the target words in the passage could also increase the chances of deeper processing of the target words among participants. Vocabulary learning in the present study varies depending on input enhancement of academic target words and the participants' language proficiency. Therefore, language instructors should take into consideration these

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## Ethical Guidelines for Hijamah in Malaysia: A Review

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**Abstract:** There is a lot of research conducted about hijāmah, particularly its wet-cupping therapy. Most research focuses on its effectiveness in curing specific illness and problems; least of them do focus on the ethics of hijāmah even though ethics are very important in guiding the practitioners not to cause harm and to give the best treatment for their patients. Without proper ethics, hijāmah therapists may face risk of litigation by their patients and related regulators. Therefore, this paper aims to review existing literature on ethics of hijāmah within Malaysia context. This study adopts meta-search analysis to extract all relevant literature from research databases and Islāmic texts. Our primary finding indicates that there is a missing integration of Islāmic ethics in the current guidelines developed by the Ministry of Health, Malaysia. Therefore, there is an opportunity to improve the current guidelines by integrating Sharī'ah compliance towards sustainable development and preservation of this Islāmic prophetic medicine.

**Keywords:** Ethical guidelines, Hijāmah, Sharī'ah compliance

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### Introduction

Hijāmah is a traditional Islāmic cupping medical practice since the time of Prophet Muḥammad (ﷺ). It has two main types of cupping therapy, they are: 1- Dried cupping which involves creating a vacuum in a cup and placing it on the skin to draw out toxins which is believed to promote blood circulation and relieve pain and inflammation. 2- Wet cupping which involves the use of small incisions made on the skin and the application of suction cups to create a vacuum that draws out small amounts of blood, fluid, and toxins from the body (Aboushanab & AlSanad, 2018). This type of wet cupping, known as ḥijāmah, was the primary form of cupping therapy used during the time of the Prophet Muhammad (ﷺ) and his companions; the terms ḥijāmah and faṣḍu were used interchangeably to refer to this particular form of therapy(Asar A.K., 2022). While hijama has been used for centuries in Islāmic cultures as a therapeutic tool, its practice raises ethical concerns that require careful consideration. The ethical guidelines of hijama is the most essential aspect in ensuring that the practitioners

provide quality care.

Ministry of Health (MoH) has recognized hijāmah therapy as one of the traditional and complementary medicines practices. Under the Traditional and Complementary Medicine Act (TCMA) 2016 which has come into operation on 1 August 2016 (Malaysia, 2016); MoH is the responsible authority to govern the policy and to impose the ethical guidelines on TCM practices and products. The aim of the TCMA is to ensure that TCM practices are safe, effective, and meet certain standards of education and training. MoH also has highlighted in their another document entitled the Traditional and Complementary Medicine Blueprint 2018-2027 Health Care (TCMBP)(Ministry of Health, 2017), that “well-declared ethical values” is the first criterion for the practices of hijāmah. However the details of the hijāmah ethical guidelines are not stated well. This paper discusses the current ethical guidelines for hijāmah highlighted by World Health Organization (WHO) and MoH.

## Method

The first step in this methodology involves conducting a review of World Health Organization (WHO) and MoH current ethical guidelines for hijāmah in Malaysia. The second step involves a review of Islamic sources and Muslim scholarly opinions on the ethical principles to identify common themes and differences regarding the ethical guidelines. The final step in this methodology involves a synthesis of the findings to develop a proposed framework ethical guideline of hijāmah.

### Ethical Guidelines of Hijāmah by World Health Organization (WHO)

Hijāmah, particularly its wet-cupping therapy has gained popularity in recent years with a lot of research conducted about it. Most research focuses on its effectiveness in curing specific illness and problems; there are ethical considerations that practitioners and patients should be aware of. In this review, we will discuss the ethical guidelines of hijāmah provided by WHO(Organization, 1999).

One of the most important ethical considerations of hijāmah is the **informed consent**. According to the WHO, the informed consent is a requirement for any research involving human participants. It involves providing an Informed Consent Form (ICF) with each proposal, indicating that the research participant has voluntarily decided to participate in the research(World Health Organization, n.d.). For hijāmah, informed consent means that the patient should be fully informed about the potential benefits and risks of the treatment. The practitioner should discuss any alternative treatments that may be available to the patient as well. In addition, the patient should be informed about the qualifications and experience of the hijāmah practitioner to ensure that they are receiving safe and effective treatment(AIBedah et al., 2015). It is essential that practitioners take the time to explain the procedure thoroughly, the risks and benefits, and the aftercare instructions. This process ensures that the patient understands what to expect and makes an informed decision about their treatment. By ensuring that

patients are fully informed, practitioners can help to build trust and establish a positive therapeutic relationship with their patients.

**Confidentiality** is the second critical ethical consideration in the practice of *hijamah*. Practitioners must prioritize maintaining patient confidentiality and respecting the privacy of their patients at all times. This includes ensuring that patient information is only shared with others when the patient provides explicit consent and that such information is only used for the purpose of providing medical care. The practitioners should ensure that they have obtained the patient's consent before disclosing any medical information to family members, other healthcare professionals, or any other third party. The practitioners should also take steps to ensure that patient records and other personal information are stored securely and confidentially for patient's safety and the quality of care (Koskimies, Koskenniemi, & Leino-Kilpi, 2020). This ethical consideration is critical in building and maintaining trust between the practitioner and the patient. By respecting the patient's privacy and maintaining their confidentiality, the practitioner can help create a safe and comfortable environment that encourages patients to share important information about their health and wellbeing.

The third ethical consideration in *hijamah* practice pertains to the use of **sterile equipments**. The practitioner should ensure that the equipment used for the procedure is sterile and that the procedure is performed in a hygienic environment to prevent the transmission of infectious diseases and other complications. This ethical guideline is not only in line with the standard guidelines of WHO and MoH but also with Islamic teachings. Cleanliness is highly valued in Islām, and Muslims are required to maintain cleanliness of their bodies and surroundings. The Prophet Muhammad (PBUH) emphasized the importance of cleanliness, stating that "*Cleanliness is part of faith, and faith leads to paradise*" (Sahih Muslim, Book 2, Hadith no.: 432). Hence, the use of sterile equipments and a hygienic environment is an essential aspect of the Islamic ethical guideline for *hijamah* practice, as it aligns with the Islamic emphasis on cleanliness and hygiene.

The fourth ethical consideration when it comes to *hijamah* is the importance of **proper training and qualifications for practitioners**. It is crucial for practitioners to have received the necessary training and qualifications to perform *hijamah*, and to have a sufficient understanding of human anatomy and physiology. They should also be knowledgeable about the potential risks and complications that can occur during the treatment process. Additionally, in Islām, seeking medical treatment and consulting with qualified medical professionals is highly emphasized. The Prophet Muhammad (PBUH) encouraged seeking medical treatment and stated that "*For every disease there is a cure, so if the medicine matches the disease, the patient will recover with the permission of Allah*" (Sahih Muslim, Book 31, Hadith 5807). Therefore, Muslims are encouraged to seek medical treatment for their illnesses and to consult with qualified medical professionals, including doctors and traditional healers, before undergoing any medical treatment. This ensures that practitioners have the necessary knowledge and skills to deliver *hijamah* safely and effectively, and that patients receive the best possible care.

The fifth ethical consideration in *hijamah* is the need for practitioners to engage in **ongoing professional**

**development.** Practitioners should stay abreast of the latest research and advancements in the field of *hijāmah* and continuously strive to enhance their knowledge and skills. This can be achieved through attending training programs, workshops, and conferences, as well as participating in online courses and other forms of continuing education. By staying up-to-date with the latest developments in the field, practitioners can provide their patients with the most effective and safe treatments possible. Furthermore, ongoing professional development is essential for maintaining the highest standards of ethical and professional conduct in the practice of *hijāmah*. It ensures that practitioners provide their patients with the best possible care and are able to adapt to changing circumstances and patient needs.

### **Ethical Guidelines of *Hijāmah* by Ministry of Health Malaysia (MoH)**

Overall, the ethical guidelines for *hijāmah* by the Ministry of Health (MoH), Malaysia are based on the WHO ethical guidelines, with some additional guidelines specifically for practitioners in Malaysia. The ethical guidelines are stated in the general guidelines in the Traditional and Complementary Medicine Act 2013 (Ministry of Health, 2013). Those additional ethical guidelines are as follows:

**Registration.** In Malaysia, the Traditional and Complementary Medicine Act 2013 (Ministry of Health, 2013) requires that *hijāmah* practitioners to be registered with the Malaysian Traditional and Complementary Medicine Council. This registration process is in place to ensure that practitioners have the necessary knowledge and skills to perform *hijāmah* therapy safely and ethically. To become a registered *hijāmah* practitioner, an individual must first complete a recognized training program in *hijāmah* therapy. This training program should cover the theoretical and practical aspects of *hijāmah* therapy, including safety considerations and ethical principles. After completing the training program, the individual must pass an examination to obtain a certificate of competency in *hijāmah* therapy. However, the implementation of this registration requirement has been met with challenges, such as the lack of standardization in the training programs. This issue can potentially lead to discrepancies in the knowledge and skills of registered practitioners, which can affect the quality of care provided to patients. Therefore, the authorities need to ensure that the training programs are standardized to maintain the competency and quality of *hijāmah* practitioners in Malaysia.

**Indications and Contraindications.** The MoH's guidelines on *hijāmah* also address the indications and contraindications of the therapy. These guidelines suggest that the treatment is suitable for various conditions, including musculoskeletal disorders, respiratory problems, digestive disorders, and gynecological disorders, among others. However, the therapy is not recommended for patients with bleeding disorders, active infections, or skin conditions that could be worsened by the procedure (Ministry of Health, 2013). Additionally, certain medical conditions, such as cancer and blood disorders, are contraindicated for *hijāmah* therapy. The guidelines require practitioners to refer patients to medical doctors if they suspect any underlying medical conditions that could be contraindicated for the therapy. These guidelines reflect the importance of ensuring that patients are properly assessed before undergoing *hijāmah* therapy, to avoid any adverse effects and to ensure the safety and well-being of the patient.

**Record-keeping.** Record-keeping is an important aspect of *hijamah* practice that is emphasized in the guidelines. Practitioners are required to maintain accurate records of each patient's personal and medical history, as well as details of the *hijamah* treatment provided. This is important for several reasons. First, it ensures that the practitioner has a complete picture of the patient's health status and can make informed decisions about the appropriateness of *hijamah* treatment. Second, it provides a record of the treatment provided, which can be useful in case of any adverse events or complications. Finally, it can help to facilitate continuity of care, as the patient's records can be shared with other healthcare providers if necessary. The records should be kept confidential and made available to the patient upon request, as patients have the right to access their own medical records.

### Islamic Ethical Guidelines in *Hijamah*

In addition to previous discussion, there are some Islamic ethical guidelines which related to *hijamah*; which do not applicable or discussed in the guidelines provided by WHO and MoH. There are as follows:

**Intention.** Intention is a crucial aspect of the practice of *hijamah*, and it is considered an ethical consideration as well. The primary intention behind *hijamah* is to seek blessings from Allah or to alleviate health problems. Therefore, the practitioner should have a sincere intention in giving the best treatment to the patient. The practitioner should not focus solely on monetary gain or reward from the service, but rather on seeking Allah's blessing in their work. When a practitioner has a sincere intention, it is believed that they can achieve mastery and perfection in their work. The concept of intention in *hijamah* is rooted in Islamic ethics, which emphasizes the importance of sincerity and the intention to seek Allah's pleasure in all aspects of life. It is believed that a practitioner who has a sincere intention will be more committed to providing the best possible care for their patients.

**Invocation.** In the practice of *hijamah*, invocation/ faith are important ethical considerations. Before starting the therapy, both the practitioner and patient should invoke the name of Allāh and seek His help in healing the ailments. This is in accordance with the prophetic tradition that states that Allah does not send down a disease without sending down a cure for it. The Prophet stated: *"Allah does not send down a disease without sending down a cure for it"* (Ṣaḥīḥ al-Bukhārī, 5678)(Al-Bukhārī, 1987). Moreover, faith in the healing power of this prophetic medical therapy is also crucial. The Prophet Muḥammad also stated *"The Prophet (ﷺ) said: "Healing is in three things: A gulp of honey, cupping, and cauterizing, but I forbid my followers to use cauterization"* (Ṣaḥīḥ al-Bukhārī, 5680) (Al-Bukhārī, 1987). However, this prohibition is not absolute, because some companions of the Prophet still do it, especially to heal wounds caused by war. The actual law is *makrūh* [disliked], it can still be used as a last resort if no other treatment works(Asar A.K., 2022). Therefore, practitioners and patients alike should have faith in the healing power of *hijamah*, and believe that it can effectively alleviate the ailments. This belief and invocation not only serve as ethical considerations but also provide a sense of comfort and reassurance to patients who are undergoing the therapy.

**Perfection.** The concept of perfection is an important consideration in the practice of hijama. According to a prophetic tradition, Allah loves it when people do something, they should do it perfectly. The Prophet states: *"Verily Allah loves that whenever any of you do something, you should perfect it"* (al-Jāmi' al-Ṣaghīr, 1855) (Al-Suyūfī, n.d.). This means that the practitioner should strive to master their work and provide the best possible treatment to their patients. In Islam, perfection means doing the best that one can, as it is mentioned in the Quran that Allah does not burden a soul beyond its capacity: *"Allah does not charge a self (anything) except its capacity"* (Sūrah al-Baqarah, 2: 286). Hence, every practitioner should aim to master their job and provide the best possible service to their patients. Additionally, even the Prophet Muhammad emphasized the importance of responsibility when performing any work or obligation. This highlights the importance of practitioners taking their work seriously and striving for excellence in the practice of hijama.

**Separation of men and women.** There are debates among Muslim scholars about the extent to which gender separation or segregation is required by Islāmic law. Some argue that gender segregation is a cultural practice that has been erroneously attributed to Islam, while others see it as an essential aspect of Islamic identity and morality. For researchers, the separation of gender is required in Islām to prevent immorality or adultery which may happen especially when two people of opposite sex stay together in a closed place. Male and female patients should be treated in separate spaces to maintain modesty and uphold Islamic teachings on gender interactions. It is not a requirement for a practitioner to be a *mahram* to the female patient; if there is an urgent need to get treatment, then the female patient can get that treatment. However, it must be based on the guidelines that have been explained by Muslim jurists to guard against the occurrence of *zinā*, or *fitnah* that may arise in society. One of the guidelines is to have her husband, guardian, or other trusted woman with the female patient when she receives treatment from the trusted practitioner (Asar A.K., 2022).

**Modesty.** Both the practitioner and the patient should observe modesty. Muslims are required to observe modesty in their dress, behavior, and interactions with others. Modesty is seen as a key aspect of Islamic morality and is often linked to the concepts of piety and righteousness. The Qur'ān contains numerous references to modesty, including Sūrah al-Nūr (Quran 24:30-31). Muslims expected to avoid arrogance, pride, and showiness. The Prophet Muhammad is reported to have said: *"Modesty is part of faith, faith is in the Heaven, obscenity is part of rudeness, and rudeness is in the Hell."* (Sunan al-Tirmidzī, 13509) (At-Tirmidzī, n.d.). In the practice of *hijāmah*, the observance of modesty is considered an essential ethical consideration. Practitioners and patients are expected to adhere to modesty in their interactions with each other. This is in accordance with Islamic teachings, which emphasize the importance of modesty in all aspects of life. Modesty is considered a fundamental component of Islamic morality and is associated with the concepts of piety and righteousness. The Qur'ān contains numerous references to modesty, such as Sūrah al-Nūr (Quran 24:30-31), which states that Muslim men and women should lower their gaze and guard their private parts. Muslims are expected to avoid arrogance, pride, and showiness, and instead, display humility and modesty in their behavior and interactions with others. The Prophet Muhammad is reported to have said: *"Modesty is part of faith, faith is in the Heaven, obscenity is part of rudeness, and rudeness is in the Hell"* (Sunan al-Tirmidzī, 13509). Therefore, both the practitioner and the patient are expected to observe modesty during the practice of *hijāmah*.



**Respect.** Both the practitioner and the patient should respect each other during the procedure. The patient's privacy should be respected, and the practitioner should maintain a respectful demeanor. Respect is a fundamental concept in Islām that emphasizes the importance of treating others with dignity and honor. Muslims are encouraged to show respect to all people, regardless of their background, race, or religion. This concept is based on the Islamic belief that all human beings are equal in the eyes of Allāh, and that showing respect to others is a way of showing gratitude and obedience to the God. The Qur'ān contains numerous references to respect, including Sūrah al-Ḥujurāt (Quran 49:11). Allāh states *"O you who have believed, let not a people ridicule [another] people; perhaps they may be better than them; nor let women ridicule [other] women; perhaps they may be better than them. And do not insult one another and do not call each other by [offensive] nicknames."* The Prophet Muhammad is also reported to have emphasized the importance of respect, saying: The Prophet (ﷺ) said, *"Whoever believes in Allah and the Last Day, should not hurt his neighbor and whoever believes in Allah and the Last Day, should serve his guest generously and whoever believes in Allah and the Last Day, should speak what is good or keep silent"*(Al-Bukhārī, 1987).

Based on previous discussion, these are the proposed ḥijāmah ethical guidelines for Muslims in Malaysia which are the integration of Islamic ethical guidelines with the standard guidelines of WHO and MoH. The guidelines aim to ensure that the practice of ḥijāmah adheres to the highest ethical standards and protects the health and well-being of patients. The proposed guidelines include the requirement for practitioners to be sincere in their intentions, invoking the name of Allāh and seeking His help in healing the ailments before starting the medical therapy, and observing modesty and respect during the procedure. The guidelines also emphasize the importance of gender separation, especially in closed places, to prevent immorality or adultery. These guidelines are in line with the Islamic principle of protecting the dignity and privacy of both the practitioner and the patient. By integrating Islamic ethical guidelines with WHO and MoH standards, these proposed ḥijāmah ethical guidelines for Muslims in Malaysia aim to promote a safe, effective, and ethical practice of ḥijāmah while upholding Islamic principles and values.

Table 1. Summary of the Ethical Guidelines

No	Ethical Guidelines	World Health Organization (WHO)	Ministry of Health, Malaysia (MoH)	Islām
1	Intention	Not applicable	Not applicable	Yes
2	Invocation	Not applicable	Not applicable	Yes
3	Perfection, proper training and qualifications	Yes	Yes	Yes
4	Ongoing professional development	Yes	Yes	Yes
5	Separation of men and women	Not applicable	Not applicable	Yes
6	Modesty	Not applicable	Not applicable	Yes

7	Respect and confidentiality	Yes	Yes	Yes
8	Registration	Yes	Yes	Not applicable
9	Cleanliness, Hygiene and Sterile equipment	Yes	Yes	Yes
10	Indications and Contraindications	Yes	Yes	Yes
11	Informed Consent	Yes	Yes	Yes
12	Record-keeping	Yes	Yes	Not applicable
13	Follow-up and Monitoring	Yes	Yes	Not applicable

## Conclusion

Hijāmah is one of the global halal treatment industry in the world, particularly for the Muslim world such as Malaysia. Without proper ethics, hijāmah therapists or practitioners may face risk of litigation by their patients and related regulators. In reality, the Islamic ethical guidelines of hijāmah do not contradict to the good practices or guidelines stated by both health organizations: WHO and MoH. With this proposed ethical guidelines which comprised of the standard guidelines and Islāmic guidelines for hijāmah, it paves the way for sustainable development and preservation of this Islāmic prophetic medicine.

## Recommendations

Based on the findings of this research, there should be a standardization of practice in the field of hijāmah. This standardization includes the development of a code of ethics for hijāmah practitioners which complies with Islamic ethical guidelines. Regular training and assessment of practitioners; monitoring of their practice by regulatory bodies, and collaboration with healthcare professionals are also a must nowadays. Finally, there is a need for public education on the benefits and risks of hijāmah, as well as the ethical guidelines that practitioners should follow. This can be achieved through public awareness campaigns, educational programs, and the dissemination of information through traditional and social media platforms.

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## The Correlation between Students' Question Words Mastery and Their Speaking Ability in Asking Information

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**Abstract:** The research proposed to examine whether there was any significant correlation between students' question words mastery and their speaking ability due to the students' difficulty in asking information about someone' personal information. There were 28 students as the samples selected by using simple random sampling. This research used a quantitative approach which was presented in correlational research design. In collecting the data, the researcher used a test which consisted of a written and spoken test. The written test aimed to measure the students' question words mastery consisted of 27 questions. Meanwhile, in measuring the students' speaking ability, the students were asked to do a short dialogue with their peers asking and giving information about their family. Then, the data analysis was conducted based on the students' written and spoken test results and its correlation was measured. The result of the data analysis of the students' question words mastery and their speaking ability were fair proved by the mean scores of these were 69.6 and 70.8. Finally, the value of  $r_{obtained}$  was 0.608 which was higher than the value of  $r_{table}$  0.374. In conclusion, there was a significant correlation between students' question words mastery and their speaking ability in asking information.

**Keywords:** Question words mastery, Speaking ability

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### Introduction

As a global language, English is taught and learned in many countries over the world either in English as a Second Language (ESL) or English as a Foreign Language (EFL) context. Then, English has become a compulsory subject since primary school to the tertiary school in some countries, including Indonesia. The reason why English has been included into Indonesian curriculum is that English as one of the most spoken languages nowadays would help Indonesian students to communicate globally with others from around the world. English is considered as a foreign language (EFL) in Indonesia where that means that English is not generally spoken in daily communication by the people. Therefore, it raises some challenges for Indonesian students to learn English effectively, especially when it comes to speaking where the students are expected to speak English fluently with the correct structures.

Speaking is one of language skills that is included to the productive skill, in which the students will not be able to produce the language if they do not have sufficient language input. In addition, according to Brown (2001), speaking skill is perceived as one of the most language skills needed in communication. Besides, to be successful in speaking English, a student is expected to be able to use grammar accurately, to use appropriate language depending on the target audience, to use proper vocabulary, and to be able to maintain the communication to create a successful interaction (Amelia et al., 2019). Meanwhile, as it was observed in EFL classroom, the challenges faced by the students in speaking English could be caused by the lack of grammatical competence, lack of vocabulary mastery, and the anxiety while speaking a foreign language. Thus, most of EFL students found that difficult to be able to speak fluently and grammatically correct in English. Since, whenever the students learn the grammar or tenses, they would start worrying about their sentences whether they speak it grammatically correct or not, then at the end it would stop them from communication. The challenges while speaking English have been always emerging in EFL students even though for speaking in daily topic, for instance talking about personal information.

In addition, there are three aspects of knowledge that should be involved in speaking of a language, namely 1) the knowledge of using the correct mechanics of language which consists of pronunciation, grammar, and vocabulary; 2) the knowledge of being able to maintain the communication in terms of changing information and giving worth message for the interlocuter; 3) the knowledge of being able to apply pragmatic norms (knowing who is speaking to whom, in what context, about what, and why) (Sitepu & Indari, 2021). Those elements or knowledge should be mastered by the EFL students to perform a good English-speaking ability. Furthermore, there are five aspects to measure someone's speaking ability according to Brown (2001), there are: 1) comprehension which refers to the ability of creating an understandable meaning to the interlocuter; 2) grammar is the use of proper language with a proper structure; 3) vocabulary is that a language learner needs sufficient vocabulary to communicate effectively; 4) pronunciation refers to the ability of pronouncing or spelling the words correctly and widely accepted; 5) fluency means that the language learner could speak without many pauses.

Besides, when it comes to interaction, there would be two people or more communicating by giving questions and information orderly. Since, English has its uniqueness in terms of the structure that is totally different from Indonesian structure, most of students perceived it more difficult to ask a question compared to answer or give the information in English. It is because the way Bahasa Indonesia and English in arranging a question sentence is different. Then, it makes the students get difficulty whenever they have to ask a question in English. In addition, in English, it is known that there are two kinds of question sentences, which are yes or no question and detailed-answer questions that use question words or WH-questions which consists of what, who, where, when, why, how, and so on.

In addition, teaching question words would help the students to improve their critical thinking as what it is required in the 21<sup>st</sup> century learners' characteristic. Since, creating a question sentence that is arranged well and understandable is not as easy as giving information when someone is being asked. It is because when the

students are required to give a question, they would need to link their prior knowledge, curiosity, and put all these into a meaningful question sentence. Furthermore, being able to give questions would play big role in improving the students' higher order thinking skills (Lee, 2015). Thus, to be able to give questions in English is highly important for the students.

Furthermore, EFL students were being asked about the literal meaning of each WH-questions, most of them would answer it correctly, in which, they students knew that *what* means *apa* in Bahasa, *when* means *kapan*, *who* means *siapa*, and so on. However, they still found it difficult whenever they have to create or arrange a complete question sentence which has gained all of the language elements that should be put there. Simultaneously with the research conducted by Silalahi (2017) on 60 university students as the participant. She did descriptive qualitative research and found out that the students still made mistakes in arranging question sentences in English by using WH-questions. The mistakes found were about choosing the right WH-questions to compose a question sentence, using the right article, verb, and an auxiliary verb, however, it was found that in terms of the meaningfulness of the question, the students were making little mistakes. In addition, she also found that most of EFL students are confused on using a particular question word especially on those which have similar meaning when those are translated into L1 as a result the students mixed up the use of each of the question word. For instance, the students were difficult to differentiate the use of *Who* and *Whom*, since those differences do not exist in Bahasa Indonesia.

The interference of mother tongue in learning L2 has always been an issue discussed in teaching English as a foreign language discussion. As what had been investigated by Kumar (2016) that most of Indian students made some errors due to the mother tongue interference that affected their L2 performance. Those students were repeating the same errors as using inappropriate question word, missing word, and putting the word order wrongly. This research result was in line with the study conducted by Sitepu and Indari (2021) focusing on the relationship of the students' WH-questions understanding and their speaking ability in expression of asking and giving opinion. They conducted study to the thirty-six of the eight-year students, and they found that there was significant correlation between those variables, namely the students' WH-questions understanding and their speaking ability in asking and giving opinions. Therefore, even though some people would agree that when someone is speaking English, the grammatical components do not really matter. However, it was proven that helping the students to improve their grammatical components understanding would highly affect the students' speaking ability becoming better.

Then, it was explained by Swan (1980) that the students would make some mistakes regarding to formulate a question sentence, especially by using WH-questions, namely 1) putting the order wrongly, for instance putting the subject after the main verb; 2) Omitting the auxiliary; 3) Overgeneralization the use of auxiliary verbs even when it is not needed. Therefore, it could be said that almost of EFL students faced challenges in creating a question sentence that led them to those mistakes. Furthermore, the existence of the auxiliary verbs in English is another challenge that has to be faced by Indonesian students in improving their WH-questions mastery, since such thing does not appear in Bahasa Indonesia structure.

Those situations also happened at one of senior high schools in Indonesia, where most of the students are able to answer the questions given orally, but they found it difficult if they had to express the question by using question words to maintain the communication, even for asking their friends' personal information. Even though, the students have learned how to talk and do introduction in English since they studied in elementary level, but if they had to ask someone about it, it was difficult for them. It might be caused by the lack of some aspects that are not mastered by the students to support their speaking ability as what has been stated earlier. Additionally, explaining the idea of the use question words in teaching English is useful for the students (Massytoh, 2021). Furthermore, if the students are being asked what they know about question words, they might know the meaning of *what*, *where*, *when*, *who*, *why*, and *how*, however if they are asked how to use those words properly in term of communication, they still found it difficult. It can happen because some words cannot be translated literally but it must be translated based on the context. For instance, "What is your name?" would have different meaning if the words in that sentence are translated word by word. Therefore, the students sometime get confused how to use the question words appropriately.

Previous study had been conducted by Massytoh (2021) related to the correlation between the students' mastery in using wh-questions and the students speaking ability at the junior high school level, and it showed that the students' mastery in using wh-question affected the students speaking ability. Other studies had also been conducted by Randong, and Marbun (2013) which was focused on the improvement of students' speaking ability through guided conversations. It was action research conducted to the students at junior high school. The result showed that by having a good grammar understanding, directly the students' speaking ability would increase especially for their accuracy and fluency. Both of those studies conducted at the junior high school level, however the current study conducted to the students at senior high school level which the assumption that the senior high school students' communication skill has developed to create a meaningful question sentence and apply their question words mastery to maintain the communication. In addition, the current study would focus on the ability of the students to ask questions in term of asking someone's personal information. Therefore, the current research was proposed under the title "*The Correlation Between the Students' Question Words Mastery and Their Speaking Ability in Asking Information*".

## Research Questions

Based on the preliminary research conducted at one of senior high schools in Indonesia, the research questions were proposed as follows:

1. How are the students' mastery on using question words?
2. How are the students' speaking ability in term of asking information about someone' personal information?
3. Is there any significant correlation between the students' mastery on using question words and their speaking ability in asking information about someone' personal information?

## Hypothesis

Ha: There is statistically significant correlation between the students' mastery on using question words and their speaking ability in asking information about someone' personal information.

Ho: There is no statistically significant correlation between the students' mastery on using question words and their speaking ability in asking information about someone' personal information.

## Method

With regard to the research questions proposed earlier on seeking the students' question words mastery, the students' speaking ability in asking information about someone' personal information, and the correlation between the students' question words mastery and their speaking ability in asking information about someone' personal information, thus it was important to conduct a quantitative correlational research design. In addition, according to Gay (2009), the correlational study is used to measure the correlation between variables. In this study, it consists of two variables, namely the independent variable which is the students' WH-questions mastery (symbolized as variable X), and the dependent variable which is the students' speaking ability in asking someone' personal information (symbolized as variable Y). Furthermore, in the correlational study design, the researcher is trying to measure the degree of association between variables involved. Therefore, this study was aimed to find out the correlation between the students' mastery on using question words and their speaking ability in asking someone' personal information.

The participants of this research were the eleventh-grade students at one of state senior high school in Siak regency in which consisted of 281 students in total as the population of the study. Additionally, population is defined as all members that are eligible to participate in the study or it is defined as the group that the members have the similar characteristics. Then, from all members of population of the study, there were several members that were chosen as the samples of the study. As what has been stated by Ary (2016), sample is a set of data or group that was selected from the total number of the population by using method of sampling. Since, there were 281 students in total, then there were 28 students participated in this study chosen by using simple random sampling. It is because in determining the number of the sample in a study, if the total number of the population is less than 100 people/subjects then it is suggested to take all the members of the population as the study samples. However, if the total number of the population is more than 100, then it is allowed to take 10-15%. 20-25%, or more from the total number of the population as the study sample (Arikunto, 2015). Therefore, I took approximately 10% of the total population as the study samples. Since, in the correlational study, there would not be comparison among the participants, so the students were choosing by applying simple random sampling which meant all the students included in the population would have the same opportunity to be chosen as the samples of the study.

In addition, there were two tests applied to measure the students' question words mastery and their speaking



ability in asking information. The first test given was a written test aimed to find out the students' mastery of the use of question words. The written test given was focused on some aspects in constructing a question sentence, such as identifying each use of WH-questions, identifying the appropriate *be* across different tenses, identifying the appropriate *non-verb* complement for nominal sentence, identifying the appropriate auxiliary verb across different tenses, identifying the appropriate complement for the verbal sentence. The total number of the questions given were 27 questions in the form of multiple choices that had been validated by trying it out first. The second test given was a spoken test where the students were asked to do a peer-dialogue with their classmates asking information about their classmates' personal information. Before doing the dialogue, the students were told that they must gain information about their peers' personal information consisting of name, hobby, age, address, family, school, date of birth, and their food preference by using question words. The students would be recorded while doing the dialogue, then their speaking abilities would be assessed by the two raters. The students speaking ability would be assessed based on their comprehension, grammar, vocabulary, fluency, and pronunciation.

- The Validity of the Test

As what has been mentioned earlier, before giving the test to the students, the test designed was tested to measure the degree of the validity and the reliability of the test. So, the results of the test would be valid which meant the test given measured as what it was supposed to measure. In determining, the degree of the validity of the test, I used SPSS 22.0 version to measure the validity coefficient (known as  $r_{\text{counted}}$ ) of each item of the test. Later, the  $r_{\text{observed}}$  was compared to  $t_{\text{table}}$  coefficient with significance level ( $\alpha$ ) was 0.05 and degree of freedom ( $df$ ) was  $N - 2$ . Furthermore, the item of the test would be considered valid if  $r_{\text{observed}} > t_{\text{table}}$ . Additionally, from the 35 items of questions designed as the instrument of measuring the students' mastery on using WH-questions, 27 items met the criteria of the validity test.

- The Reliability of the Test

Before giving the test to the students, the reliability test was needed to measure whether the test given was consistent and stable. Then, I conducted re-test reliability for the written test and inter-rater reliability for the spoken test to measure the reliability degree of each test. Then, the reliability coefficient (known as the alpha value) gained by calculating it using SPSS 22.0, it was gained 0.893 for the written test and 0.809 for the spoken test which meant those were higher than the minimum value of reliability degree referring to Cohen et al guidelines (2007) in which it should be at least 0.60 to be considered as reliable.

- The Data Analysis Technique

To analyze the data obtained in this study, it applied *Pearson Product Moment* correlation (Chee, 2013) analysis between the two variables involved. The *Pearson Product Moment* analysis could be only applied if the data

obtained was distributed normal and linear. Furthermore, to assist in analyzing the data, the SPSS 22.0 was used. Then, the correlation coefficient result from the SPSS would be interpreted by referring to the table below:

**Table 1.** Interpretation of the Correlation Coefficient

Interval of the Correlation Coefficient	Interpretation
0.800-1.000	Very high
0.600-0.799	High
0.400-0.599	High Enough
0.200-0.399	Low
0.000-0.199	Very low

Adopted from Arikunto (2015)

By referring to the table above, then it could be determined whether the correlation degree between those variables was high or low. Furthermore, to decide whether there was or there was no significant correlation, the critical values of *Pearson's* correlation with the degree of freedom ( $df = N - 2 = 26$ ) was if the  $r_{\text{result}} > t_{\text{table}}$ , so  $H_a$  hypothesis was accepted.

## Results and Discussion

It was explained in the previous section that in collecting the data it consisted of two types, namely the written test for collecting the data on the students' mastery on using words, and the spoken test was used to collect the data on the students' speaking ability in asking about someone' personal information. The data were given to the students one by one, the each of test were be scored. From the data obtained, the mean score of each test were measured. The total scores of the students' mastery on using questions ( $X$ ) were worth as 194, then it was divided by the total samples (28), and the mean score result was 69.6. meanwhile, for calculating the mean score for the students' speaking ability in asking information about someone' personal information, two scores given by two raters were calculated and divided, then the whole score obtained was 1982, and then divided by the total number of the students involved in this study (28), the result was worth as 70.8.

Furthermore, the classification testing of the students' mastery on using question words are divided into five level namely excellent, good, fair, less, and poor. Based on the statistical measurement, there was 1 student who got the lowest score which was in the interval 33-42, there was 1 student who was in the interval 43-52, there were 6 students who were in the interval 53-62, there were 4 students who were in the interval 63-72, there were 4 students in the interval 73-82, and there were 12 students in the interval 83-92 as the highest score that was obtained from the data collection in this study. From the 28 students joining this study as the sample, there were 22 students who succeeded the multiple-choice test on the students' mastery in using question words, and there were 6 students who failed the test.

Based on the results, some students were still found it difficult to differentiate the use of wh-questions, especially to the question words that have different meaning from Indonesian and English, such as choosing *What is your address?* or *where is your address?* Furthermore, the students were difficult in using proper auxiliary verb such as *is, are, do, or does* to complete a nominal or verbal question sentence. It is caused in Indonesian, auxiliary verb did not appear on its structure, so it made the students get confused about it.

In the 21<sup>st</sup> century, the students are expected to have a good communication skill to communicate each other, especially to communicate in English. Based on the spoken test given to the students, it found that some students had acquired a good English-speaking ability, but some of them had not owned it yet. It proved that senior high school students speaking ability span in various ways. Their habitual language learning affected their language skill as well. The one who often practiced and spoke in English would be easier to express his/her idea and feeling, including in term of asking information by using English question words. However, based on the scores given by two raters who assessed the students' speaking ability in asking information about someone's personal information, there were 6 intervals of the students' speaking ability in asking information about someone' personal information.

It was found that there 1 student who was in the interval 61-63, there were 4 students who were in the interval 64-66, there were 3 students who were in the interval 67-69, there were 12 students who were in the interval 70-72, there were 4 students who were in the interval 73-75, and there were 4 students who were in the interval 76-78. It could be considered that there were 24 students who categorized in fair level and 4 students who were categorized in the good level of speaking in asking information about someone' personal information. Furthermore, the students speaking ability had gained different score for each aspect of speaking assessment. Some of students gained high score in pronunciation aspect, or some of them did better in term of the fluency and vocabulary. It all was caused by their habitual in learning English, some students said that they liked listening to English song which helped them to improve their vocabulary mastery and pronunciation.

Based on the data analysis conducted, the result of data analysis showed that the correlation coefficient between variable X and variable Y was 0.608. Furthermore, the value of  $r_{table}$  acquired could be used to determine whether there was any significant connection between two variables. Additionally, it could be noticed that the  $r_{observed}$  was 0.608 with a degree of significance of 1%, the score of the  $r_{table}$  obtained was 0.479; as a result,  $r_{observed} > r_{table}$  (0.608 > 0.479).

In contrast, with a degree of significance of 5%, the score of the  $r_{table}$  obtained was 0.374; as a result,  $r_{observed} > r_{table}$  (0.608 > 0.374); the findings demonstrated that there was a significant correlation between the students' mastery of question words and their speaking ability in asking information about someone's personal information and the level of correlation was strong based on Riduan's classification (2010) of the interpretation of correlation coefficient which it was stated that if the correlation coefficient interval was 0.60-0.799, that meant that the correlation level between both variables were strong.

## Conclusion

To conclude the research conducted on examining the correlation between the students' question words mastery and their speaking ability in asking information about someone', especially asking about someone's personal information at the eleventh-grade students at one of state senior high schools in Indonesia. The mean score of the students' question words mastery was 69.6 and the mean score of the students' speaking ability in asking information was 70.8, in which it could be said that both mean scores of the two variables were not significant different.

The result of coefficient correlation was 0.608 with a degree of significance of 1%, and 5% meanwhile for the  $r_{table}$  obtained with the degree significance of 1% and 5% were 0.479 and 0.374. It could be concluded that  $r_{observed} > r_{table}$  at both degree of significance of 1% and 5% and that meant that there was a significant correlation between the students' question words mastery and their speaking ability in asking information. Additionally, the level of correlation obtained was strong, since the coefficient correlation obtained was in the range of 0.60-799 which was classified into strong correlation.

Based on the research result, it could be concluded that the alternative hypothesis ( $H_a$ ) was accepted, and the null hypothesis ( $H_o$ ) was rejected. Thus, enhancing the students' question words mastery could affect the students' speaking ability. Therefore, it is suggested that English teachers could explain idea of the use of question words to enhance students' understanding about its structure as well as to avoid misunderstanding different context between Indonesian and English.

## Recommendations

The present research consisted of 28 participants; therefore, the future research will need to be conducted with larger participants to get more comprehensive result. In addition, digging students' perceptions on formulating the WH-questions sentence would enrich the result of the research.

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## Key Elements of Total Quality Management Implementation in Vocational High School

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**Abstract:** The main projection of vocational high school graduates is to work. To be able to make graduates ready to work, schools must know what graduates need to enter the world of work so that they can produce graduates who meet customer expectations, which in this case are industry and business players. The application of total quality management as a philosophy to satisfy customers has finally become the choice of most vocational high schools. The aim of this study is to describe and model the key elements for the successful implementation of total quality management (TQM) in vocational high schools. The research approach used is descriptive qualitative with the literature study method. The results of the study show that several elements that are key in the implementation of total quality management (TQM) in vocational high schools include leadership, top management commitment, customer focus, customer motivation and commitment, continuous improvement, quality culture, communication, training and education, quality assurance, involvement and empowerment of academic staff, and teamwork. These key elements in the model are grouped into two major groups namely leadership and customer focus where top management commitment is included in the leadership group and motivation and commitment of employees are included in the customer focus group, while the rest are included in the combined leadership and customer focus group. The application of these key elements is ultimately expected to achieve customer satisfaction.

**Keywords:** Total Quality Management, Leadership, Customer Focus, Vocational High School

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### Introduction

Unemployment and employment have always been a major problem in most countries around the world (Soleh, 2019). The ever-increasing number of unemployed can affect the economic growth of a country (Franita & Fuady, 2019). An increase in the quantity of unemployment will lead to a deterioration in economic conditions,

which in turn can lead to the birth of other problems in people's lives (Harjanto, 2014). Unemployment is caused by a number of factors, while the most common is the imbalance between the availability of the job market or employment with the number of existing workers and the discrepancy of the competencies that the workforce has with the needs of the market or the world of work (Franita & Fuady, 2019; Suhandi et al., 2021). The consequences of these factors that cause the lack of absorption of Labor (Soleh, 2019).

Based on data, unemployment in the world is still high at 6.17% in 2021. Although this figure decreased compared to the time of the covid-19 pandemic, which at that time the unemployment rate, which was exacerbated by the number of layoffs, reached 6.57% in 2020, however, this figure is still quite high compared to the period before the pandemic, which was 5.35% in 2019 (International Labour Organization, 2022). In Indonesia in particular, based on data released by Badan Pusat Statistik (2022) Indonesia's Open unemployment rate (TPK) in February 2022 stood at 5.83%, a decrease compared to the previous year of 6.26% when the covid-19 pandemic was still at its peak. Although the figure is down, it is still quite high compared to the period before the pandemic which was far adrift at 4.94%. This shows that Indonesia even the world still has homework to solve these problems.

Efforts to resolve the unemployment rate of the education sector contained in the Sustainable Development Goals (SDGs) began in 2015. Target number 4.4 in quality education points strive to improve technical and vocational skills in youth and adults as a provision for work and entrepreneurship (Bappenas, 2015). As for one type of education that is the main target of meeting these targets is vocational education. This is in accordance with the opinion of Clarke and Winch (2007) yang said that vocational education is education with the aim of training young people to enter the workforce so that learning is done more towards mastering techniques and practices. In Indonesia, vocational education is available in the form of Vocational High School. In line with the opinion of Clarke and Winch on the official Vocational High School website it is written that the target of the education carried out is to prepare students to enter the world of work (Ari, 2012). However, Law No. 20 of 2003 article 15 also states the same thing that vocational education is secondary education whose purpose is to develop the ability of learners, especially to work. However, the fact states that based on the data on the number of TPK that has been mentioned previously, from a total of 5.83% the highest percentage is precisely from vocational school graduates which is 10.38%. While in other types of education the number is still less, namely 8.35% for high school graduates, 6.17% for graduates of Diploma IV, undergraduate, graduate, postgraduate and 6.09% for Diploma I/II/III graduates. This shows that the achievement of the objectives of the vocational school is not optimal.

Ensuring that students get what they need when they graduate from vocational school is one solution to improve the quality and minimize the number of unemployed vocational school graduates. This is because students are the main customers of a vocational school. Ensuring students get what they need right during the study, is one effort to ensure customer satisfaction or satisfy the customer, which in this case is the student who is the main customer of a school. This is consistent with the theory total quality management (TQM). In TQM mentioned that the services provided by an institution must be in accordance with the needs, expectations and desires of

customers (Sallis, 2011). We are a company engaged in the procurement of goods to facilitate field work in the procurement of goods to facilitate field work continuous improvement (Azhar, 2018). According to Davis et al., (2014) total quality is the quality of services or products produced, humans who do the service process, the process itself and its environment.

In Indonesia, TQM has been applied to most vocational schools. However, in reality there are still many schools that have not been able to implement so well as the lack of ability to attract partner industries that are stakeholders and also customers to be able to work together with schools (Arifin, 2012; Fatah et al., 2022), so that the expected results of the application of TQM has not seen the maximum. It is necessary to understand the important elements that must be ensured in the application of TQM in vocational schools. Adopting TQM into the field of education is certainly not an easy thing because in practice TQM is more widely applied in companies, so to determine the key elements of the successful application of TQM in vocational schools, a study is needed by matching which elements are included in the realm of education, especially vocational high schools. For that reason, this paper aims to examine more deeply related to the important elements that must be known and applied by vocational schools that apply TQM in school management so that the application of TQM and the expected results can be maximized. After concluding the important elements, the researcher then made a model related to the elements of TQM and its relation to customer satisfaction. To examine the important elements related to the implementation of TQM in vocational high schools, the researchers used literature review where the literature taken from journals linked to Scopus and other reliable sources in the span of 10 years and from the previous year as supporting data, so that the results of this study can be a good reference for vocational high schools that implement TQM in Indonesia in particular and in the world in general as well as a reference for other researchers who pursue similar research fields.

## Method

To answer the research question about key elements of total quality management implementation in vocational high schools, a literature study is applied in this research. The method used is descriptive qualitative. The literatures studied are from scientific articles, books, and other type of research documents taken from national or international sources which related to the topic of the research. The primary sources chosen are them which in the range of ten years, while from other years are only for supporters. The process of the data analysis started when searching the sources. After getting enough sources that meet the criteria, all sources are entered to an analysis software to be analyzed. After getting some points, data was displayed. The conclusion and research model were made after the data display was done.

## Results

Reed, Lemark, and Mero in Azhar (2018) agree that the key elements of TQM implementation include customer satisfaction, cost reduction, top management leadership and commitment, training and education, teamwork and



organizational culture. Almost agree with that opinion Zakuan et al., (2012) in the results of his literature review on the key elements in the implementation of TQM in higher education mentioned that there are seven elements, namely management and leadership commitment, continuous improvement, total customer satisfaction, employee engagement, training, communication and teamwork. Rahmawati & Supriyanto (2020) finding that leadership and teamwork are the main keys to implementing TQM in educational institutions. While Azhar, (2018) finding that to apply TQM in education there are at least two changes that must be made, namely cultural change and substantive change. Cultural change is a change in the way of thinking and work that must focus on quality. While the substantive change is a business arrangement and objectives aimed at meeting customer satisfaction with. Then, Megnounif et al., (2013); Taskov & Mitreva; El-Hilali et al.; Glushak et al.; Larina, (2015); Azhar (2018) agreed that quality assurance is also an important element in the application of TQM in education.

Several field studies focusing on key elements in the application of TQM in educational institutions have been conducted by previous researchers. Megnounif et al., (2013), conducting survey research found that the key elements of quality management at the Faculty of technology at the University in Tlemcen in the field of administration include training and stakeholder engagement. Selanjutnya Moldovan (2012) mention of Quality Management System (QMS) and quality assurance is key to the implementation of TQM in higher education in Romania. Taskov & Mitreva (2015) conducting survey research on higher education in Macedonia found that stakeholder engagement, leadership and top management commitment occupy the top positions as key elements. And the last one is dari Wibowo et al., (2019) who conducted a study on SD Tunas Bangsa in Kubu Raya regency found that the key elements of TQM implementation in the school include the quality of leadership, the quality of teamwork and efforts to build a culture of quality.

## **Discussion**

### **Total Quality Management in education**

Quality according to Firdaus dkk (2021) it is in accordance with established standards or requirements aimed at meeting customer expectations. Meanwhile, some figures cited by Hoyer & Hoyer (2001) have their own views related to the definition of quality, among others: (1) Crosby revealed that quality is in accordance with demand. (2) Deming revealed that quality is defined as customer satisfaction. (3) Feigenbaum states that quality is determined by the customer, not by the technician, not the marketing department or manager. (4) Ishikawa states that quality is the satisfaction of customers who are always changing. (5) Juran argues that quality consists of two levels. The first Level is that quality means meeting expectations, while the second level is that quality means satisfying customers. From the views of some figures regarding the definition of quality, it is concluded that quality is related to standards and customer satisfaction.

From the definition of quality or quality above, it can be said that total quality management it deals with how an institution achieves customer satisfaction by setting standards that are tailored to its requirements. Davis et al

(2014) mention that total quality management is a philosophy about focusing on customers by involving people, measurements and processes as an effort to achieve success. According to Besterfield dkk (2012) total quality management it is an art to achieve success. In addition, he also mentioned that total quality management it can be interpreted both as a philosophy and as a series of guidelines based on the principles of continuous improvement. Furthermore, it is also said that total quality management includes the application of quality techniques in all segments of the organization (Pries & Quigley, 2013). From these opinions, concluded that total quality management it is a series of guidelines that contain established standards and adhere to the principle of continuous improvement to achieve customer satisfaction.

Next, to define total quality management in education, it is necessary to elaborate on the quality of education itself. Quality in education according to Firdaus dkk (2021) is the level of achievement of assurance (quality assurance) made in a certain period in the education unit. Meanwhile, according to Sopiadin quoted by Zazin (2017) the quality of education is the quality of the services of educational institutions provided to students or teaching staff who aim to make a quality educational process so as to produce graduates with the competencies and abilities and knowledge needed when he plunged into the community environment. Then it was concluded that total quality management in education is a strategy to achieve customer satisfaction education by improving the quality of the educational process so as to print graduates who match expectations.

The customer education in question according to (Sallis, 2011), are as follows: (1) primary customers, namely customers who get services directly. In this case it is students. (2) secondary customers, that is, those who have a direct interest in the education of both individuals and institutions, including parents, governors, job seekers from vocational school students. (3) tertiary customers, namely those who have an indirect interest in education but have an important role in the world of education, including future employers, government and society as a whole. (4) internal customers, namely employees of the institution and who have an important role in the success of the organization.

The relationship between education customers is as shown in Figure 1.

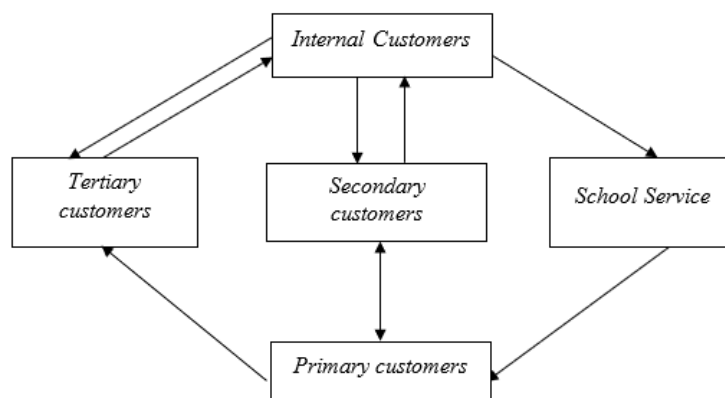


Figure 1. Customer Relations Education

(Source: Soetopo 2009)

Implementation of TQM in schools is said to be successful if it can achieve customer satisfaction education. The Mone team (Zazin, 2017) mention that school success can be measured from: (1) student satisfaction with school services, which include lessons received, treatment of teachers and leaders, school facilities or the overall situation of the school. (2) parents ' satisfaction with the services provided by the school to their children and the services received by parents in the form of student progress reports and school programs received by students. (3) satisfaction of the user or recipient of graduates which includes universities, industry and the community for receiving qualified graduates and according to expectations. (4) satisfaction of teachers and employees with the services received from the school in the form of division of labor, relationships and communication between teachers or leaders and other staff, salaries or honors received and other services.

To be able to achieve this success, schools that apply TQM according Zazin (2017) the following are some of the most important things to keep in mind: (1) continuous improvement (2) the standard of care (quality assurance) (3) cultural change (4) organization change (upside-down organization) (5) maintain a good relationship with customer (keeping close to the customer).

In addition, according to Salleh dkk (2018) successful implementation of TQM can be achieved through the application of the principles total quality management itself. According to Charantimath (2017) there are eight principles of TQM as follows: (1) focus on customers, meaning that an organization in meeting its customer satisfaction must listen to what they want because the success of the organization depends on customer assessment. As for some steps in meeting customer satisfaction, among others: (a) identify customer needs; (b) design products in accordance with customer needs; (c) produce products in accordance with customer demand; (d) improve service to complaints; (e) measure customer satisfaction; (f) improve quality in order to please customers. (2) leadership, meaning that an organization definitely needs direction from superiors to explain the value of quality, customer-oriented approach. Leaders in this case needed to be role model for members of the organization. (3) the involvement of each person, meaning that in total quality management everyone has the right to be involved, so that everyone can contribute work donations according to their individual abilities. (4) process approach, meaning that good results are produced when the process through which good anyway. The process approach is an important principle in total quality management. (5) management systems approach, i.e., identifying, understanding, and managing systems that contribute to organizational efficiency. (6) continuous improvement, meaning that all members of the organization must constantly improve performance to meet the needs of interested parties is a permanent goal of the organization. (7) decision making based on facts, meaning to be able to make good decisions required analysis of data and information so that the resulting decision to be effective. (8) the relationship between supplier, namely that the ability of the organization and supplier to produce a value can be done through a relationship of mutualism.

While according to Zakuan dkk (2012) this is a list of some of the most important factors in implementing TQM i.e., management commitment and leadership, continuous improvement, total customer satisfaction employee engagement involvement, training, communication and teamwork.

### **Key Elements of Total Quality Management Implementation in Vocational High School**

From the findings related to several key elements in the application of TQM as well as important discussions related to the application of TQM in the world of Education Above, It is concluded that the following key elements are the most relevant to the application of TQM in vocational high schools some of the key elements include leadership, top management commitment, customer focus, customer motivation and commitment, continuous improvement, quality culture, communication, training and education, quality assurance, employee empowerment, involvement of academic staff, and teamwork.

#### *Leadership*

According to Taskov & Mitreva (2015) leadership is the essence that is very influential on the successful implementation of TQM. It is with the opinion Djuwariyah (2008) which states that leadership skills in moving and exploring the resources owned by the school is a determinant of success in the management and development of curriculum in vocational schools to produce quality graduates. The role of leaders in the implementation of TQM is very important, namely as an advisor and a driving force in the improvement effort (Rahmawati & Supriyanto, 2020).

As for according to (Sallis, 2011) the functions or roles of leaders in developing a quality culture are as follows: (1) having an integrated vision; (2) having a clear commitment to improving quality; (3) communicating quality; (4) ensuring that policies and all activities are centered on customer needs; (5) being a guide for staff development; (6) being a wise problem solver by not blaming someone without knowing the truth because the majority of problems occur not because of staff errors but due to institutional policies; (7) Creating Innovation; (8) creating organizational structures and clear distribution of responsibilities and delegating responsibilities to the right people; (9) committed to overcoming organizational or cultural obstacles (10) building an effective team; (11) controlling and evaluating performance results with appropriate mechanisms.

The leadership initiative in TQM according to Taskov & Mitreva (2015) includes commitment to the philosophy of TQM by actively participating in both academic and opinion delivery, applying a proactive work style, through cooperation, training and providing support for good work and achievement. In addition, in the process of quality improvement, according to Austin and Peters cited by Sallis (2011), the leader is someone who has a vision and role as a facilitator and is responsible for motivating his team. They call such leadership management by walking about (MBWA). This style of leadership allows the leader to stay close to the staff, leading to the creation of innovative and creative ideas. The characteristics of leaders who apply the MBWA style are: (1) listening to staff, this is intended to show that the leader cares about his employees. (2) teach and transmit values. (3) facilitate and provide assistance and advice directly on the spot. Good leadership from the principals of Vocational High Schools, Vice Principals, teachers and all school residents can make the implementation of TQM in vocational high schools run well and purposefully.

### *Top Management Commitment*

One of the keys to the success of TQM is leadership as previously discussed. A leader must have a commitment, especially to keep members focused on the quality to be achieved by still communicating organizational goals to all members (Azhar, 2018). This commitment according to Glushak et al., (2015) is a form of quality in TQM. The principles of TQM in order to run in an educational organization take time and also commitment, especially commitment from the leader of the organization (Moldovan, 2012).

According to Taskov & Mitreva (2015) without a commitment from top management to create targets in making quality institutions TQM implementation will only spend time and money and can hinder the achievement of success. Wibowo et al (2019) finding that the successful implementation of TQM in one of schools in Indonesia is a strong commitment from senior leaders and teachers. Zakuan et al (2012) finding that top management commitment is one of the critical success factors of TQM implementation in educational institutions. Thus, the commitment of top management influences the successful implementation of TQM in vocational high schools.

### *Customer Focus*

In order to compete in a fast-changing global world an educational institution must reorganize its academic programs in order to achieve stakeholder expectations (El-Hilali et al., 2015). This is because the desire of stakeholders or customers is the main objective of the implementation of TQM (Azhar, 2018; Glushak et al., 2015; Lapiņa et al., 2015). Therefore, to be able to achieve success in the implementation of TQM an organization must listen to the aspirations of the customer (Kędzierska-Bujak, 2021). Quality assurance carried out in TQM must focus on customers so as to achieve customer satisfaction (Megnounif et al., 2013). The focus on the customer is the starting point for improving the quality of service of educational organizations (Moldovan, 2012). In educational institutions all efforts such as curriculum management, revamping school culture and all the qualities to be achieved estuary school is customer satisfaction so that the school must depart from the needs of customers in conducting school affairs (Wibowo et al., 2019). In (Zakuan et al., 2012) it is stated that customer focus is the main goal of TQM and is the key to the success of TQM implementation. Thus, customer focus can be considered as one of the key elements of the implementation of TQM in vocational high schools.

### *Customer Motivation and Commitment*

Commitment is one of the main concepts in the implementation of TQM (Azhar, 2018; Glushak et al., 2015; Moldovan, 2012). Therefore, the academic staff in the school should be rewarded for their work achievements because the poor assessment and treatment of these internal customers will cause them to lose their motivation and commitment (Megnounif et al., 2013). Commitment and motivation are academic staff greatly affect the success of the implementation of TQM in schools (Taskov & Mitreva, 2015). Wibowo et al (2019) finding that the lack of motivation from teachers can be an obstacle to the implementation of TQM, especially in continuous

improvement. This is reinforced by Zakuan et al (2012) who found that customer motivation and commitment to be a factor in the successful implementation of TQM in educational institutions. Starting from that, it is concluded that customer motivation and commitment can also be the key to successful implementation of TQM in vocational high schools.

### *Continuous Improvement*

The main concept of TQM is continuous improvement (Azhar, 2018; Glushak et al., 2015). This is because quality improvement is a long process that requires gradual and continuous improvement (Azhar, 2018). Effective school management can be achieved through continuous improvement (Kędzierska-Bujak, 2021). Understanding the needs of students is important, but no less important must be followed by continuous improvement thereafter (Larina, 2015). To be able to perform continuous improvement needed a guideline, rules and quality standards to be achieved (Megnounif et al., 2013). Continuous improvement is one way to continue to improve the quality of Education (Taskov & Mitreva, 2015). One of the obstacles in running effective management is the lack of continuous learning and improvement (Taskov & Mitreva, 2015). In a school continuous improvement is important to improve the professionalism of teachers and other academic staff (Wibowo et al., 2019). Continuous improvement according to Zakuan et al (2012) like a wheel on a vehicle that can make the vehicle move forward. Thus, continuous improvement can be considered as one of the key elements of total quality management implementation in Vocational High School.

### *Quality Culture*

To be able to spread the concept of TQM required a certain quality culture (Taskov & Mitreva, 2015). That is why quality culture is one of the causes of successful implementation of TQM (Azhar, 2018). To be able to improve the quality of organizational culture, it is necessary to have a strategic development chosen by an educational institution that must also be guided by the rules of organizational quality (Lapiņa et al., 2015). In addition, quality culture can also be achieved through training to all academic staff on a regular basis (Moldovan, 2012). Taskov & Mitreva (2015) mention that to be able to change organizational culture can be done by improving teamwork. Research results (Wibowo et al., 2019) finding that quality culture is one of the keys to the implementation of TQM in one of the schools by continuing to make quality improvements. From these discussions, it was concluded that quality culture is also the key to successful implementation of TQM in vocational high schools.

### *Communication*

In TQM cooperation is carried out between everyone in the organization. In a school, all school residents ranging from principals, vice principals, teachers, administrative staff, gardeners to security guards work together to create a comfortable learning environment and atmosphere for customers, namely students. Such great cooperation needs to be bridged by effective communication so that every work done by each party is in

accordance with what has been shared previously and the school's goal of creating a comfortable atmosphere for students can be achieved (Azhar, 2018). In this case, the role of the leader in communicating the tasks of its members becomes very important so that the communication skills of the leader become one of the most important factors in the implementation of TQM in vocational high schools.

Research results by Lapiņa et al (2015) finding that to be able to change an organization towards a better direction requires a good internal communication process. Intensive communication with members in one department is also one that determines the successful implementation of TQM in educational organizations (Larina, 2015). Communication between different departments is also something that cannot be ruled out because good cooperation between different departments can lead the organization to success (Megnounif et al., 2013).poor communication between all parties in an organization will lead the organization to poor results as well (Taskov & Mitreva, 2015). Thus, communication is one way to increase the success rate of TQM implementation (Zakuan et al., 2012). Thus, it can be concluded that communication is one of the key elements of successful implementation of TQM in Vocational High School.

#### *Training and Education*

As an organization that aims to produce graduates who are able to work vocational high schools must adapt to the rapid development of technology so that schools can know the needs for their learners. To be able to know the needs of these students, schools need to ensure that teachers and other academic stars have an understanding that also adapts to the rapid development of the Times, which can be achieved through training and education (Azhar, 2018). It is also similar to that expressed by Glushak et al (2015), that to achieve quality in education it is necessary to have training and also continuous professional development for all school staff.

Megnounif et al (2013) mention that quality training is one of the things contained in quality planning. Staff training is aimed at achieving customer satisfaction because the staff who perform services to the main customers where in this case there are Vocational High School students (Moldovan, 2012). The training is also aimed at self-evaluation as well as external evaluation in order to overcome the lack of professional experience (Taskov & Mitreva, 2015). Less good a training can be a problem for management work (Taskov & Mitreva, 2015). Training can be aimed at teachers who have been teaching for a long time or who have recently received teaching assignments (new teachers) to improve their performance (Wibowo et al., 2019). The involvement of all school residents in school work causes them to stay updated on the capabilities needed for their involvement, and this can be achieved through training (Zakuan et al., 2012). Thus, training and education are important things to consider in the implementation of TQM in vocational high schools.

#### *Quality Assurance*

Quality assurance is a form of fulfillment of responsibilities and promises to stakeholders by steps to establish and meet the quality standards of managers consistently and sustainably (Sani, 2015). In the quality approach,

quality assurance against stakeholder demands is none other than to improve customer satisfaction (Megnounif et al., 2013). In addition, the limited resources in the implementation of education causes quality control to be carried out in the form of quality assurance. It is intended that educational services can achieve or exceed the expectations of stakeholders and the eight points of the national standard of Education (Zahrok, 2020). As a form of fulfilling the demands of stakeholders, quality assurance must be met in the implementation of quality education so that it can produce graduates who are skilled and have good skills (Zahrok, 2020). Competency standards of vocational high school graduates based on Permendikbud (Indonesian education and culture Ministerial Regulation) number 7 of 2022 is contained in the content standard developed from the analysis of material needs to achieve the expected graduate competencies. The content standard consists of two parts, namely general content and vocational content. The development of general content is equivalent to high school while the development of vocational content is specific in accordance with the program or competence of each skill.

Quality assurance of education should be set out in the form of a strategic document on the development of the institution. As for the content of the document, it should contain the relevance of quality management as an activity aimed at meeting the demands of stakeholders and ensuring the quality standards of educational activities based on process control focused on results and efficiency (Glushak et al., 2015). Presentation of a description of the quality assurance system to external evaluators, members of the organization, Students and other stakeholders can be in the form of a quality map (Larina, 2015). Deming in Larina (2015) states that quality assurance starts from the planning stage to set long-term goals. Examples of good planning include: (1) the formation of small groups that allow an individual approach; (2) classes scheduled according to the needs of students; (3) the selection of qualified academic personnel; (4) the required classrooms and teaching materials adapted to the characteristics of education and international requirements. With the quality assurance expected vocational high school has a clear benchmark related to graduates like what the school wants to produce.

#### *Involvement and Empowerment of Academic Staff*

Quality according to (Azhar, 2018) in the hands of stakeholders. Academic staff are stakeholders and also internal customers of vocational high schools, so their involvement and empowerment can be the key to successful implementation of TQM in vocational high schools. The aspirations of these academic staff are also important because they are the ones who are directly related to their respective tasks (Kędzierska-Bujak, 2021; Megnounif et al., 2013; Rahmawati & Supriyanto, 2020; Taskov & Mitreva, 2015). According to Stabback (2016) In the development of curriculum to create qualified vocational graduates, their involvement is very important.

Because the views of the academic staff can enable the creation of an inclusive and practical curriculum that can meet the needs of diverse learners. Stakeholder engagement can increase their satisfaction as customers can also increase their commitment to what they have voiced (Salleh et al., 2018). Conversely, lack of stakeholder involvement can be an obstacle to the implementation of TQM in vocational schools (Wibowo et al., 2019).



Thus, it is concluded that the involvement and empowerment of academic staff can be decisive for the successful implementation of TQM in vocational high schools.

### ***Teamwork***

The team is a group of people who have the same goal (Rahmawati & Supriyanto, 2020). In educational institutions, all residents in the educational institution are part of the team so that teamwork will be created if they are involved in activities at the institution (Rahmawati & Supriyanto, 2020). Solid teamwork is one of the most efficient ways to accomplish organizational tasks and missions (Belbin, 2010). This is because the thoughts of two or more people are considered better than one person, the results of the work of a team are better than those of a person or individual, communication and socialization between members can be better established through teamwork (Rahmawati & Supriyanto, 2020). In addition, according to Rukly in (Zakuan et al., 2012), teamwork can unite all staff of the organization in achieving quality improvement or quality repair.

Furthermore, to achieve the expected quality, it takes collaboration and contributions from all members of the organization and this can be achieved through teamwork (Wibowo et al., 2019). Therefore, teamwork is one of the key elements of successful implementation of TQM (Azhar, 2018; Wibowo et al., 2019; Zakuan et al., 2012). In addition, teamwork is considered an important component in the implementation of TQM because it can increase trust and communication between members and develop independence (Azhar, 2018; Wibowo et al., 2019). Teamwork can also be an initiator of organizational change (Taskov & Mitreva, 2015), so it should be expanded and completely spread throughout the institution (Azhar, 2018). From some of the opinions above, it can be concluded that teamwork is inseparable from the implementation of TQM in any sector, including its practice in curriculum preparation.

The way to build good cooperation is to develop active team behavior (Wibowo et al., 2019). The characteristics of the active team in question are as follows: (1) initiating discussions; (2) collecting information and opinions; (3) providing input related to procedures to achieve goals; (4) clarifying and elaborating ideas; (5) concluding and testing agreements; (6) acting as gatekeeper (information selectors); (7) organize conversations; (8) compromise and resolve disputes creatively (9) try to calm tensions and overcome difficulties in the Group; (10) make the group agree on standards, refer to data and documentation; (11) praise and correct others fairly; (12) accept praise and complaints.

In addition, to form a good teamwork in educational institutions, things that can be done include improving the quality of human resources through activities workshop, seminars to training (Rahmawati & Supriyanto, 2020). In line with this Taskov & Mitreva (2015) believes that teamwork in the implementation of TQM in schools, rests on Team training held over a long period of time and includes all members of the organization in accordance with their fields and jobs. Druskat and The Wolf Inside Taskov & Mitreva (2015) it also added that the elements of cooperation are the ability to work creatively that leads to professional contribution, respect for the opinions and attitudes of other members, willingness to be involved in management, passion for mutual

success and this will ultimately result in the development of mutual trust and respect, commitment, expansiveness, patience and loyalty to each other and even loyalty to the institution. Awareness of the importance of cooperation on each team member will be able to contribute positively to the successful implementation of TQM in vocational high school.

Model key elements of total quality implementation in vocational high school can be seen in Figure 2.

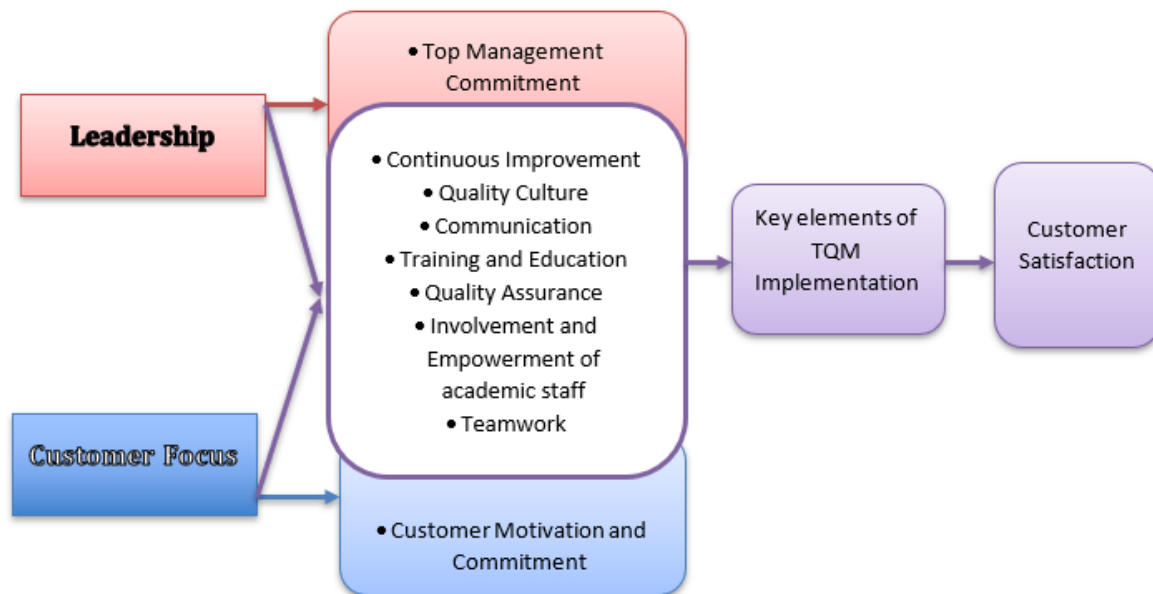


Figure 2. Key Elements of Total Quality Implementation in Vocational High schools

## Conclusion

The results of the study show that several elements that are key in the implementation of total quality management (TQM) in vocational high schools include leadership, top management commitment, customer focus, customer motivation and commitment, continuous improvement, quality culture, communication, training and education, quality assurance, empowerment, involvement and empowerment of academic staff, and teamwork. These key elements in the model are grouped into two major groups namely leadership and customer focus where top management commitment is included in the leadership group and motivation and commitment of employees are included in the customer focus group, while the rest are included in the combined leadership and customer focus group. The application of these key elements is ultimately expected to achieve customer satisfaction. Future research on education management in vocational high school (case study).

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## Assessing the Viability, Functionality, and Effectiveness of the Concurrent Classroom Modality: A Quantitative Study

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**Abstract:** The study was conducted to evaluate the implementation of the Concurrent Classroom (CC) modality, a type of hybrid learning modality wherein an in-person teacher teaches in-person and online students simultaneously. The study utilized a quantitative research design to assess the implementation of the CC based on its viability, functionality, and effectiveness. Grades 4 to 12 students, teachers, and subject coordinators participated in the study. Quantitative data were obtained from the self-rating survey, classroom observation rating and summative assessment results. Remarks about the implementation of the CC were also solicited. Obtained results show that the CC modality has high viability. It is practical, useful, and suitable for instructional delivery. CC also shows high functionality. It has enabled teachers and students to perform tasks that are expected from them. Lastly, it is an effective modality because it has produced favorable positive learning outcomes. Recommendations are focused on providing a targeted professional development to empower teachers in effectively handling CC classes, focusing on equitable cognitive engagement, active participation, and balanced support and attention for both in-person and online student groups. Also, provision and functionality of required devices, technical equipment, and connectivity in the CC learning environment must be ensured and emphasized.

**Keywords:** Education, E-learning, Hybrid, Concurrent Classroom, Learning Modality

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### Introduction

School systems across the country are slowly reopening for face-to-face classes using different hybrid learning

modalities to deliver instructions. The hybrid learning modalities aim to prevent possible resurgence of the COVID pandemic and to address the varied needs of students who choose to attend online or in-person on-campus classes. There are varied types of hybrid learning modalities (e.g., rotation, blendflex, hyflex, multi-track, and concurrent classroom) which enable students to attend classes either online or in person. In anticipation of the use of hybrid learning modalities, La Salle Green Hills (LSGH) has considered and examined the implementation of the Concurrent Classroom or CC as its alternative modality in the conduct of classes.

Following the pilot implementation of the concurrent classroom model in select classes during the previous academic year (2021-2022), LSGH has decided to continue utilizing this hybrid approach as the preferred method of teaching and learning for the academic year 2022-2023. As per Tucker's definition (2021), a concurrent classroom involves the teacher teaching one group of students in-person while simultaneously teaching another group of students online. This model is now implemented for Grades 4 to 12 where both in-person and online groups attend the same classes and learn together simultaneously.

The implementation of the CC learning modality began with teacher training on the principles of instructional design for the CC and the different CC modes (simultaneous, split, individualized and combination). During the training, teachers produced instructional materials and practiced handling the technical equipment in selected CC venues and related software applications. The teacher training provided the various academic and support units concerned an opportunity to understand, experience and reflect on the preparations needed for the efficient and effective conduct of the Concurrent Classroom.

In the article authored by the University of Texas, it is stated that the primary challenge in the concurrent classroom is to ensure equitable learning opportunities and active participation for online students. This necessitates additional planning; nevertheless, concurrent classrooms offer specific advantages. The most significant benefit is that, if implemented thoughtfully and precisely, they empower students to have significant control over their own learning journey.

The Quality Assurance and Research Office (QARO) in collaboration with the academic supervisors of LSGH conceptualized this study to document and evaluate the different activities of the Concurrent Classroom. The primary focus of this study is to assess the implementation of the CC learning modality in terms of its *Viability*; the capacity of a learning modality to deliver instruction which helps to determine the usefulness of the CC modality for teaching and learning,

*Functionality*; the ability of teachers and students and the learning environment to do or perform the instructional, managerial and technical procedures and tasks that are expected of them, and *Effectiveness*; performance of students in summative assessments of competencies related to the learning goals of Acquisition, Make Meaning and Transfer. Data obtained from varying assessments and evaluation sources will be analyzed to answer the study's specific objectives and research questions.

### **Specific Objectives**

The objectives of the study were as follows:

1. Evaluate the implementation of the concurrent classroom learning modality in terms of its viability, functionality, and effectiveness.
2. Determine the effect of the general hybrid online learning modality and the specific concurrent classroom process on student learning outcomes.
3. Compare the students' performance based on the assessment of the learning competencies according to the concurrent classroom learning groups: Online and In-person.
4. Identify aspects of the concurrent classroom implementation that help, hinder, and challenge the students' attainment of expected learning outcomes and teachers' instructional process; and,
5. Recommend actions that will improve the preparations for and implementation of the concurrent classroom.

### **Literature Review**

As a means of delivering instruction during the pandemic, hybrid learning modalities have received much attention. In general, hybrid learning differs from blended learning which was already practiced by different schools before the pandemic. Siegelman (2021) observes that “‘blended courses’ and ‘hybrid courses’ are the terms most likely to be used interchangeably, but hybrid courses differ in that their online components are intended to replace a portion of face-to-face class time.” In hybrid learning, online class schedules are counted and regarded as part of the total teaching time.

Due to the varied conditions schools face as well as the diverse contexts of their students, various forms of hybrid learning modalities have emerged. For schools that plan to teach classes where online and in-person groups of students simultaneously meet, the CC modality provides the set-up for this type of instruction. Tucker (2021) states that “In a concurrent classroom, the teacher is teaching one group of students in class while simultaneously teaching another group of students online”. Unlike the rotation type where all students are either in online or face-to-face learning classes which are alternately scheduled, students in the CC may choose to be in an online or face-to-face learning group throughout the school year. Teachers also do one preparation for both groups unlike in other types of hybrid learning where the teachers have to do separate preparations for the online and face-to-face groups.

Being a new form of hybrid modality, much concern has been raised about the usefulness of the Concurrent Classroom for teaching and learning and attending to two learning groups at the same time. Although there are some studies which discuss principles of instructional design for hybrid learning (e.g., Beatty, 2019), there is little research done evaluating the Concurrent Classroom as practiced in basic education. Moreover, factors that



contribute to the productive implementation of the Concurrent Classroom have yet to be identified and examined. What is currently available for many basic education schools looking for direction and guidance for designing the Concurrent Classroom are presentations on Concurrent Classroom teaching such as those done by Caitlin Tucker in her blogs ([caitlintucker.com](http://caitlintucker.com)) and YouTube videos of Concurrent Classroom practices uploaded by different school districts in the United States (e.g. Concurrent Classroom Instruction Practices at <https://www.youtube.com/watch?v=2ViSd-nm768> by the Fairfax County Public Schools, Fairfax, Virginia).

Because of the relatively scant research work done on the Concurrent Classroom, schools planning to implement the Concurrent Classroom stand to benefit from doing their own study. Schools can define the focus of their research based on particular concerns and questions by school administrators, teachers, students and other stakeholders. For LSGH, varied questions have been asked about how the Concurrent Classroom can respond to specific challenges such as managing students in two different learning settings (online and in-person) at the same time, sustaining student interest and engagement, and producing positive learning outcomes. These questions inquire into the usefulness or viability of the Concurrent Classroom as an instructional modality, the interaction of students and teachers in the Concurrent Classroom and student learning outcomes. In response to these concerns, this study then seeks to examine these perceived challenges regarding the viability, functionality and effectiveness of the Concurrent Classroom.

With regards to viability, among those who first studied the usefulness of a particular medium or technology to communicate or deliver intended information were Daft and Lengel (1986) who articulated the “media richness theory” which attributed the positive effects of a technology to its media properties. The theory has often been criticized for its narrow focus on technology features as the cause for positive communication results. While the theory has been able to underscore the importance of establishing users’ perception of technology’s capacity and its interface design, others have sought to build on these factors and examine other factors that influence people’s perception of a technology’s power.

For example, Webster and Hackley (1997) in their studies of distance learning technologies that involve online learning point out five critical factors that lead to positive perceptions of these technologies: student involvement and participation, cognitive engagement, technology self-efficacy (i.e., the belief that one has the capability to interact with a given technology), perceived usefulness of the technology employed, and the relative advantage or disadvantage of online delivery. Aside from technology features, when teachers see that a technology can facilitate other aspects such as student-teacher interaction and intellectual activity, teachers develop a positive view of the technology and deem the technology as important for teaching and learning.

Webster and Hackley’s factors also suggest the interplay of instructional, technical, and managerial aspects of implementing online or distance learning. The actual use of the technology entails selecting and using appropriate teaching strategies (instructional), following certain routines and protocols (managerial), and mastering the operation of the technology’s devices, equipment, and software applications. These aspects are applicable to the conduct of the Concurrent Classroom, and these may be regarded as part of the modality’s

functionality. Although the managerial aspect also pertains to the way teachers conduct synchronous and asynchronous classes, management in the Concurrent Classroom deals with providing equivalent attention to two groups of students simultaneously interacting with the teacher. The challenge of achieving this is examined in other studies where attention is conceptualized into four different types namely, selective attention, sustained attention, divided or limited attention and alternating attention (World Mental Healthcare Association). These types enable teachers to expand their understanding and ability to respond to students in two different learning groups. The different types of attention also suggest that implementing the Concurrent Classroom may involve varied modes with each type corresponding to a particular mode. For example, selective attention can be done for an individualized mode where teachers take time to provide specific feedback to particular students. Alternating attention can be carried out for a split mode where teachers give comments first to the in-person group and then to the online group or vice-versa.

In terms of effectiveness, various studies have compared the performance of students in various standardized or criterion-referenced assessments given as part of an online or distance learning program (e.g., Means, Toyama, Murphy, Bakya & Jones, 2010; Sahni, Polanin, Zhang, Michaelson, Coverley, Palese, & Young, 2021). Such studies examine the learning gains that students have achieved by comparing pre and post-test scores. Others differentiate learning outcomes in terms of attainment of learning goals as articulated by Wiggins and McTighe (2008). These goals are Acquisition, Make Meaning and Transfer and these go beyond the students’ recall of facts. These emphasize the depth of students’ analysis and reasoning and application of knowledge and skills in real world situations. These goals are already incorporated in the Philippine K12 summative assessments which are composed of quarterly exams, written works and performance tasks. Hence, when summative and formative assessments are designed and conducted in a Concurrent Classroom, the results are studied in terms of the attainment of these learning goals and considered as indicators of student learning outcomes.

**Research Framework**

The preceding literature review provides guidance in conceptualizing the aspects of viability, functionality, and effectiveness of the implementation of the Concurrent Classroom.

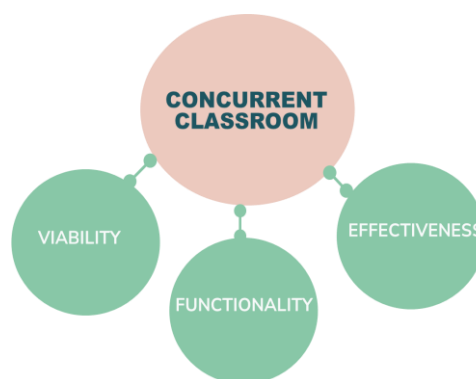


Figure 1. Framework of the Study

In this study, viability is operationalized as the capacity of a learning modality to deliver instruction in terms of five factors namely, students' participation, cognitive engagement, technological efficacy, perceived usefulness of the technology and relative advantage or disadvantage (Webster & Hackley, 1997). Viability answers the question: Is the CC modality useful for teaching and learning?

With regards to functionality, it is defined in this study as the ability of teachers and students and the learning environment to do or perform the instructional, managerial, and technical procedures and tasks that are expected of them. Functionality asks the questions: Are teachers, students, and the learning environment able to carry out the responsibilities or tasks assigned to them in the CC modality? How are teachers able to do the designated managerial, technical, and instructional procedures and tasks in the CC modality?

In terms of effectiveness, it pertains to the performance of students in summative assessments of competencies related to the learning goals of Acquisition, Make Meaning and Transfer. Competencies related to Acquisition involve the students' memorization and recall of facts and procedures. Competencies in line with Make Meaning are related to students' analysis, reasoning, and synthesis and evaluation. Competencies in line with Transfer pertain to the students' application of knowledge and skills in performance tasks based on real world scenarios and situations. Hence, for effectiveness, the questions raised are: How do students perform in assessments related to Acquisition, Make Meaning and Transfer? Does the CC modality affect the students' performance in these assessments?

These concepts of viability, functionality and effectiveness serve as the framework for the articulation of the following specific research questions:

1. How do students and teachers perceive the viability of the CC modality?
2. Is there a significant difference between the self-rating responses of students and teachers with regards to the viability of the full implementation of the CC?
3. How do teachers conduct and implement the teaching-learning process in a CC? How are teachers able to do the designated managerial, technical, and instructional procedures and tasks in the CC modality?
4. How do the students perform in the CC modality based on the results of the assessments of their learning competencies related to Acquisition, Make Meaning and Transfer?
5. What recommendations may be made to ensure the viability, functionality, and effectiveness of the CC modality?

## **Method**

### **Research Design**

A quantitative research design was utilized in the study, employing a structured data collection method that

included self-rating surveys, observation forms, and assessment results. Descriptive and inferential statistics were used to analyze the data gathered. Remarks of the subject coordinators about the accomplishment of procedures in the CC were also solicited.

### Participants

Purposive sampling was used to determine the participants of the study. The participants included the following: for the pilot implementation, selected students ( $N_1=281$ ) and teachers ( $N_2=21$ ) who simultaneously experience online and in-person classes on campus during the initial preparation for the reopening of schools. A larger set of participants were engaged during the full implementation, wherein students from grade 4 - 12, ( $N_3=1345$ ) and teachers ( $N_4=47$ ) accomplished the self-rating survey; for functionality, subject coordinators ( $N_5=24$ ) participated in the classroom observations; and for effectiveness, a total of  $N_6=1033$  assessment results were gathered to measure students' academic performance based on the learning goals of acquisition, make meaning, and transfer.

### Measures of the Study

For viability, a researcher-made Concurrent Classroom Self-Assessment Form was used. The survey questionnaire given to the students and teachers is focused on assessing their perception regarding their experience towards the conduct of the Concurrent Classroom classes. The questionnaire has 29 statements divided into 5 Critical Factors for Successful Online Learning of Webster & Hackley (1997) namely, student participation and involvement, cognitive engagement, technological efficacy, perceived usefulness of the technology, and the relative advantage or disadvantage. The survey questionnaire utilized a 4-point Likert type scale in determining the level of agreement to the statement.

The rating scales as shown in Table 1 and Table 2, were used in the interpretation of responses in the self-assessment form.

Table 1. Scale used in the survey

Numerical Equivalent	Interpretation
4	I strongly agree with the statement
3	I agree with this statement
2	I disagree with this statement
1	I strongly disagree with this statement

Table 2. Mean range used in the survey

Mean Range	Interpretation
3.00 – 3.99	Students'/Teachers' perception of the Concurrent Classroom

	shows high viability
2.00 – 2.99	Students'/Teachers' perception of the Concurrent Classroom shows moderate viability
1.00 – 1.99	Students'/Teachers' perception of the Concurrent Classroom shows low viability.

For functionality, a researcher-made Concurrent Classroom Observation Tool was utilized. The observation tool was accomplished by the subject coordinators in evaluating the conduct of the CC classes. It is composed of two sub-areas and utilized a 4-point scale: Classroom Observation Areas - this refers to the ability of teachers and students and the learning environment to do or perform the procedures and tasks that are expected of them. Functional areas - this covers the managerial, technical, and instructional aspects of the CC. Open-ended question was included to solicit remarks from the subject coordinators.

The rating scales as shown in Tables 3, 4 and 5, were used in the interpretation of responses in the self-assessment form.

Table 3. Mean range and verbal interpretation of the overall functionality mean ratings

Mean Range	Verbal Interpretation
0.00 to 0.99	Overall functionality of the Concurrent Classroom is poor.
1.00 to 1.99	Overall functionality of the Concurrent Classroom is low.
2.00 to 2.99	Overall functionality of the Concurrent Classroom is moderate.
3.00 to 3.99	Overall functionality of the Concurrent Classroom is high.

Table 4. Observation areas interpretation guide

Observation Areas	Mean Values and Interpretation
Teachers	0.00-0.99 Teacher's performance of expected functions in the Concurrent Classroom is poor.
	1.00-1.99 Teacher's performance of expected functions in the Concurrent Classroom is low.
	2.00-2.99 Teacher's performance of expected functions in the Concurrent Classroom is moderate.
	3.00-3.99 Teacher's performance of expected functions in the Concurrent Classroom is high.
Students	0.00-0.99 Students' participation in the Concurrent Classroom is poor.
	1.00-1.99 Students' participation in the Concurrent Classroom is low.
	2.00-2.99 Students' participation in the Concurrent Classroom is moderate.
	3.00-3.99 Students' participation in the Concurrent Classroom is high.

Learning Environment	0.00-0.99	The assistance of the learning environment in the Concurrent Classroom is poor.
	1.00-1.99	The assistance of the learning environment in the Concurrent Classroom is low.
	2.00-2.99	The assistance of the learning environment in the Concurrent Classroom is moderate.
	3.00-3.99	The assistance of the learning environment in the Concurrent Classroom is high.

Table 5. Functional areas interpretation guide

Functional Areas	Mean Values and Interpretation	
Technical	0.00-0.99	Learning environment's functionality in the Concurrent Classroom is poor.
	1.00-1.99	Learning environment's functionality in the Concurrent Classroom is low.
	2.00-2.99	Learning environment's functionality in the Concurrent Classroom is moderate.
	3.00-3.99	Learning environment's functionality in the Concurrent Classroom is high.
Managerial	0.00-0.99	Functionality of management in the Concurrent Classroom is poor.
	1.00-1.99	Functionality of management in the Concurrent Classroom is low.
	2.00-2.99	Functionality of management in the Concurrent Classroom is moderate.
	3.00-3.99	Functionality of management in the Concurrent Classroom is high.
Instructional	0.00-0.99	Functionality of instruction in the Concurrent Classroom is poor.
	1.00-1.99	Functionality of instruction in the Concurrent Classroom is low.
	2.00-2.99	Functionality of instruction in the Concurrent Classroom is moderate.
	3.00-3.99	Functionality of instruction in the Concurrent Classroom is high.

For effectiveness, results of the summative assessments of students were gathered. The assessments were administered during the conduct of the CC class. The assessments given to the students were categorized based on the three learning goals - acquisition, making meaning, and transfer.

The transmuted grade range and verbal description of assessment results are shown in Table 6.

Table 6. Transmuted grade range and verbal description of assessment results sy 2022-2023

Transmuted Grade Range	Verbal Description	Letter Grade Equivalent
96 and above	Outstanding	A
90 to 95	Highly Satisfactory	A-
86 to 89	Very Satisfactory	B+
80 to 85	Satisfactory	B

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75 to 79	Moderately Satisfactory	B-
74 and below	Failed / Needs Improvement	C

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### Data Gathering Procedure and Statistical Analysis

For viability, the Concurrent Classroom Self-Assessment Form was distributed to the students and teachers using Google Form. Mean ratings were computed and interpreted according to a given scale that shows different levels of students and teachers' perceptions of the Concurrent Classroom's viability.

For functionality, the Concurrent Classroom Observation Tool was given to and accomplished by the Subject Coordinators. Mean ratings were computed and interpreted according to different scales. The first set of scales indicated levels of teachers' performance of expected functions, students' participation, and the assistance of the learning environment. The second set of scales indicated levels of functionality for the instructional, managerial, and technical aspects of implementation. Based on the mean results of the first and second scales, an overall functional rating was obtained. The scale below shows the interpretation of the ratings.

In terms of effectiveness, a Google worksheet was shared to the teachers for encoding of student scores from the summative assessments. The worksheet had columns for entries related to assessments of Acquisition, Make Meaning and Transfer. The sheet included the students' data on learning competencies, learning group (online or in-person).

The responses were downloaded and processed using MS Excel and SPSS. Frequency distribution, percentage and mean ratings were generated to determine the evaluation, observation, and assessment results based on the identified variables. Descriptive statistics were obtained from self-assessment rating and observation forms distributed to the students, teachers, and subject coordinators. T-tests were used to establish significant differences between the variables used in the study.

## Results

### *Q1: How do students and teachers perceive the viability of the CC modality?*

Research question 1 investigated the viability or usefulness of the CC modality. Viability answers the question: Is the CC modality useful for teaching and learning? As seen on Tables 7 and 8, the implementation of the concurrent classroom generally shows high viability among students and teachers. Students, in the Concurrent Classroom environment, highly agree on the essential role of technology in class and homework. Students also responded positively on items addressing communication with their teachers and classmates, observation of health precautions and protocols, and participation in class discussions and activities. Students also showed high regard for the use of technology on a given task, availability and access of instructional materials and options for the use of appropriate technological applications. In addition, the factor of perceived technology usefulness

received the highest mean rating among the teachers, followed by cognitive engagement and technological efficacy. All these results imply that the CC modality is practical, useful, and suitable for instructional delivery.

Table 7. Self-rating results based on self-rating results of the CC modality

Critical Factors for Successful Online Learning	Self-Rating Results	Pilot			Full		
		N	Mean	SD	N	Mean	SD
OVERALL MEAN							
• Student Participation and Involvement	Teachers	20	3.60	0.33	47	3.32	0.48
• Cognitive Engagement							
• Technological Efficacy							
• Perceived Usefulness of Technology	Students	208	3.72	0.44	1345	3.41	0.57
• Relative advantage and disadvantage							

(Mean Interpretation: 3.00-3.99- Students' perception of the Concurrent Classroom shows high viability, 2.00-2.99- Students' perception of the Concurrent Classroom shows moderate viability, 1.00-1.99- Students' perception of the Concurrent Classroom shows low viability)

Table 8. Self-rating results based on the learning group of the CC modality

Critical Factors for Successful Online Learning	Learning Group	Pilot			Full		
		N	Mean	SD	N	Mean	SD
OVERALL MEAN							
• Student Participation and Involvement	In-Person	109	3.89	0.24	1021	3.45	0.57
• Cognitive Engagement							
• Technological Efficacy							
• Perceived Usefulness of Technology	Online	99	3.56	0.53	324	3.30	0.55
• Relative advantage and disadvantage							

(Mean Interpretation: 3.00-3.99- Students' perception of the Concurrent Classroom shows high viability, 2.00-2.99- Students' perception of the Concurrent Classroom shows moderate viability, 1.00-1.99- Students' perception of the Concurrent Classroom shows low viability)

**Q2: Is there a significant difference between the self-rating responses of students and teachers with regards to the viability of the full implementation of the CC modality?**

Research question 2 tries to determine significant differences between the level of perceptions of teachers and students and in-person and online students with regards to the viability of the CC modality. Based on the results, which can be seen in Table 9, the full implementation of the concurrent classroom generally shows high



viability among students. The factor on perceived usefulness of technology achieved the highest mean rating ( $M = 3.56$ ,  $SD = 0.62$ ) followed by technology efficacy ( $M = 3.52$ ,  $SD = 0.60$ ). Students, in the CC environment, show high affirmation in the usefulness of technology. Students responded positively on items pertaining to the ability to communicate with their teachers and classmates, observe health precautions and protocols, and participate in class discussions and activities. Students also show high regard on the use of technology on a given task, availability and access of instructional materials and options for the use of appropriate technology applications. Areas on student participation, cognitive engagement, and relative advantage and disadvantage obtained high marks, as well.

Table 9. Descriptive and comparative t-test analysis of self-rating results of teachers and students based on the critical factors for successful online learning

Critical Factors for Successful Online Learning	Participants	N	Mean	SD	t	Sig. (2-tailed)
Student Participation and Involvement	Teachers	47	3.32	0.54	-.550	.582
	Students	1345	3.37	0.63		
Cognitive Engagement	Teachers	47	3.43	0.48	-.133	.894
	Students	1345	3.44	0.62		
Technological Efficacy	Teachers	47	3.39	0.49	-	.135
	Students	1345	3.52	0.60		
Perceived Usefulness of Technology	Teachers	47	3.49	0.53	-.805	.421
	Students	1345	3.56	0.62		
Relative Advantage & Disadvantage	Teachers	47	3.02	0.62	-	<b>.012</b>
	Students	1345	3.26	0.65		

(Mean Interpretation: 3.00-3.99- Students' perception of the Concurrent Classroom shows high viability, 2.00-2.99- Students' perception of the Concurrent Classroom shows moderate viability, 1.00-1.99- Students' perception of the Concurrent Classroom shows low viability)

Similarly for teachers, the factor on perceived usefulness of technology received the highest mean rating ( $M = 3.49$ ,  $SD = 0.53$ ) followed by cognitive engagement ( $M = 3.43$ ,  $SD = 0.48$ ) and technological efficacy ( $M = 3.39$ ,  $SD = 0.49$ ). Teachers also show high regard on the use of technology on a given task, availability and access of instructional materials and options for the use of appropriate technology applications. Areas on student participation, cognitive engagement, and relative advantage and disadvantage obtained high marks, as well.

Looking further, the comparative analysis as shown in Table 9,  $p > .05$  show that there is no significant difference found between the perception of the students and teachers in terms of the participation, cognitive engagement, technological efficacy, and usefulness of the concurrent classroom modality. Both types of respondents seem to have similar perceptions in terms of implementation based on the response ratings of the students and teachers in the five factors. However, responses differ significantly for both groups in the area of

relative advantage and disadvantage. Students perceived the implications of the concurrent classroom higher than that of their teachers.

Table 10 displays the descriptive statistics and independent-sample t-test conducted to compare and determine the differences in the learning modality used by the students. Based on the mean rating results, students' level of agreement on all the factors for successful online learning is highly viable for both in-person and online learning modality. The perceived usefulness of technology ( $M = 3.59$ ,  $SD = 0.63$ ) obtains the highest mean score for in-person students while technology efficacy ( $M = 3.50$ ,  $SD = 0.58$ ) registered the top favored factor among online students.

Table 10. Descriptive and comparative t-test analysis of self-rating results based on the learning modality of students and critical factors for successful online learning

Critical Factors for Successful Online Learning	Modality	N	Mean	SD	t	Sig. (2-tailed)
Student Participation and Involvement	In-person	1021	3.44	0.61	6.823	<b>.000</b>
	Online	324	3.17	0.63		
Cognitive Engagement	In-person	1021	3.46	0.63	1.624	.105
	Online	324	3.39	0.61		
Technological Efficacy	In-person	1021	3.53	0.61	.685	.493
	Online	324	3.50	0.58		
Perceived Usefulness of Technology	In-person	1021	3.59	0.63	2.596	<b>.010</b>
	Online	324	3.49	0.59		
Relative Advantage & Disadvantage	In-person	1021	3.31	0.64	5.362	<b>.000</b>
	Online	324	3.09	0.65		

(Mean Interpretation: 3.00-3.99- Students' perception of the Concurrent Classroom shows high viability, 2.00-2.99- Students' perception of the Concurrent Classroom shows moderate viability, 1.00-1.99- Students' perception of the Concurrent Classroom shows low viability)

In the conduct of the t-test analysis, results show significant difference between in-person and online students' perception towards participation and involvement  $t(1343) = 6.823$ ,  $p < .05$ , perceived usefulness of technology  $t(1343) = 2.596$ ,  $p < .05$ , and relative advantage and disadvantage  $t(1343) = 5.362$ ,  $p < .05$ . This implies that, based on the mean rating of responses, the differences in the level of agreement between in-person and online students for the following factors: participation and involvement, usefulness of technology, and relative advantage and disadvantage of online learning are statistically significant. In-person students are expected to respond more favorably to the different activities and situations covered under the concurrent classroom modality compared to students online.

***Q3. How do teachers conduct and implement the teaching-learning process in a concurrent classroom? How are teachers able to do the designated managerial, technical, and instructional procedures and tasks in the***

*CC modality?*

Research question 3 was posed to evaluate how teachers conduct and implement the teaching-learning process in the CC and how students perform the tasks expected of them. This refers to the functionality of the CC. Functionality also covers the managerial, technical and instruction aspects of the CC (Webster and Hackley, 1997).

Table 11. Descriptive statistics of the observation ratings in the full implementation of the CC based on observation areas

Classroom Observation Areas	N	Min	Max	Mean	SD	Interpretation
Part 1. The Teacher	24	1	4	3.73	0.598	Teacher's performance of expected functions is high.
Part 2: The Students	24	1	4	3.61	0.615	Students' participation is high.
Part 3: The Learning Environment	24	1	4	3.77	0.531	The assistance of the learning environment is high.

*Mean Interpretation: 0.00 to 0.99: Functionality is poor.; 1.00 to 1.99: Functionality is low; 2.00 to 2.99: Functionality is moderate.; 3.00 to 3.99: Functionality is high.*

Table 11 shows the observation mean rating of the teachers classified according to observation areas. The observation tool is divided into three parts namely, the students, the teachers, and the learning environment. The mean rating of all areas; teacher (M = 3.73, SD = 0.598), students (M = 3.61, SD = 0.615) and learning environment (M = 3.77, SD = 0.531) indicates that the teacher's performance of expected functions, the student's participation, and the assistance of the learning environment in the CC are all high.

Table 12. Descriptive statistics of the observation ratings in the full implementation of the CC based on functional areas

Functional Areas	N	Minimum	Maximum	Mean	SD	Interpretation
Technical	24	1	4	3.84	0.433	Learning environment's functionality is high.
Managerial	24	1	4	3.65	0.707	Functionality of management is high.
Instructional	24	1	4	3.66	0.576	Functionality of instruction is high.

*Mean Interpretation: 0.00 to 0.99: Functionality is poor.; 1.00 to 1.99: Functionality is low; 2.00 to 2.99: Functionality is moderate.; 3.00 to 3.99: Functionality is high.*

Table 12 displays the teacher's observation mean ratings classified according to functional areas. The observation tool is divided into 3 functional areas namely, technical, managerial, and instructional. The mean

rating of all areas; technical ( $M = 3.84$ ,  $SD = 0.433$ ), managerial ( $M = 3.65$ ,  $SD = 0.707$ ) and instructional ( $M = 3.66$ ,  $SD = 0.576$ ), indicates that the functionality of the learning environment, management and instruction in the CC is high. Generally, the teachers were able to implement the planned activities for the CC, were able to guide students to resolve problems related to access of resources or accomplishment of the activity, checks on student's progress and output and provides feedback to different groups in varied ways, and required learning resources were available and accessible to the students.

Table 13 displays the observation comments of the subject coordinators with regard to the things needed to be improved in the conduct of CC. Despite the high mean rating for student participation, observation comments indicate that online students need to be more involved in class activities. Teachers should give equal attention to both student groups and encourage both to participate in class discussions. These results serve as a challenge in implementing CC because the World Mental Healthcare Association suggests that the CC teachers must be able to expand their understanding and ability to respond to two different learning groups. Additionally, devices such as microphones, LCD projectors, TV monitors, and strong Wi-Fi connections need to be installed and monitored for their functionality in the CC.

Table 13. Summary of class observation comments: What needs to be improved in the classroom observation areas of the cc?

The Teacher	Students	Learning Environment
1. Equal attention must be given to both in-person and online students.	1. Students need to engage more in the class activities specifically the online students.	1. Proper wearing of mask must be observed.
2. Give more time for feedbacking of outputs.	2. Students need to be oriented regarding the CC mode of the day.	2. No LCD installed and some has an LCD projector but not working. Online students were not able to see the presentation of the teacher.
3. More conscious effort in using the CC modes.		3. Use lapel to have a clearer sound or audio for the online students.
4. Give more activities that focus on HOTS.		4. There was no TV monitor at the back of the classroom for teachers to see the online students.
5. Teacher got disconnected due to slow or intermittent internet connection.		5. There was no microphone installed.
		6. Internet was functional but very slow.

Generally, results of the observations as seen in Table 14, show that the CC modality has high functionality ( $M = 3.69$ ,  $SD = 0.598$ ). This suggested that the tasks being implemented, and various activities included in the CC framework were accomplished and achieved based on the requirements given for each area.

Table 14. Overall descriptive statistics of the observation ratings

Observation Area	N	Minimum	Maximum	Mean	SD	Interpretation
Overall CC Functionality	24	1	4	3.69	0.598	High Functionality

The teacher's performance of expected functions, the student's participation, and the assistance of the learning environment in the CC were all rated high. In terms of the teacher's observation, the functional areas namely, technical, managerial, and instructional achieved the mean rating range from 3.65 to 3.84 in all areas. The results indicated that the functionality of the learning environment, management and instruction in the concurrent classroom is high.

***Q4. How do the students perform in the CC modality based on the results of the assessments of their learning competencies related to Acquisition, Make Meaning and Transfer?***

Research question 4 tries to assess how the students perform in the written tests administered during the conduct of CC. The assessments are categorized according to the three learning goals; Acquisition (A), Make Meaning (M) and Transfer (T). Two assessments results were submitted per subject area. The effectiveness of the CC model is based on the results of students' performance in classroom-based and teacher-made assessments.

Table 15 shows that the assessment results of both in-person and online students towards the attainment of the three learning goals (Acquisition, Make Meaning, and Transfer) are ranging from very satisfactory (B+) for acquisition and make meaning to highly satisfactory (A-) for transfer. These results indicate that the skills under the three learning goals as articulated by Wiggins and McTighe (2008) were satisfactorily attained by the students.

Table 15. Assessment results per subject in the full implementation of the CC: in-person and online groups

Subject Department	In-person			Online		
	A (N=597)	M (N=584)	T (N=594)	A (N=226)	M (N=228)	T (N=226)
1. Christian Living	91.22	97.53	98.81	92.69	97.96	97.05
2. Social Science	89.35	88.35	96.74	92.91	86.90	97.24

3. Math	88.42	83.48	90.16	92.69	93.16	93.11
4. Science	88.72	88.07	96.54	90.79	91.42	93.86
5. English	90.36	89.03	93.42	91.07	94.33	97.08
6. Filipino	84.57	86.70	93.23	85.61	86.15	96.10
7. VPPA	92.85	94.02	92.93	91.57	92.37	92.14
8. Computer	89.21	94.07	96.14	84.30	89.63	91.77
9. PE	89.24	95.56	93.28	86.78	95.71	91.21
10. ABMR	84.26	92.86	84.08	80.56	90.69	80.65
11. HUMSS	84.21	84.71	87.94	81.71	81.55	86.07
ADCI						
12. STEM	87.76	78.96	92.57	88.62	78.94	96.11
General						
Transmuted	88.53	89.51	93.27	88.56	89.81	93.30
Grade Average						
Verbal	Very	Very	Highly	Very	Very	Highly
Description	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Grade Equivalent	B+	B+	A-	B+	B+	A-

Comparative analysis as shown in Table 16, indicates that online students outperformed in-person students in Math ( $p < .05$ ) and English ( $p < .05$ ) make-meaning assessments, while in-person students performed better in Computer ( $p < .05$ ) transfer assessments than their online counterparts. These are the only results where significant differences are observed.

No statistically significant differences ( $p > .05$ ) are observed in the results of other assessments administered by the other subjects. Overall, with regard to the learning goals, there is not enough evidence to suggest any significant differences in the acquisition, meaning-making, and transfer assessment results between the in-person and online students. The performance of students attending classes in-person is equivalent to that of their online counterparts in assessments.

Table 16. Independent t-test result between in-person and online learning groups per subject department in the full implementation of the CC

Subject Department	Learning Goals	In-person			Online			Letter Grade Equivalent	Letter Grade	Sig. (2-tailed)
		Mean	N	SD	Mean	N	SD			
1. Christian	A	91.22	44	8.788	A-	92.69	21	9.303	A-	0.538

		www.icres.net	May 18-21, 2023	Cappadocia, Turkiye	www.istes.org						
Living	M	97.53	44	6.050	A	97.96	21	4.659	A	0.083	0.774
	T	98.81	44	2.593	A	97.05	21	4.756	A	3.730	0.058
	A	89.35	49	8.898	B+	92.91	25	8.561	A-	2.718	0.104
	M	88.35	49	10.955	B+	86.90	25	12.130	B+	0.270	0.605
2. SS	T	96.74	49	4.334	A	97.24	25	3.920	A	0.229	0.634
	A	88.42	32	10.218	B+	92.69	25	8.001	A-	2.939	0.092
	M	83.48	32	12.991	B	93.16	25	9.918	A-	9.526	<b>0.003</b>
3. Math	T	90.16	32	10.009	A-	93.11	25	7.240	A-	1.540	0.220
	A	88.72	47	7.956	B+	90.79	15	6.482	A-	0.842	0.362
	M	88.07	47	9.276	B+	91.42	15	6.489	A-	1.688	0.199
4. Science	T	96.54	47	7.797	A	93.86	15	10.654	A-	1.121	0.294
	A	90.36	51	9.976	A-	91.07	23	9.866	A-	0.081	0.777
	M	89.03	51	8.458	B+	94.33	23	7.396	A-	6.698	<b>0.012</b>
5. English	T	93.42	51	8.815	A-	97.08	23	4.605	A	3.500	0.065
	A	84.57	44	9.831	B	85.61	22	9.767	B	0.163	0.687
	M	86.70	44	10.612	B+	86.15	22	10.445	B+	0.040	0.843
6. Filipino	T	93.23	44	6.850	A-	96.10	22	5.275	A	2.984	0.089
	A	92.85	60	8.724	A-	91.57	12	8.255	A-	0.218	0.642
	M	94.02	60	6.460	A-	92.37	12	9.196	A-	0.564	0.455
7. VPPA	T	92.93	60	6.913	A-	92.14	12	6.905	A-	0.129	0.721
	A	89.21	54	10.034	B+	84.30	26	9.315	B	4.405	0.039
	M	94.07	54	10.566	A-	89.63	26	12.766	B+	2.701	0.104
8. Computer	T	96.14	54	7.747	A	91.77	26	10.834	A-	4.284	<b>0.042</b>
	A	89.24	69	9.865	B+	86.78	10	11.362	B+	0.524	0.471
	M	95.56	69	5.832	A-	95.71	10	6.901	A-	0.006	0.939
9. PE	T	93.28	69	7.308	A-	91.21	10	10.000	A-	0.634	0.428
	A	84.26	31	10.702	B	80.56	12	10.761	B	1.030	0.316
	M	92.86	18	4.374	A-	90.69	14	4.095	A-	2.045	0.163
10. ABMR	T	84.08	28	7.666	B	80.65	12	6.233	B	1.871	0.179
	A	84.21	59	9.249	B	81.71	20	8.390	B	1.149	0.287
11. HUMSS ADCI	M	84.71	59	9.065	B	81.55	20	5.073	B	2.190	0.143
	T	87.94	59	8.024	B+	86.07	20	6.978	B+	0.864	0.356
	A	87.76	57	11.124	B+	88.62	15	10.609	B+	0.072	0.789
12. STEM	M	78.96	57	8.437	B-	78.94	15	7.498	B-	0.000	0.993
	T	92.57	57	8.514	A-	96.11	15	7.736	A	2.127	0.149

In addition, Table 17 indicates that at  $p > 0.05$ , there is not enough evidence to show that the results of acquisition, make meaning and transfer assessments between the in-person and online students show significant differences. This indicates that generally, CC does not affect or favor any group in terms of their performance in the assessments.

Table 17. Independent t-test result between in-person and online learning groups

Learning Goals	Modality	N	Mean	SD	t	Sig. (2-tailed)
Acquisition	In-person	597	88.53	9.887	-0.046	0.963
	Online	226	88.56	9.892		
Make Meaning	In-person	584	89.51	10.313	-0.373	0.709
	Online	228	89.81	10.197		
Transfer	In-person	594	93.27	8.139	-0.056	0.955
	Online	226	93.30	8.344		

## Discussion

The findings of the study indicate that the concurrent classroom implementation demonstrates a high level of viability among both students and teachers. Students highly acknowledge the crucial role of technology in their classroom and homework activities within the concurrent classroom environment. They also responded positively to items related to communication with teachers and classmates, adherence to health precautions and protocols, and active participation in class discussions and activities. Furthermore, students expressed a strong preference for the use of technology for various tasks, as well as the availability and accessibility of instructional materials and appropriate technological applications. This supports the media richness theory as described by Daft and Lengel (1986) that technology is a useful medium to communicate or deliver an instruction. Among the teachers, perceived technology usefulness received the highest mean rating, followed by cognitive engagement and technological efficacy.

Although results show that both student groups displayed a high positive perception of CC, the in-person students reported a more favorable CC experience compared to the online students. Tucker (2021) addressed the issue of teacher attention inequality that arises in concurrent classrooms. According to her, when students in the physical classroom can raise their hand or verbally seek assistance, they naturally receive more attention from the teacher. To address this issue, Tucker suggests that teachers should establish a uniform channel for all students to ask questions or seek support. Additionally, she recommends allocating dedicated time to confer with individual learners, regardless of whether they are participating online or in person, in order to discuss their progress.

In terms of functionality, observations revealed that the CC modality exhibited a high level of functionality. The tasks and activities included in the CC framework were successfully accomplished based on the given requirements. The teachers performed their expected functions, students actively participated, and the learning environment in the CC facilitated the process effectively. According to teacher observations, the functional areas of technology, management, and instruction received mean ratings ranging from 3.65 to 3.84 in all areas, indicating a high level of functionality in the concurrent classroom. While student participation received a high mean rating, observation comments suggest that online students need to be more actively engaged in class



activities. It is crucial for teachers to provide equal attention to both student groups and encourage participation from both in class discussions. These findings present a challenge in the implementation of concurrent classrooms, as the World Mental Healthcare Association highlights the need for CC teachers to broaden their understanding and enhance their ability to respond to the distinct learning needs of two different groups. According to Tucker (2021), educators who recognize the significance of building strong connections with students and who actively design and facilitate learning experiences that prioritize fostering these relationships are likely to achieve the greatest success in navigating the current challenging landscape of education.

In terms of effectiveness, there was insufficient evidence to show significant differences in the acquisition, meaning-making, and transfer assessment results between in-person and online students when considering the learning goals. This implies that CC does not affect or favor any group in terms of their performance in the assessments. Both in-person and online assessments results indicate that students performed from very satisfactory (B+) to highly satisfactory (A-) in achieving the three learning goals: Acquisition (A), Make Meaning (M), and Transfer (T). These goals are already incorporated in the Philippine K12 summative assessments which are composed of quarterly exams, written works and performance tasks. Hence, the attainment of these goals emphasizes the students' ability to critically analyze, reason, and apply their knowledge and skills in real-world situations. However, to further study on the effectiveness of the CC must be conducted to assess the impact of the CC on the achievement of students' learning outcomes.

## **Conclusion**

The results and findings of this study reveals that the concurrent classroom modality, as implemented, shows high viability, functionality, and effectiveness as a hybrid learning approach. The CC learning modality is viable or has the capacity to deliver instruction. The usefulness of technology, particularly in completing tasks, accessing instructional materials easily, and using suitable technology applications, has received high affirmation from both students and teachers. Observations indicates that students were greatly involved and engaged in class discussions and activities but it is also noted that equal attention to both student groups must be given and online students must be encouraged to participate more actively in class. The CC has also demonstrated excellent functionality by enabling both teachers and students to perform their expected functions in terms of technical, managerial, and instructional aspects. In addition, the CC learning environment allowed teachers to enhance their capacity to cater and address the unique needs of two distinct learning groups. Lastly, achieving the three learning goals (acquisition, make meaning and transfer) shows that the CC modality is effective as it yields to positive and favorable learning outcomes.

## **Recommendations**

For the continuation and further improvement of the implementation of the CC, the following are recommended:

1. Provide a targeted professional development to empower teachers in effectively handling CC classes, focusing on equitable cognitive engagement, active participation, and balanced support

and attention for both in-person and online student groups.

2. Ensure that the necessary devices, technical equipment, and connectivity in the CC learning environment (such as microphones, cameras, and Internet bandwidth) are sufficient and remain functional. Continuous use by teachers of these devices and equipment can result in wear and tear, making maintenance a necessity.
3. Conduct a study on the effectiveness of CC to further assess and evaluate the impact of the CC on the achievement of students' learning outcomes.

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## Screen Time in Learning Management System as Student Learning Time Indicators for Academic Quality Assurance

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**Abstract:** This study explores the potential of using screen time data in learning management systems (LMS) to estimate student learning time (SLT) and validate the credit value of courses. Gathering comprehensive data on actual student learning time is difficult, so this study uses LMS Moodle logs from a computer programming course with 490 students over 16 weeks to estimate SLT. The data was segmented into a minute for each record and total duration was calculated for each student on a weekly basis. The study found variations in SLT on a weekly basis and identified that the number of students who engaged with the LMS after midnight varied according to week, possibly due to assessment deadlines. These findings suggest that screen time data in LMS can be utilized for data-driven decision making for academic quality assurance in higher education. This study can help policy makers and academic institutions to make more informed decisions and promote personalized learning experiences.

**Keywords:** Screen Time, Student Learning Time, LMS, Quality Assurance

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### Introduction

Student learning time (SLT) is a critical aspect of higher education, as it is a key indicator of the amount of time that students 'expected' to spend to engage in learning activities that credited for their qualification. In practice, SLT has been determined based on notional learning hour which include all learning activities associated to achieve the learning outcomes. However, very few research and practice address the validation aspect of the credits due to the difficulty in gathering a comprehensive actual data of SLT in a course. Besides, it is important to note that the actual amount of time that a learner spends on a particular activity may vary depending on factors such as prior knowledge, learning style, and individual pace of learning. Getting data or responses from each student on how much they spent their actual time for learning in each course they enrolled through self-report or survey seems impractical. This is due to inaccuracy and incompleteness of the data to represent the whole student in individual manner. Nevertheless, many scholars have research using user engagement data or screen time data in learning management system (LMS) towards quality education(Zanjani, 2016). Therefore,

this paper aims to investigate the feasibility of measuring SLT based on screen time data in LMS as potential new indicator for academic quality assurance in higher education.

## Literature Review

### Student Learning Time

Student learning time (SLT) refers to the amount of time a student spends on academic activities such as attending lectures, participating in discussions, completing assignments, and studying for exams. SLT is a theoretical estimation based on the concept of notional learning time. Notional learning hours are often used to calculate the credit value of a course or module, and they can also be used to plan and schedule training activities. It was based on estimated value by the experts or higher education providers during the curriculum design stage. In the context of Malaysian higher education, SLT has been described as “*the amount of time that a student is expected to spend on the learning-teaching activities, including assessment to achieve specified learning outcomes.*” (Malaysian Qualification Agency, 2008).

A literature (Mohamed, 2016) that proposed the SLT model indicates there are four major operational components namely as official contact hours, guided learning time, self-study time and assessment time as shown in Figure 4. The model also categorized the the components as “*Guided Learning Time*” and “*Independent Learning Time*”. The “*Guided Learning Time*” might be used for face to face (F2F) or none face to face (NF2F) interactions or learning activities, while “*Independent Learning Time*” is typically used with NF2F learning activities.

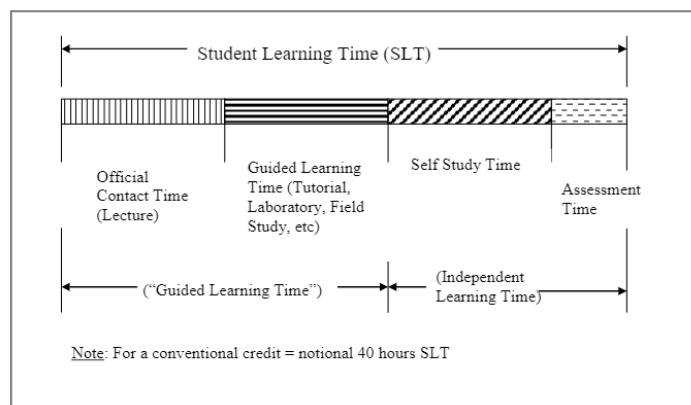


Figure 4 SLT Model (Mohamed, 2016)

Basically, the F2F is conducted based on the designated schedule can be practically quantified based on the duration of ‘contact hours’ either in classroom or online meetings normally with the presence of instructor. The amount of time for F2F sessions can be expected is the same for each learner. While for NF2F, where it been conducted without the presence of instructor, the amount of time student spend may varies due to various factors such as complexity of learning materials, learning style, personal disabilities, conduciveness of the learning environment as well as student’s personal commitment and responsibilities. Nevertheless, the total of SLT from

F2F and NF2F were used as indicators to determine the credit hours of the course.

In the Code of Practice for Programme Accreditation (COPPA) of higher education in Malaysia, SLT can be categorized as F2F and NF2F as shown in Figure 5. The NF2F of SLT is very significant for higher education since higher education is distinguished from general and secondary education by its focus on independent learning (Thompson, Pawson, & Evans, 2021). Research has shown that higher levels of NF2F SLT or independent learning are associated with better academic performance and higher rates of student retention (Kuh et al., 2008). Additionally, SLT has been linked to the development of key skills and competencies, such as critical thinking, problem-solving, and information literacy (Pascarella & Terenzini, 2005). The issue is, how to validate the NF2F SLT in term of accuracy and what are the variation of actual NF2F SLT in a course?

Distribution of Student Learning Time (SLT):								
Course Content Outline	CLO*	Learning and Teaching Activities						Total SLT
		Guided Learning (F2F)				Guided Learning (NF2F) e.g. e-Learning	Independent Learning (NF2F)	
		L	T	P	O			
1.								
2.								
3.								
4.								
Continuous Assessment		Percentage (%)		F2F		Independent Learning (NF2F)		Total SLT
1.								
2.								
Final Assessment		Percentage (%)		F2F		Independent Learning (NF2F)		Total SLT
1.								
2.								
GRAND TOTAL SLT								

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face  
\*Indicate the CLO based on the CLO's numbering in Item 8.

Figure 5 SLT Calculation in COPPA (Malaysian Qualification Agency, 2008)

### Learning Management System (LMS) in Higher Education

Learning Management System (LMS) is a type of information system or software that designed to manage, deliver and monitor online and offline educational courses and training programs. It typically involves the use of internet or digital platforms and can come in various forms, such as online courses, virtual classrooms, educational software, and mobile apps. Its features typically include user registration, course creation and management, tracking of progress, grading and assessment, and communication tools. LMS offers learners the

convenience and flexibility of accessing educational materials and interacting with instructors and peers at any time and from any location(Dimitrova, Mimirinis, & Murphy, 2004). Additionally, learners can personalize their learning experience by choosing the style and pace of their learning(Dhaiouir, Ezziyyani, & Khaldi, 2022). As a result, LMS has gained popularity in recent years and is increasingly being adopted by schools, universities, and organizations for educational programs and training. The recent global COVID-19 pandemic also has become a significant factor for global higher education to adopt LMS for their educational productivity(Wang, Li, Malik, & Anwar, 2022). With these benefits, LMS can be a significant technology for e-learning implementation to achieve the United Nation Sustainable Development Goals(Ghanem, 2020) as illustrated in Figure 6.



Figure 6. E-learning impacts on SDG (Ghanem, 2020)

In research, LMS holds great importance as it contains valuable data regarding the users' interactions with the system. This educational data known as system log is a valuable resource for scholars as it provides insights into human behavior, particularly related to the complexity of future learning and future competences in higher education(Kleimola & Leppisaari, 2022). Apart of that, these data can provide valuable information to administrators and policymakers about resource allocation and program evaluation using learning analytics(Hou, Lee, Chen, & Wu, 2023). Adopting learning analytics from LMS data oriented to academic quality assurance can bring about numerous advantages for educational institutions. For instance, instructors and administrators can receive immediate feedback through learning analytics, enabling them to pinpoint areas where students might be facing difficulties and modify their teaching approaches accordingly. This can enhance student achievement and, in turn, enhance the overall excellence of the educational program.

The crucial aspect linking learning analytics and SLT is the amount of time spent student engage in LMS. In LMS, the actual moment and duration of SLT either by guided learning or independent learning can be indicate by their screen time. In addition, learning analytics can also assist in identifying patterns and trends in student behavior, such as their level of engagement and participation in online discussions and assignments. By analyzing this data, instructors and administrators can gain valuable insights into how students are interacting with the course material and with each other, which can help them make informed decisions about how to improve the learning experience. Furthermore, learning analytics can also support decision-making related to resource allocation, as institutions can use the data to determine which courses and programs are most effective and where additional support may be needed. Overall, learning analytics provides a powerful tool for improving

the quality and effectiveness of education by leveraging the rich data generated through LMS.

### Screen Time

Screen time (ST) is a concept that referring to the amount of time spent using a device with a screen such as a smartphone, computer, television or video game console. ST also can be determine based on digital engagement that include the context of time and object that user engage with in the LMS. In practice, the timestamp data play a crucial role to determine the moment and duration of ST in any information system like LMS. Some scholars refer this data as digital footprint(Pavlenko, Barykin, & Dadteev, 2021). Many literatures highlight the negative effects especially on excessive screen time (EST) on students' academic performance, physical health, and overall well-being. EST can lead to a sedentary lifestyle, which in turn can increase the risk of obesity(Benaich et al., 2021) and other health issues(Tang, Werner-Seidler, Torok, Mackinnon, & Christensen, 2021). Additionally, too much ST can negatively impact students' sleep patterns(Hjetland, Skogen, Hysing, & Sivertsen, 2021; Muhammad, Hussain, & Adnan, 2021), which can affect their ability to learn and retain information.

While many scholars associate screen time with negative impacts, there is a potential benefit of screen time in the context of academic quality assurance. Some scholars assess the ST by using self-report or survey based approach(Vizcaino, Buman, Desroches, & Wharton, 2019). Although self-reported is a well-established and commonly adopted in wide area of research studies, a study proves that self-reports can overestimated the actual use of ST(Hodes & Thomas, 2021). ST can be quantified by using specific tools or pre-designed mechanism of information system. In the context of data quality, there are ST software tools that have been developed that aim to manage the user screen time with objective manner(Kristensen et al., 2022). For example, the built-in ST software tools in mobile operating systems that assisting user to manage and monitor their screen time with smartphone as shown by Figure 7. Since LMS also stored the user engagement data or screen time data, there is potential how these data can be further utilized to quantify objectively SLT similarly from the existing ST software tools.

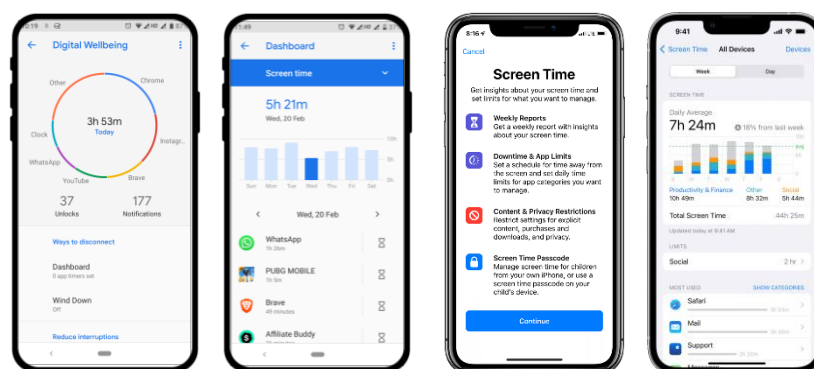


Figure 7. Screen Time Control in Android and iOS Mobile Operating System



## Method

This study aims to quantify in objective manner the SLT based on ST in LMS. Research questions of the study are as follows:

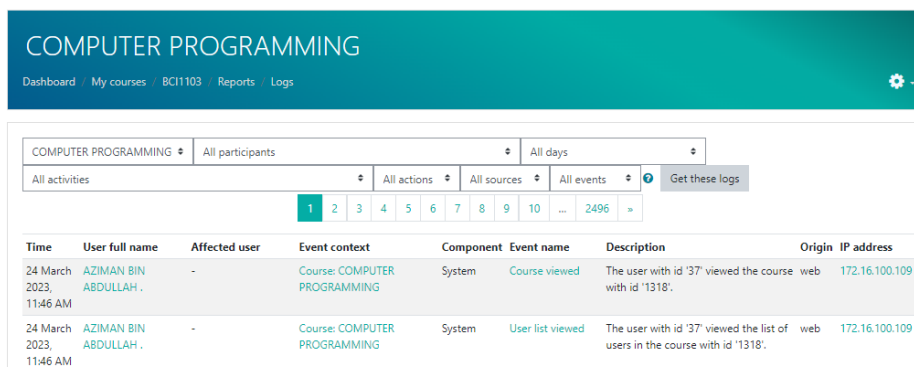
- How to visualize the SLT of one individual student?
- How to visualize the SLT of the whole student?

To answer the research questions, information about the research model, data collection and data analysis have been given.

## Research model

This study adopts the learning analytics approach for acquiring the collected data from LMS. The following are the research model adopted in this study: -

1. The dataset was acquired from the log report that generated from LMS based on Moodle for Computer Programming course enrolled by 493 students. There are 9 parameters stored in the Moodle log as shown in Figure 8 and it can be downloaded into various file formats such as Comma Separated Values (.csv), Microsoft Excel (.xlsx) or HTML table.



Time	User full name	Affected user	Event context	Component	Event name	Description	Origin IP address
24 March 2023, 11:46 AM	AZIMAN BIN ABDULLAH .	-	Course: COMPUTER PROGRAMMING	System	Course viewed	The user with id '37' viewed the course with id '1318'.	web 172.16.100.109
24 March 2023, 11:46 AM	AZIMAN BIN ABDULLAH .	-	Course: COMPUTER PROGRAMMING	System	User list viewed	The user with id '37' viewed the list of users in the course with id '1318'.	web 172.16.100.109

Figure 8. Moodle LMS Log

2. Download the dataset in Microsoft Excel (.xlsx) format since the analysis will be done in Microsoft Excel software. The size file is subject to the total record of the log in the course. In principle, the bigger is the class size or number of student, the larger the size of the log or the size file to save all the record. However, the small class size with highly active online learning activities may result with large size file of the log.
3. Open the file in Microsoft Excel and transform the data of the date into 6 new parameters namely year, week, time, hour, minutes and day of the week as shown in Figure 9. This transformation can be done

by using specific Excel function and formula.

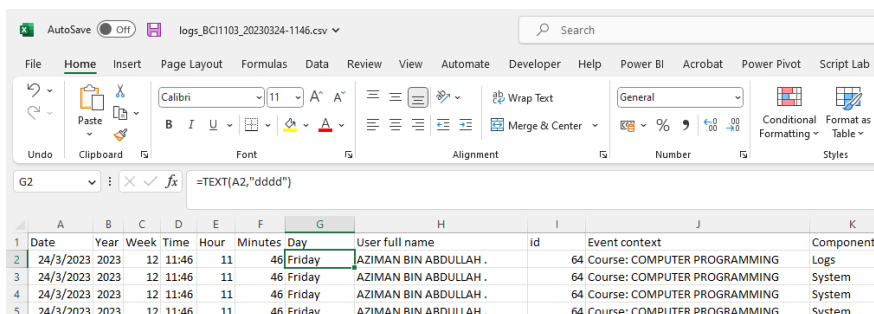


Figure 9. Transformed Dataset in Microsoft Excel

- Analyze the dataset with Microsoft Excel by using PivotTable to calculate the total number of ST to represent SLT.

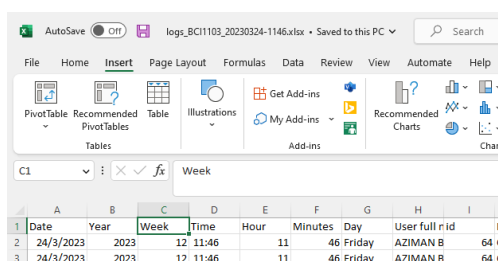


Figure 10. Data Analysis with PivotTable

- Based on the pivoted dataset, then many analysis can be used to explore the pattern of SLT by using various visualization techniques available in Excel.

## Results

There are 24955 logs were retrieved from the LMS. The description of the study population is illustrated in Table 3.

Table 3. Dataset description

Faculty	Enrolled students
Faculty Of Chemical And Process Engineering Technology	86
Faculty Of Civil Engineering Technology	100
Faculty Of Electrical & Electronic Engineering Technology	57
Faculty Of Industrial Sciences & Technology	79
Faculty Of Manufacturing And Mechatronic Engineering Technology	37
Faculty Of Mechanical And Automotive Engineering Technology	131
Total	490

The findings from this study are organized based on the research questions as follows: -

1. How to visualize the SLT of one individual student?

Since the student’s timetable has been organized in a weekly basis, the analysis of SLT or ST should be view in a weekly basis. Data that represents the context of time should adopt the temporal visualization and we found bar chart similarly with the existing ST software tools can be effective visualizations to visualize SLT of one individual student. Figure 11 shows the fluctuation of ST frequency for each week of the highest ST overall sample. To explore the difference of the other student who are moderately engaged in LMS, this study uses another sample based on the median value of overall ST per semester as shown in Figure 12.

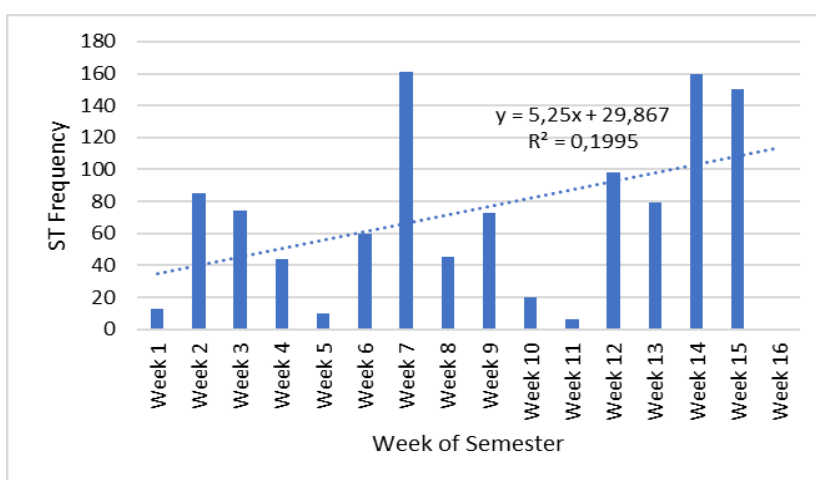


Figure 11. SLT Trend Per Week of Highest ST

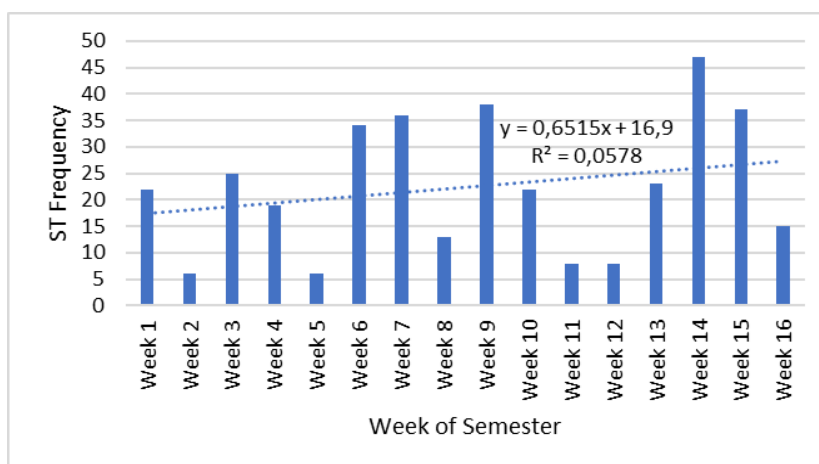


Figure 12. SLT Trend Per Week of Moderate ST

2. How to visualize the SLT of the whole student?

Based on the findings in Figure 11 and Figure 12, it is clear that the weekly SLT frequency pattern of two different student is varied. To visualize the pattern of the whole population with the size of 493 students, obviously the analysis and visualization for one student with simple linear regression is not appropriate. Therefore, this study attempts to visualize the SLT pattern of the whole student by using distribution

visualization. There are two distribution visualization techniques been adopted which are heatmap matrix and boxplot. The heatmap matrix used to indicate the distribution of actual number of students on contextual SLT according to the time clock and week of semester as shown in Figure 13. While Figure 14 displays a boxplot chart that can be used to further examine the weekly SLT pattern of all students over a semester.

Hour	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	32	24	62	26	23	47	156	41	29	15	23	29	77	58	157	26
1	13	13	31	12	19	31	72	9	13	8	15	13	45	40	94	14
2	4	2	13	7	7	18	45	7	10	2	3	6	32	25	67	12
3	6	2	8	7	6	9	30	4	6	3	6	5	17	11	38	7
4	1	1	3	3	2	9	17	2	2	3	3	1	1	3	36	11
5	4	3	4	3		3	17	4	2	3	5		7	2	19	6
6	19	4	7	8	1	6	16	5	3	4	1	1	6	5	15	3
7	30	16	29	20	8	18	37	6	18	4	2	9	5	18	22	11
8	66	82	83	57	19	98	123	14	68	39	15	81	71	85	27	13
9	68	41	81	80	26	92	99	15	94	37	17	32	42	46	43	13
10	103	88	140	102	52	125	149	82	110	80	72	78	78	66	51	26
11	91	64	143	89	57	103	126	104	75	55	36	49	75	74	79	35
12	146	106	217	139	140	161	216	100	154	119	102	145	159	129	78	26
13	76	95	134	92	45	71	146	70	116	78	46	52	95	133	76	34
14	77	71	138	90	64	106	156	50	122	80	47	62	72	116	110	39
15	76	60	130	91	62	94	149	46	93	38	37	44	85	76	140	35
16	47	41	131	96	85	100	182	52	106	50	29	63	91	92	127	33
17	33	36	81	54	56	80	137	43	47	39	23	22	59	89	118	47
18	30	17	67	41	17	89	123	25	34	31	12	23	55	87	111	24
19	42	25	95	40	27	75	168	38	43	22	20	26	50	376	116	20
20	65	85	147	60	34	120	180	39	65	40	27	82	142	387	184	39
21	69	71	169	73	39	104	213	36	92	32	42	35	155	379	199	47
22	59	45	151	59	44	103	219	40	60	25	33	39	134	382	216	47
23	49	47	123	44	29	108	235	48	32	28	34	40	98	88	252	41

Figure 13. Total Student with contextual SLT every week

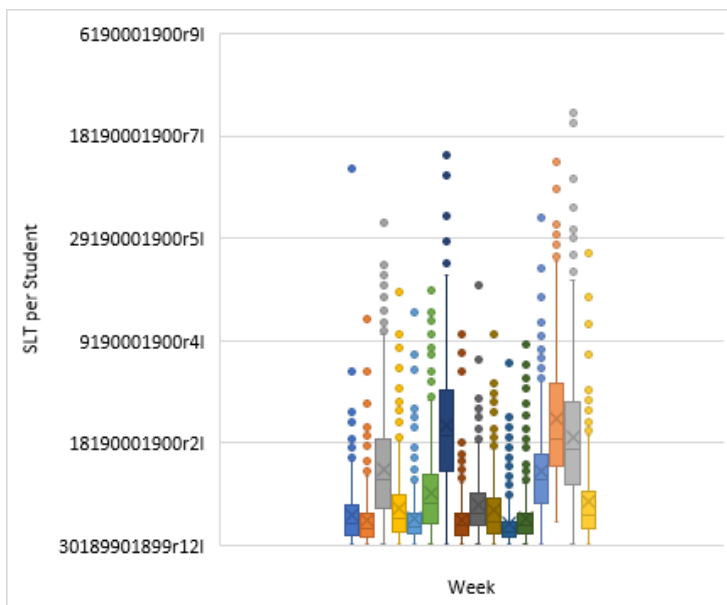


Figure 14. Weekly SLT Trend for Whole Student

**Discussion**

Based on the Figure 11 and Figure 12, both samples indicate the increasing trend of ST throughout the semester when the data is regressed linearly. The value of coefficient of determination ( $r^2$ ) shows that the amount of SLT can be explained by the number of weeks in a semester. It seems the variation of the  $r^2$  score can be used to

quantify the SLT pattern of student on weekly basis for a semester in individual manner. This analysis is potential to be used for data-driven decision making for students and instructors indicating their committed time for learning or SLT that can be translated from ST data. This is critical for higher education institution to promote and monitor personalized learning experiences (Bernacki, Greene, & Lobczowski, 2021). This type of analysis could be used to promote personalized learning experiences and monitor student progress in higher education institutions. By using ST data to track SLT, instructors and students can identify patterns and trends in their study habits and use this information to develop more effective time management strategies. For example, students who consistently spend more time on their coursework earlier in the semester may be better prepared for exams and assignments later on, while students who consistently procrastinate may benefit from additional support and resources to help them stay on track. Furthermore, the potential for data-driven decision making based on ST data has important implications for the e-learning industry. Personalization is becoming increasingly important in next-generation LMS (Kipp, 2018), and the ability to track and analyze SLT can be a valuable tool for instructors and developers looking to create more personalized and effective learning experiences for students. By utilizing this data to track and analyze student study habits, instructors and students can work together to promote academic success and personal growth.

There are many students were spending time in the LMS and staying late after midnight referring to Figure 13. One possibility is that the students were highly motivated and were using the LMS to supplement their learning. They may be working on assignments, studying for exams, or reviewing course materials to ensure that they fully understand the material especially when it is near to the deadlines or exam dates. In this case, spending extra time in the LMS could be a sign of their dedication to their studies and a desire to excel academically. However, there may be other reasons why students are staying up late in the LMS. For example, they may be struggling with the material and feel that they need to put in extra effort to catch up. They may also be dealing with personal or family issues that make it difficult for them to study during regular hours. In some cases, students may simply be procrastinating and putting off their work until the last minute (Reinecke et al., 2018). Regardless of the reason for their behavior, it is important for educators to be aware of the situation and provide support to students as needed.

Figure 11 suggests that there are some outliers in the student's weekly SLT as well as a high degree of variation in the average SLT per week for the entire semester. Outliers refer to values that are significantly higher or lower than the majority of the data points. In the case of Figure 11, this means that there are some students who are spending much more on self-regulated learning activities than the average student. This could be indicative of a variety of factors, such as differences in learning styles, motivation, or personal circumstances. Meanwhile, the high variation in the average SLT per week for the entire semester could suggest that students are having difficulty maintaining consistent study habits over the course of the semester. This could be due to several factors, such as changes in workload, stress levels, or competing priorities over the time.

By identifying these patterns through Figure 11, educators can better understand the challenges that students are facing and develop targeted interventions and support strategies to help students overcome these obstacles. For

example, educators could offer additional resources or support to help struggling students catch up or develop more effective study habits. They could also encourage students to reflect on their learning habits and identify areas for improvement. Overall, the insights gained from Figure 11 can inform data-driven decision making that ultimately leads to more effective and personalized support for students.

The potential impacts of utilizing screen time data in LMS as SLT indicators for academic quality assurance are significant across several sectors as follow:

1. **Society:** Utilizing LMS can be an effective strategy to enhance accessibility to education, advance learning achievements, and promote lifelong learning and collaboration, particularly for individuals from marginalized groups like people with disabilities or physical barriers. The research provides insights on how to create a more supportive and emphatic learning environment for such individuals by utilizing data-driven decision making to gain a better understanding of their actual learning experience within the course.
2. **Academia:** This approach has the potential to revolutionize how student learning time is measured, verified, and used to design, develop, and deliver academic programs. It could lead to a more accurate, objective and comprehensive understanding of the time students actually spend on learning activities, and therefore, enable institutions to ensure that students are meeting the necessary credit value of a course. It could also facilitate personalized learning experiences for students and provide instructors with insights on how to improve teaching practices.
3. **Government:** The use of screen time data in LMS could help regulators and accrediting bodies to verify the quality of academic programs and ensure they meet the necessary standards. This approach could also provide policymakers with valuable insights into the effectiveness of online learning environments and how they can support the expansion of digital learning opportunities.
4. **Industry:** This approach could lead to the development of better Learning Management Systems that are designed to collect and analyze screen time data and provide personalized learning experiences for learner either in education or corporate training. It could also foster the development of data-driven decision-making processes that can improve the overall quality of academic programs and contribute to better workforce outcomes.
5. **Environmental:** The use of screen time data in LMS could reduce the need for paper-based assessments and feedback, which would have a positive impact on the environment by reducing waste and resource consumption. This approach could also facilitate distance learning opportunities, which could reduce the need for students and instructors to travel, leading to reduced carbon emissions and a smaller environmental footprint.

## Conclusion

The potential contribution of data-driven decision making based on student data from the LMS can be significant in supporting students who are spending time in the LMS and staying up late after midnight. By

analyzing student data, educators can gain insights into how students are using the LMS and identify patterns in their behavior, such as which activities they are spending the most time on and when they are most active in the LMS. This information can then be used to inform interventions and support strategies that are tailored to the needs of individual students. For example, if educators notice that a particular student is spending a lot of time on a particular activity but is not making progress, they may offer additional resources or support to help them understand the material better. In addition, by using SLT data to inform decision making, educators can develop more effective strategies for promoting healthy study habits and time management skills (Cao, Zhang, Chen, & Shu, 2022). They can identify which interventions are most effective for different types of students and adjust their approach accordingly. As digital learning has become an integral part of academic operations in many institutions, our findings can provide insight for policymakers and academics on how to use screen time data from LMS for data-driven decision making to ensure academic quality assurance in higher education.

## Recommendations

Future research could build on the findings from this study and explore additional questions related to SLT in higher education. Here are some potential areas for further investigation:

1. **Factors influencing SLT:** This study identified that there is high variation in SLT among students. Future research could examine the factors that contribute to this variation, such as differences in learning styles, motivation, or personal circumstances. Understanding these factors could help educators develop targeted interventions and support strategies that are tailored to the needs of individual students.
2. **Relationship between SLT and academic performance:** This study did not examine the relationship between SLT and academic performance. Future research could explore whether there is a correlation between SLT and grades or other measures of academic success. This could help educators better understand how SLT relates to overall student achievement and inform strategies for promoting academic success.
3. **Relationship between SLT and digital well-being:** As students spend more time engaging with digital technologies, it is important to understand how this affects their well-being and how it may impact their ability to engage in effective self-regulated learning. Policy makers could work with educators and experts to develop guidelines for healthy digital use that can be shared with students and families.
4. **Longitudinal analysis of SLT:** This study examined SLT over one course of a single semester. Future research could conduct a longitudinal analysis of SLT over a longer period of time to better understand how students' study habits evolve over time and whether there are changes in SLT over the course of a student's academic career.
5. **Comparison of SLT across courses for the whole curriculum:** This study examined SLT among students in a

single course. Future research could compare SLT across different courses and student's level to explore whether there are differences in study habits and self-regulation strategies across courses.

6. Impact of support interventions on SLT: Finally, future research could examine the impact of support interventions on SLT. For example, researchers could explore whether offering additional resources or support to struggling students leads to an increase in SLT and improved academic performance. Understanding the effectiveness of different support strategies could help educators develop more effective and targeted interventions to support student success.

## Acknowledgements

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## The Degree of Students' Commitment to Virtual Lectures

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**Abstract:** The coronavirus pandemic has forced the world to change education policies in educational institutions. For example, Jordan's Ministry of Higher Education has allowed courses in academic programs to be taught in three types of education: distance e-learning, blended education, and traditional education. Hence this study came to reveal students' behaviors during virtual lectures. The researcher used the descriptive method, the sample consisted of (96) students from Shobak University College. The results of the study show that (68%) of students are committed to attending e-lectures fully and following up with teachers for a full explanation of lectures, (13%) are Commitment to attending without focus, (10%) Log in and get busy with something else, (7%) Make sure to attend some of the lectures, and (2%) Others attend lectures about me. Results on preferred learning patterns showed that (37%) of students prefer a face-to-face education pattern, (32%) of students prefer full e-learning, and (31%) of students prefer Blended education. Results of Students' focus on virtual lectures, 43% full lectures, 10% (10 minutes or less), 12% (11-25 minutes), 20% (26-40 minutes), and 15% (41-60 minutes). Result of Reasons for students' lack of attendance and focus during virtual lectures, (44%) there are no reasons, they attend all lectures, (18%) There is no internet and computer or smart device to be able to attend the lectures, (16%) There is no special place at home prepared to attend the lectures, (15%) Preoccupation with other work, and (7%) They lack the motivation to attend the lectures.

**Keywords:** Virtual Lectures, Behaviors of University Students.

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### Introduction

Interest in e-education was not evident in Jordanian universities before the Corona pandemic, which engulfed Jordan by the Defense Law of 17/3/2020 (Bnitaha and Mahasneh, 2021), which directed the ministries of education and higher education to continue implementing academic programs by using distance education.

The Ministry of Higher Education has been working to change policies and regulations regarding the nature of teaching at universities, colleges, and institutes. Regulations No. (96) of 2021, which includes a system for the integration of e-learning in higher education institutions, stipulates the obligation of higher education institutions to restructure academic programs and plans of subjects by the requirements of the integration of e-

learning (Face-to-face, full E-learning, Blended education) (Jordan's Ministry of Higher Education and Scientific Research,2022).

By the legislation and regulations, universities and colleges in Jordan have taught courses in academic programs according to three types of education (Face-to-face, full E-learning, and Blended education).

**Face-to-face Education**

According to this pattern, there are courses in each academic program that must be studied face-to-face, especially practical courses (Mahasneh, 2021; Mahasneh,2020A).

**Blended Education**

According to this pattern, there are courses in each academic program that must be taught in a Blended Education, meaning teaching courses as face-to-face lectures and virtual lectures simultaneously and remotely asynchronously (Mahasneh,2020 B; Mahasneh,2020 C).

**Full E-Learning**

Electronic learning systems such as (Moodle) and some electronic applications such as (Teams) have been used to teach courses in academic programs at Jordanian universities and colleges since the adoption of legislation. Full e-learning can be defined as a pattern of education that enables a faculty member and a student to meet to attend virtual lectures simultaneously or asynchronously using an e-learning system or electronic applications (Mahasneh, 2021).

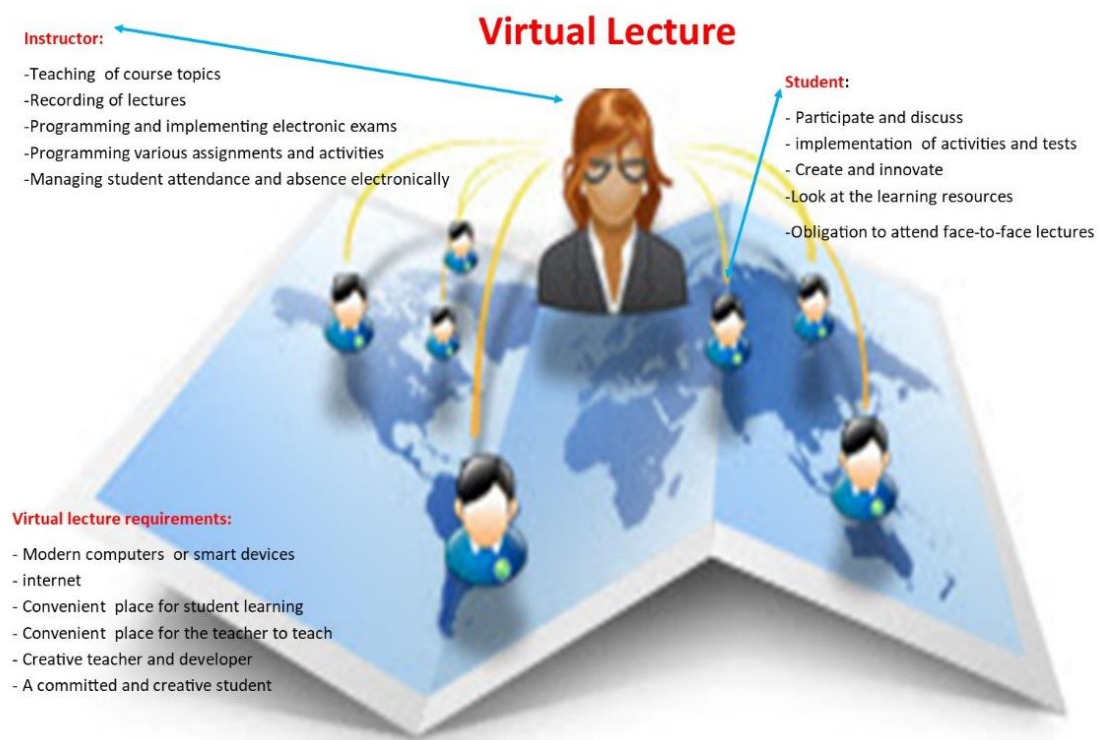


Figure 1.Illustrates the virtual lecture in the e-learning environment

Note. Figure 1. illustrates the virtual lecture in the e-learning environment, requiring the teacher to prepare well for the virtual lecture in terms of scientific material design and display for students, to being able to use the available e-learning systems as a system (Moodle) and various applications of virtual lectures such as (Teams), it is also necessary for the teacher to see the latest e-learning strategies such as flipped education strategy and use in the teaching process, to keep abreast of scientific developments in the use of technology in teaching (Mahasneh, Tawarah, & Al-lawama, 2021).

The student's role in virtual lectures is at the center of the educational process, intending to devote a place to attend virtual lectures, discuss create and provide solutions, in addition to the need for the student to have computers or modern smart devices and subscribe to the Internet.

The student in e-learning and virtual lecture is the basic pillar for achieving the course's learning output, requiring the student to create the right environment for him to learn, commit to attending and interact during lectures, carry out activities and perform the duties required by the course. So, this study came to reveal students' behaviors during virtual lectures.

After familiarizing the researcher with theoretical literature and previous studies, he found studies relevant to the subject of the study, conducted by Hollister, Nair, Hill-Lindsay, and Chukoskie (2022) A study entitled Engaging in Online Learning (Direction and Behavior) During the Coronavirus Pandemic, the study sample consisted of (187) Students from American universities. The results of the study showed that 72% of the study sample confirmed a decrease in students' participation in direct virtual lectures affected the experience of online learning. There are positive impressions of teachers and students feeling more comfortable asking questions and answering them in online classrooms.

Azmi, Khan, and Azmi (2022) conducted a study aimed at knowing the impact of virtual learning on students' educational behaviors and the spread of depression among college students due to the coronavirus pandemic. The study sample consisted of 157 students from two universities in Saudi Arabia. The results of the study showed that 75% of the study sample had different tactical symptoms. The online learning method is boring for students and 75% of students experience stress and fear in exams.

Curelaru, Curelaru, and Cristea (2022) conducted a study entitled Students' Perceptions of Distance Learning During the Coronavirus Pandemic. The study sample consisted of 209 students. The results of the study showed that there are negative aspects to online learning, including (Stress, anxiety, isolation, low motivation, indifference, misunderstanding, undernourishment, and lack of challenge) There are also advantages to online learning (rest, accessibility, saving time and money, psychological and medical safety).

Lin, Jin, Zhao, Yu, and Su (2021) studied the factors affecting changing students' behavior toward online learning to consider the coronavirus pandemic. The results of the study showed that there are factors that affect students' acceptance of online learning, including (usability, ease of use, teacher behavior, and matching tasks

with technology).

That it is the only study that attempted to study the **Universities' Students and Virtual Lectures** in Jordan that characterize the current study of previous studies. This study is consistent with the above studies in some molecules associated with the objectives of the current study.

### Study Problems and Question

Through his experience teaching virtual lectures, the researcher noted behaviors from students that are incompatible with modern educational theories. Hollister, Nair, Hill-Lindsay, and Chukoskie's (2022) study confirmed that students' low participation in direct virtual lectures was detrimental to the experience of online learning. Hence, this study came to answer the following questions:

First question: **What is the form of education preferred by students?**

Second question: **how are the students committed to virtual lectures?**

Third question: **How long are the students concentrate with the teacher during virtual lectures?**

Fourth question: **What are the reasons causing students' lack of attendance and focus on virtual lectures?**

### Methodology

The researcher used the descriptive method through an electronic questionnaire after ascertaining its validity and Reliability. The study sample consisted of 96 students from Shobak University College, who were selected in the available sample method. Figure 1 shows their distribution by sex variable. Repeats and percentages shown by Google Forms were used for electronic identification to answer study questions.

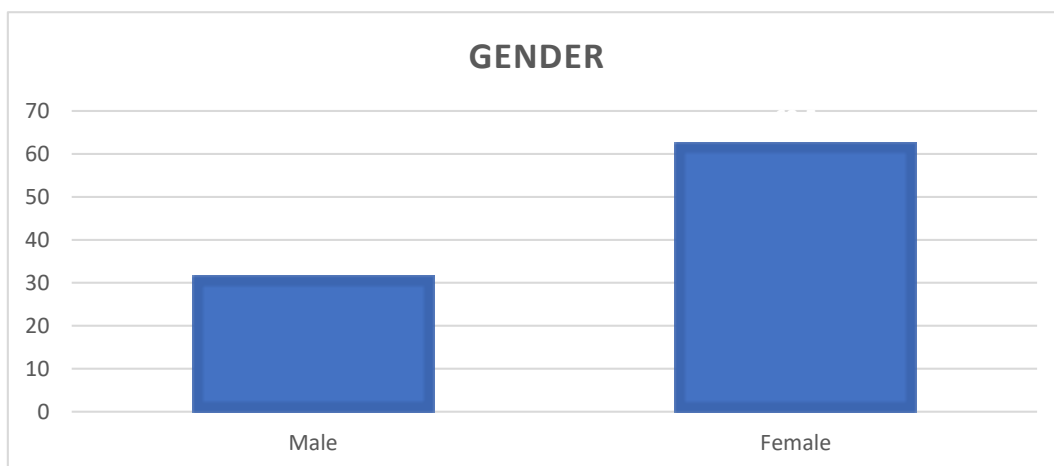


Figure 2. Dfistribution of study sample by gender

Figure 2. shows that the study sample was distributed to 39% males and 61% females

**Results**

Frequencies and percentages of responses to study questions have been found, these results are presented below:

**Results related to the first question**

Figure 2. shows the responses of the study sample to the first study question: What is the form of education preferred by students?

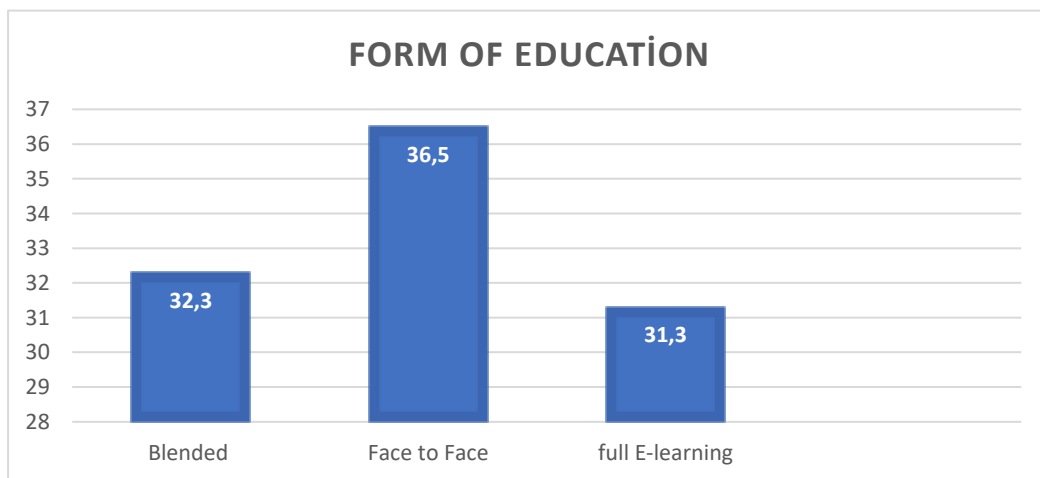


Figure 3. Students' preferred forms of education

Figure 3 shows Preferred learning patterns, 37% of students prefer a face-to-face education pattern, 32% of students prefer full e-learning, and 31% of students prefer Blended education.

**Results related to the second question**

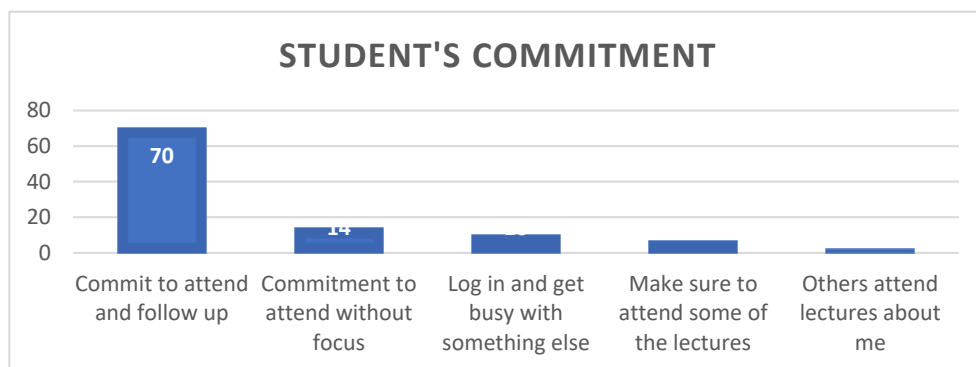


Figure 4. The responses of the study sample to the second study question: **how are the students commit to virtual lectures?**

Figure 4. shows Students attend virtual lectures, 68% Commit to attending and following up, 13% Commitment to attending without focus, 10% Log in and get busy with something else,7% Make sure to attend some of the lectures, and 2% Others attend lectures about me.

**Results related to the Third question**

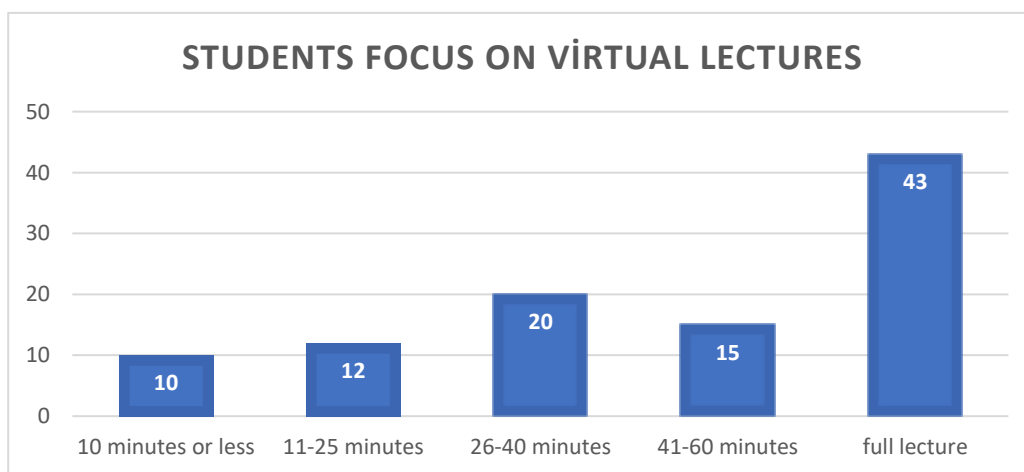


Figure 5. The responses of the study sample to the third study question: **How long are the students concentrate with the teacher during virtual lectures?**

Figure 5 shows Students' focus on virtual lectures, 43% full lectures, 10% (10 minutes or less), 12% (11-25 minutes),20% (26-40 minutes), and 15% (41-60 minutes).

**Results related to the fourth question**

Table 1. shows the responses of the study sample to the fourth study question: **What are the reasons causing students' lack of attendance and focus on virtual lectures?**

Table 1. Reasons for students' lack of attendance and focus on virtual lectures

n	Reasons for students' lack of attendance and focus on virtual lectures	frequency	%
1.	There are no reasons, they attend all lectures	48	44%
2.	They lack the motivation to attend the lectures	8	7%
3.	There is no special place at home prepared to attend the lectures	17	16%
4.	There is no internet and computer or smart device to be able to attend the lectures	19	18%
5.	Preoccupation with other work	16	15%

Table 1 shows the Reasons for students' lack of attendance and focus during virtual lectures, 44% there are no

reasons and they attend all lectures, 18% There is no internet and computer or smart device to be able to attend the lectures, 16% There is no special place at home prepared to attend the lectures, 15% Preoccupation with other work, and 7% They lack the motivation to attend the lectures.

## Conclusions

Considering the results of the study the researcher confirms that:

1. There are some courses in academic programs that require teaching face-to-face such as practical courses that require experience and work. Therefore, students prefer to teach them face-to-face. Also, in some courses that include theoretical and practical aspects students prefer the blended learning style. Some courses include a theoretical aspect, so students prefer full e-learning.
2. That students vary in commitment to attend lectures due to self-motivation and students may be busy with other work. This result agrees with the result of a study (Hollister, Hill-Lindsay ,and Chukoskie, 2022).
3. The difference in the concentration rate of students due to their different circumstances and environments.
4. That the reason for this is the different motives and desires of students.

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## Typology of Corporate Social Responsibility: The Applicability of CSR within SMES Companies in Developing Countries – The Case of Morocco

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**Abstract:** This research aims to analyze and evaluate the constraints and factors that prevent the implementation of CSR principles within SMEs in developing countries, specifically in Morocco. Morocco has adopted a national sustainable development strategy in line with its 2011 constitution and international commitments. The National Strategy for Sustainable Development sets objectives for 2017-2030 and identifies operational measures. It is considered a continuous process that requires various actors, including SMEs, to modify their behavior by integrating socio-environmental components more significantly into their strategic roadmaps. However, recent diagnostics have revealed that while the elements of sustainability are present in the majority of policies, their implementation remains insufficient. This study focuses on both internal variables (employee commitment, strategic decisions, internal organization, and the posture of the entrepreneur-owner) and external variables (competition, business opportunities, and government incentives) that can influence the application and implementation of CSR in Moroccan SMEs. The results highlight significant gaps in terms of employee awareness, company strategy, organizational structure and processes, as well as owner awareness regarding CSR. The findings also suggest that company size, sector, and age are associated with distinct outcomes.

**Keywords:**

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### Introduction

SMEs are often perceived as problematic in the CSR debate, primarily due to the perceived difficulty they face

in engaging in CSR practices. However, an alternative viewpoint suggests that the problem lies with the CSR debate itself and its current conceptualization, which fails to adequately include SMEs (Jenkins, 2004). CSR is commonly understood and presented as a singular and uniform field of research, which is misleading as it overlooks the specificities of CSR in SMEs (Louche and Michotte, 2011). The terminology associated with CSR may not be suitable for SMEs, as they often struggle to grasp the concept but are capable of defining what it means in the context of their own company (Lynch-Wood, Williamson, and Jenkins, 2009). It is evident that CSR in SMEs should not be studied as if an SME were a miniature version of a large company (Julien and Marchesnay, 1990). Unfortunately, research on CSR in SMEs often suffers from the influence of the "large company" perspective in which the concept of CSR was originally developed. The literature on CSR in SMEs primarily focuses on the strategic and economic aspects of CSR, while neglecting sociological and community issues (Mankelov, 2008). Similarly, when it comes to the role of employees in CSR research within SMEs, we observe similar trends to research conducted on large companies, with a predominant focus on management and external stakeholders. Employees are often regarded as mere recipients of CSR efforts, serving strategic purposes, while their voices are largely unheard, reinforcing a normative approach to CSR.

### **Global CSR**

The notion of CSR is relatively recent, but the concern for the consequences of business and economic activities dates back more than 70 years (Capron, Quarel-Lanoiselee, 2010; Freeman and Hasnaoui, 2011). A socially responsible company is one that recognizes the impact of its actions on the environment, society, and the wider community. CSR has been defined through various approaches. Carroll (2021) argues that a company's efforts should go beyond mere "responsibility," which implies a sense of obligation, and should encompass a way of conducting business and embracing sustainable development. Prakash, Chandra, and Chandrashekar (2021) propose a three-level scheme to align a company's behavior with societal needs. This scheme includes "Social obligation," "Social responsibility," and "Social responsiveness," encouraging companies to anticipate and proactively address the needs of society, rather than simply reacting to them.

### **CSR and SMEs**

Interest in the social responsibility of SMEs has emerged less than two decades ago (Gendron, Lapointe, and Turcotte, 2004). However, the number of academic studies on the subject is increasing (Quarel and Auberger, 2005; Ben Boubaker-Gherib, 2009; Berger-Douce, 2009; Fassin, Van Rossem and Buelens, 2011; Douyon & Paradas, 2022). Theories developed within the context of large corporations can only be partially applied to SMEs (Jenkins, 2004, 2009). The unique characteristics of these small economic entities (Torrès, 1997) pose significant challenges in integrating management principles and responding to specific motivations (Hamdoun, Achabou, and Dekhili, 2022). Moreover, most methodologies have been developed for application in large companies, aiming to ensure certain ethical standards in their activities. However, these CSR methodologies may include criteria that are not always appropriate or fully relevant to the reality of SMEs.

Nevertheless, the inapplicability of these globalized methods does not prevent us from using them as guidelines or parameters for assessing CSR management in SMEs. If we consider that CSR fundamentally refers to values such as ethics towards society, the environment, local authorities, etc., it becomes easier to interpret responsible management and adapt its application to SMEs.

Quairel and Auberger (2005) proposed a strategic framework for understanding CSR in SMEs. According to their approach, the efforts made by SME managers and civil society in relation to CSR expectations are important elements to consider. These authors also suggest that stakeholder theory is a relevant theoretical framework for modeling CSR, regardless of company size. In the management process of SMEs, the relationship between the entrepreneur and stakeholders is not analyzed as an agency relationship but as a relationship of dependence on resources.

Furthermore, Gherib, Spence, and Biwolé (2009) developed a theoretical framework for studying SMEs' commitment to sustainable development. They argue that the neo-institutionalist theory, which considers the company's embedding in a social environment, and the entrepreneurial theory, which focuses on the personal values of leaders, are suitable for analyzing this commitment. Buciuniene and Kazlauskaitė R. (2012) also suggest that economic and organizational approaches reveal that companies' commitment to CSR is primarily explained by organizational and environmental criteria. They note that while this finding applies to large companies, the commitment of SMEs to CSR practices is influenced by organizational criteria but also significantly impacted by the leader's role. Therefore, it is understood why SMEs with similar organizational and environmental criteria, but managed by individuals with different personalities, do not all adopt CSR strategies. The strong centralization often observed in small companies gives the manager and their motivations a crucial role. In a small business, the manager is often the sole decision-maker (Kechiche and Soparnot, 2012), and the vision of this leader becomes pivotal (Bayad and Garand, 1998). The leader is considered the driving force behind CSR and is expected to demonstrate a certain ethical perspective that directly relates to the concept of stakeholders, as discussed by Courrent (2003). The author posits ethics as a relationship with others, and managers must represent the interests of multiple stakeholders, which may have conflicting views. Ultimately, the leader represents just one stakeholder among others (Kechiche and Soparnot, 2012).

### **CSR Strategic positioning**

The unique characteristics of the SME environment, including tools, constraints, and structures, result in different CSR practices compared to large corporations (Rim and Kim, 2016). The limited time, financial resources, and skills often hinder SMEs from formalizing their CSR commitments and effectively managing CSR issues internally or communicating about their actions in this area. Recent surveys conducted in several European countries (Aminudin, 2013; Arnaud and Wasilewski, 2014) indicate that SMEs tend to be more active in local sponsorship-type initiatives rather than adopting a fully structured approach to CSR.

The level of strategic involvement in CSR varies depending on the sector of activity. Industries exert different pressures on companies to consider CSR, given their specific characteristics (Hartmann, 2011). Two factors can

explain the interest in sectoral breakdown. Firstly, there is a need for product differentiation. In sectors where product differentiation based on price or quality has diminished, companies strive to differentiate themselves through environmental or social aspects of their products or production methods. This allows them to attract consumers willing to pay a premium for goods with ethical attributes (Buciuniene and Kazlauskaite, 2012; Rim and Kim, 2016).

### **CSR and owner's awareness**

SMEs often revolve around the entrepreneur or owner, who typically maintains close relationships with employees and tends to communicate changes orally rather than formalizing strategies in writing (Laperche and Levratto, 2012). This informal nature of SMEs requires a specific approach when implementing a CSR strategy, which is based on the personal motivation of the leader. The leader's ethical awareness can lead to the allocation of funds for proactive approaches, while their lack of awareness or disapproval of environmental, social, and societal actions can become an additional obstacle. The central role of the SME manager has been emphasized in theoretical works (Gendron, Lapointe, and Turcotte, 2004; Berger-Douce, 2008) and surveys such as the ACFCI survey conducted by the Assembly of French Chambers of Commerce and Industry (2006), which reported that 91% of the surveyed SMEs identified the manager's conviction as the origin of their CSR approach.

Previous research has shown that the commitment of business leaders, entrepreneurs, and owners is crucial for the success and longevity of a CSR approach (Cooke and He, 2010). However, employee involvement at all stages of the CSR process, from design to implementation and evaluation, is equally important. While management's commitment and support are essential for initiating and sustaining the process, the active participation of employees is crucial in ensuring the effectiveness and efficiency of a responsible corporate policy (Essid, 2009). All internal stakeholders of the company need to be involved to align their work towards achieving the objectives set by the CSR approach.

### **CSR and Employees Engagement/Training**

Few articles relate specifically to employees and their engagement in CSR in developing countries. Academic research on CSR in SMEs is primarily centered on the SME manager. Data related to the leaders is collected – their motivations, personality, origins, community, commitments, point of view, etc. – regardless of the question addressed (Courrent and Gundolf 2008; Del Baldo 2010; Berger-Douce 2011; Des Rochers and Turcotte 2012; Murillo and Lozano 2006; Paradas 2011; Koch, Bekmeier-Feuerhahn, Bögel and Adam, 2019; Kunz, 2020). Admittedly, the manager is a central figure in the SME. Its values and personality significantly guide the positioning and operation of the organization. Moreover, it is often difficult to distinguish the company from its owner in terms of values, policies and day-to-day practices (Murillo and Lozano 2006). However, research neglects the essential contribution of employees, particularly in interaction with the manager.

Employees occupy a central place in SMEs (Jenkins 2009), with most managers considering job creation as their major contribution to society (Painter-Morland and Dobie 2015; Morsing and Spence, 2019). Many researchers agree that employees represent the closest and most strategic stakeholder for the manager (Mankelov 2008; Preuss and Perschke 2010; Oldham and Spence, 2022). Members of an SME very often share the same workplace and the hierarchical distance is apparently less great. That being said, the hierarchical power can be stronger, because the leader and the owner are often one and the same person. The functions in the company are strongly intertwined. Strategic, administrative and operational decisions are then diffused within the organization. These specificities impact the way in which CSR materializes in SMEs (Arenas-Torres, Bustamante-Ubilla and Campos-Troncoso, 2021). Proximity relationships indeed generate processes of reciprocity, trust and cooperation that promote the assumption of social responsibility by SMEs (Murillo and Lozano 2006; Perrini 2006). These processes are implemented more intuitively, informally than strategically (Fassin 2008; Jenkins and Obara 2006), often through unnamed CSR. Codes of conduct or ethical charters are almost non-existent (Courrent 2003), the essence of CSR residing in the implementation of responsible practices at all levels of the organization, in a corporate culture rather than in formalization (Fassin 2008).

One observation across publications and findings is that CSR professional training is currently primarily intended for executive positions, whereas the objective should be to mobilize all of the company's players (management, managers, non-executive employees, staff representatives, etc.). It also appears that when employees take CSR training, it is not uncommon for them to be unable to put their learning into practice once they return to the company (Dubruc and Salameh, 2014). However, each category of actor is likely to make a contribution to the approach and bring it to its level. It should be noted that the actions of employees depend in part on the resources allocated to them by their managers and managers, as well as on the maturity of the sustainable development approaches in the company. Finally, since dialogue with stakeholders is an integral part of CSR, training in dialogue with stakeholders can therefore be considered as CSR training (Guzzo, Abbott, Madera and Dawson, 2022).

According to Turner, McIntosh, Reid and Buckley (2019), CSR accelerates recruitment and employee engagement, particularly among young people. Employees seem to be more committed when the company develops concrete CSR values and programs. In the same study, 51% of workers say they do not want to work for a company that does not have a strong social or environmental commitment. 58% say that CSR is an important criterion in choosing their job. Some even place this criterion above the salary: 55% of respondents say they would choose to work for a socially responsible company even if the salary offered was lower than their other proposals. In general, 70% of employees say they would be more loyal and more faithful to their employer if the latter were really invested in a responsibility approach. This observation is particularly strong among the young generation, namely the Millennials. 79% of Generation Y young people place CSR as a criterion for their job searches, and 76% place CSR above salary in these criteria. According to a Korn Ferry study, nearly 3/4 of employees even say they are disappointed that their employer does not offer more ways to engage on topics related to CSR (Waples and Brachle, 2020).

### CSR context in Morocco

Morocco's decision to open its economy and align with the demands of globalization poses a significant challenge for Moroccan companies (El Abboubi and El Kandoussi, 2009). The emergence of new international competitors and the opening of markets compel companies to adopt similar management methods, including social responsibility, in order to maintain their competitiveness against multinational companies and local representatives (Filali, 2009). Corporate social responsibility in Morocco encounters both opportunities and obstacles (El Abboubi and El Kandoussi, 2009). On one hand, its development is motivated and encouraged by a favorable global context that includes innovative legal and institutional reforms.

From a political perspective, initiatives such as the National Initiative for Human Development, reforms in the legislative framework, and the standardization and labeling movement play crucial roles. The royal speech serves as a starting point, encouraging companies to engage in socially beneficial initiatives. The following excerpt from a royal speech illustrates this perspective: "The social responsibility of investors has as its counterpart and condition the social responsibility of companies. In this regard, we follow with interest and satisfaction the action of Moroccan companies that have voluntarily embarked on this path."

On the environmental front, Law 11-03, which pertains to the protection and enhancement of the environment, lays the foundations for the national policy in this area. This policy aligns with universal concerns aimed at safeguarding the environment from all forms of pollution and degradation, improving the living conditions of individuals, and defining guidelines to be followed in the legislative, technical, and financial fields related to environmental protection and management (El Baz, Laguir, Marais, and Staglianò, 2016).

On the legislative level, Moroccan legislation introduced a new labor code in 2004, reinforcing the commitment to human rights and international labor conventions (El Kandoussi & Radi, 2008). Furthermore, on the economic front, the CGEM (General Confederation of Moroccan Enterprises) launched a Label for Corporate Social Responsibility, which serves as a significant catalyst for the establishment and development of CSR in Morocco (CGEM, 2006).

However, several obstacles hinder the progress of CSR in Morocco. These include the predominance of small and medium-sized enterprises (SMEs) (Torres, 1997), the lack of university and professional training that educates future professionals about CSR (Ettahiri, 2009), and the prevailing Moroccan management style, which tends to be discreet and non-declarative, with managers displaying paternalistic tendencies rather than adopting a managerial approach (Echaine and Smouni, 2022). Increasingly, CSR-related work focuses on establishing a close relationship between environmental, social, and economic aspects in company management. Companies cannot fully implement their social responsibility without safeguarding human rights and reporting on them (Berger-Douce, 2008; Brandellec and Cadet, 2014; NgokEvina, 2018). This research does not isolate any of these variables but treats all three components simultaneously to align them effectively with the overall management principles of companies.

As mentioned earlier, CSR principles are employed by any company that aims to adopt a socially responsible approach in its day-to-day management practices. Several CSR principles that address the well-being of employees at work originate from the ISO 26000 guidelines. In this regard, the International Labor Organization (ILO) outlined four fundamental principles in its 1998 declaration that govern the relationship between individuals and work: freedom of association and representation, prohibition of forced labor, non-discrimination, and elimination of child labor.

Additionally, the SA 8000 standard emphasizes social responsibility and the treatment of employees within companies, promoting the establishment of fair and decent working conditions. SA 8000 seeks to globally disseminate codes of conduct concerning employee treatment beyond mandatory national legal frameworks. Introduced in 1997 by the Council on Economic Priorities, it advocates nine key areas of social performance: prohibition of forced labor and child labor, prohibition of disciplinary practices, adherence to essential health and safety regulations, freedom of association and collective bargaining rights, limitations on working hours, establishment of minimum wage levels that meet basic needs, non-discrimination based on race, gender, religion, etc., and independent monitoring and control to ensure compliance with the standard. However, the standard recognizes the necessity of adapting these principles to the local requirements and constraints of each company (Charpateau and Wiedemann-Goiran, 2012).

In Morocco, the CSR charter is considered the standard for corporate social responsibility. Its social component is reflected in the first two axes of the charter. The first axis promotes the respect for all human rights, including the right to freely join trade unions, the prohibition of child labor and forced labor, as well as the elimination of any form of racial or gender discrimination in the workplace. The second axis focuses on continuously improving employment and working conditions, as well as professional relationships. This is achieved through enhancing employee skills and employability, fulfilling the legal obligation of declaring all employees to social security and protection organizations, and ensuring compliance with health and safety regulations as mandated by the current legislation.

The definition of SMEs in Morocco has evolved over time. It began with the establishment of a simplified and accelerated procedure in 1972, followed by the introduction of the SME charter in 2002, the mobilization of a pilot line in 1978, and the promulgation of the investment code in 1983. Since 2002, in order to be classified as an SME, companies must meet the following conditions: existing companies should have a permanent workforce not exceeding 200 people and an annual balance sheet total not exceeding 50 million dirhams over the past two financial years. For newly established companies (less than two years old), they are considered SMEs if they have undertaken an initial investment program not exceeding 25 million dirhams and maintain an investment ratio per employee of less than 250,000 dirhams. To simplify matters, the final version of the new definition of SME, established in 2017, considers only the criterion of annual income and disregards the number of employees. It categorizes companies into three types based on their annual revenues: very small businesses with less than 3 million Moroccan dirhams in annual revenues, small businesses with revenues ranging from 3 to 10 million dirhams, and medium-sized enterprises with annual revenues between 10 and 175 million dirhams.



## Research Design Methodology

A quantitative statistical approach was employed in this research, utilizing an online survey to investigate the applicability of CSR in Moroccan SMEs. The survey consisted of two parts. The first part aimed to explore the internal factors that may influence the implementation of CSR practices from the perspective of SME entrepreneurs-owners. The second part focused on the external factors. To design a reliable and valid questionnaire, discussions and meetings were conducted with 23 potential entrepreneurs and participants. Their input was sought to determine the important determinants that influence their perception of CSR applicability. From these discussions, two meta-dimensions emerged: internal and external dimensions. Annex 1 provides a summary of these determinants as drawn from the discussions.

A total of 250 potential participants were randomly selected, representing various industries and regions. The research was conducted in the second semester of 2021 and covered the cities of Casablanca, Rabat, and Tangier, which are the three most important economic regions in the country. Names and contact details were obtained from the Moroccan Office of Industrial and Commercial Property (OMPIC, 2022), the institution responsible for centralizing and providing access to company information in the country (such as legal status, activity, region, financial statements, etc.) based on the national commercial trade logbook. Potential participants were contacted via phone calls and emails and were invited to complete an online questionnaire (see Annex 2). Out of the 210 respondents, 123 valid questionnaires were considered for this study. Table 1 below displays the distribution of companies according to their profile:

Table 1. Main summary statistics

Variable/values	Statistic
Size: Very small	25.2%
Size: Small	29.3%
Size: Medium	45.5%
Sector: Primary	14.6%
Sector: Secondary	54.5%
Sector: Tertiary	30.9%
Number of employees	
Average	33.8
Median	20
Standard Deviation	30.4
Years in operation	
Average	8.8
Median	8
Standard Deviation	6.4

The method employed to collect data was through self-administered questionnaires. This presents the advantage of efficiency and standardization, providing participants with a clear understanding of the limited time required to answer. This method allows for the collection of data in a relatively quick manner while respecting the privacy of participants. Furthermore, the anonymity provided by questionnaires encourages honest responses. Standardization also helps to minimize incorrect and inappropriate responses. However, one important disadvantage is the uncertainty surrounding who actually completed the questionnaires. Once questionnaires are sent to participants, it becomes difficult to track and ensure their accurate completion. Additionally, it is challenging to assess the attitudes and feelings participants may have had when reading the questions, and there is a possibility of misinterpretation. While some of these issues could potentially be addressed through individual interviews, they cannot be entirely eliminated.

Table 2. List of questions presented to the respondents

Dimension	Information area	Variable	Question
Employees	Are Employees engagement in CSR principles?	INT_Empl_1	Would you say that employees are aware of the CSR principles?
		INT_Empl_2	Would you say that employees demonstrate engagement in CSR activities?
		INT_Empl_3	Would you say that employees are trained to apply CSR principles?
		INT_Empl_4	Would you say that employees demonstrate CSR principles understanding and interests?
Company's Strategy	Does the company' Strategic management reflect CSR principles?	INT_Str_5	Would you say that CSR principles are aligned with the company's strategy?
		INT_Str_6	Would you say that the company's strategy reflects any CSR application?
		INT_Str_7	Would you say that applying CSR principles strengthens the company's strategic decision?
		INT_Str_8	Would you say applying CSR principles will increase productivity and competitiveness?
Company's Structure	Is the company organized to support and capture CSR advantages?	INT_Org_Pro_9	Would you say that the company measures adequately its carbon footprint?
		INT_Org_Pro_10	Would you say that the company has sufficient time and competencies to implement CSR practices?
		INT_Org_Pro_11	Would you say that the company's IT system will support CSR principles application?
		INT_Org_Pro_12	Would you say that the company's global organization and processes are capable of supporting CSR practices?
		INT_Org_Pro_13	Would you say that CSR principles will improve productivity costs?
Owner Awareness	Is the owner aware? Does the owner	INT_Own_14	Would you say that you are fully aware of the CSR principles and objectives?
		INT_Own_15	Would you say that you promote CSR applications in your

	promote CSR?		company?
		<b>INT_Own_16</b>	Would you say that CSR principles and applications have its own merits?
		<b>INT_Own_17</b>	Would you say that you consult employees regarding CSR applications and challenges?
Competitive Advantage	Is CSR principles bringing value to the company?	<b>EXT_Comp_18</b>	Would you say that CSR principles will reinforce the company's market position?
		<b>EXT_Comp_19</b>	Would you say that CSR principles will give the company a reliable and stronger competitive advantage?
Business Opportunities	Is CSR principles helping to capture business opportunities?	<b>EXT_Buz_Opp_20</b>	Would you say that CSR principles will help to develop new business opportunities?
		<b>EXT_Buz_Opp_21</b>	Would you say that CSR principles will contribute to reach and capture new costumers?
		<b>EXT_Buz_Opp_22</b>	Would you say that CSR principles will help to enhance the company's quality of products/services?
		<b>EXT_Buz_Opp_23</b>	Would you say that CSR principles will help the company to develop business partnership?
Fundings issues	Is there enough support from the government?	<b>EXT_Fund_24</b>	Would you say that the government provides enough support to implement CSR practices and principles?
		<b>EXT_Fund_25</b>	Would you say that government/agencies provide enough support to implement CSR practices and principles?
		<b>EXT_Fund_26</b>	Would you say that government provides financial support to implement CSR practices and principles?
Incentives issues	Are incentives really attractive to implement CSR principles?	<b>EXT_Inc_27</b>	Would you say that government/agencies provide encouragement to develop and implement CSR principles?
		<b>EXT_Inc_28</b>	Would you say that Government Agencies provide enough incentives to implement CSR principles?
		<b>EXT_Inc_29</b>	Would you say that the Government Agencies communication strategies/actions are appropriate to help in applying CSR principles?

*Note: respondents could choose between 5 levels of agreement, from 1 (strongly disagree) to 5 (strongly agree)*

### **Anonymity**

No respondent or company was ever disclosed. Respondents were ensured that field notes, data and transcripts did not contain personal identifiers. Raw and processed data was locked, and password protected.

### **Informed consent**

To get informed consent from participants, trustful and reliable communication was established with participants. First, background information on the main researcher was provided. Furthermore, the aim and brief outline of the research was discussed and clarified. They were told the purpose of the questionnaire, how much time it should take to fill out and whether they wanted to receive the findings by email. They were told about the

general research schedule and planning.

## Confidentiality

Participants were told sensitive data would not be shared. Any other type of data would be shared with those who are part of the research team. Results were reported in a way that protects participants' identity and prevents tracking back their sources. To reassure respondents, they were informed of all procedures used to keep data safe and under control. Moreover, data collected was not used for any other purpose.

## Results

### Descriptive statistics

We begin the analysis of the data by examining the average of the responses to all the questions presented in Table 1. Figure 1 illustrates the overall averages across all statements, differentiating between internal and external factors. Lower values indicate disagreement with the statements, while higher values indicate agreement. Respondents displayed a higher level of disagreement with statements concerning internal factors, particularly regarding whether employees are trained to apply CSR principles and whether the company adequately measures its carbon footprint. This indicates gaps in terms of employees' awareness, strategy, company structure and processes, as well as the owner's awareness. On the other hand, the highest level of agreement was found in relation to statements concerning external factors, specifically whether Government Agencies provide enough incentives to implement CSR principles. The average of responses for external factors is significantly higher than the average for internal factors (2.23 on average compared to 1.82 on average;  $p$ -value  $< 0.00$  obtained from a paired t-test).

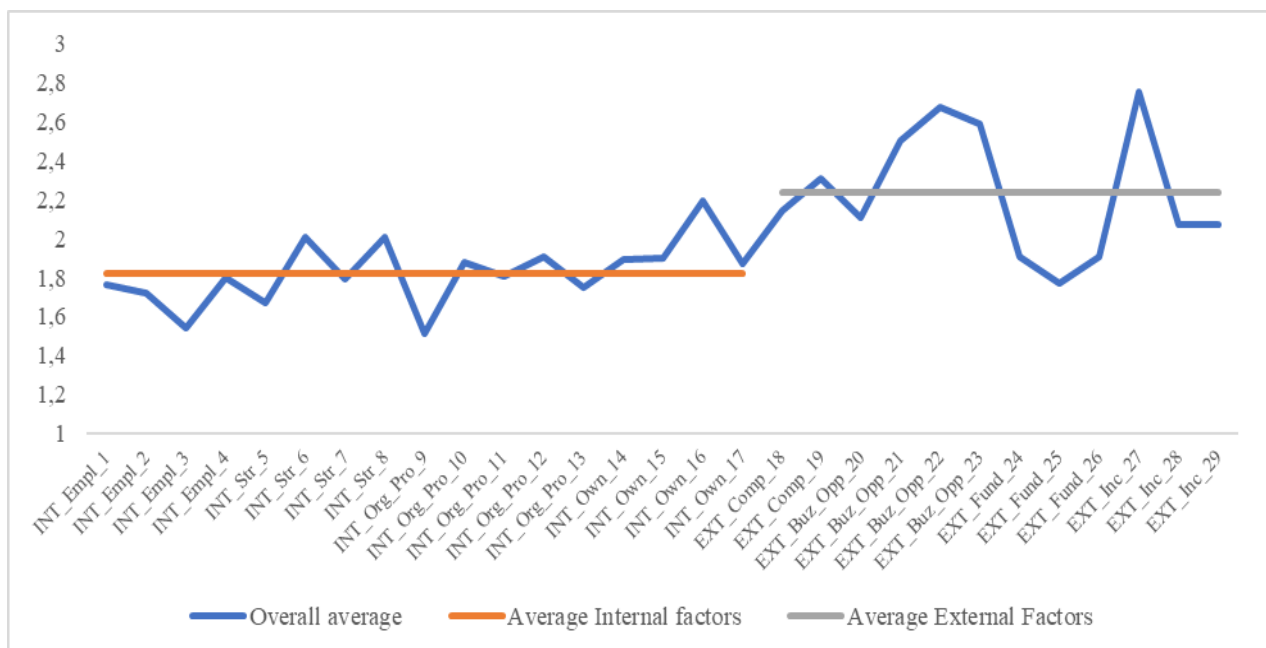


Figure 1: Average of answers to statements related to internal and external factors

Next, we examine whether there are significant differences in the importance of internal and external factors based on the size of the company (Figure 2), the sector in which it operates (Figure 3), and the number of years it has been in operation (Figure 4). The disparity in terms of company structure and processes becomes less pronounced when considering smaller companies. Very small companies tend to agree more that "the company's global organization and processes are capable of supporting CSR practices," while for small companies, external factors appear to be more important.

When assessing differences by sector, companies operating in the tertiary sector show a much stronger agreement with the statement that "government/agencies provide encouragement to develop and implement CSR principles." Examining differences by the number of years in operation, younger companies (in operation for up to 8 years) seem to agree more with statements related to business opportunities.

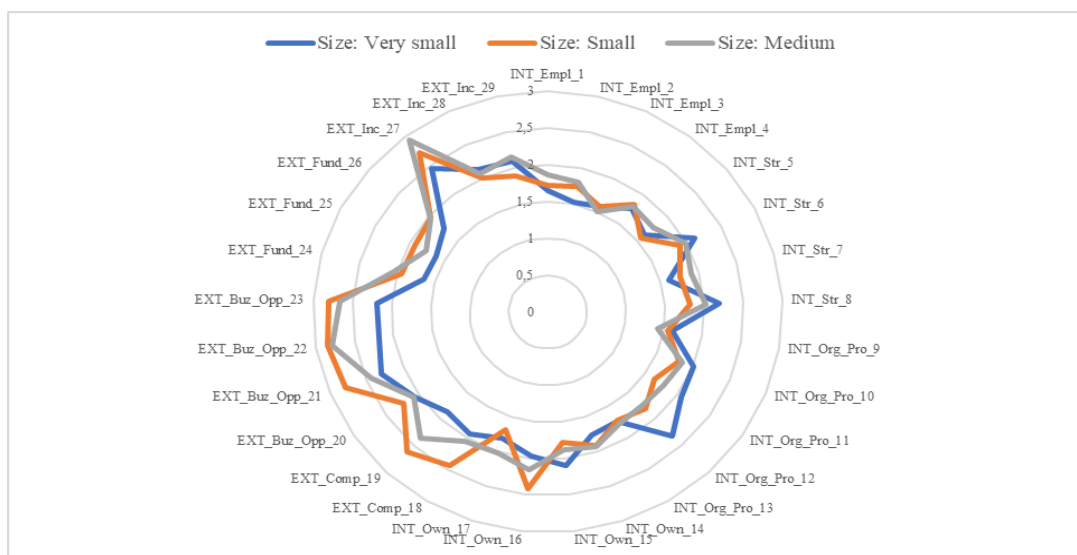


Figure 2: Average of answers to statements related to internal and external factors by size

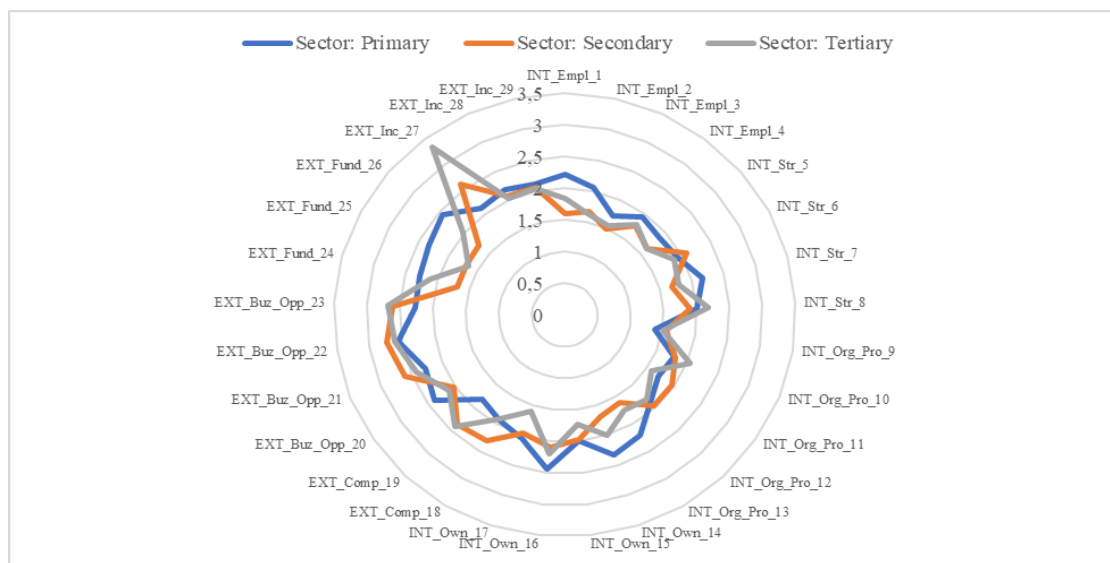


Figure 3: Average of answers to statements related to internal and external factors by sector

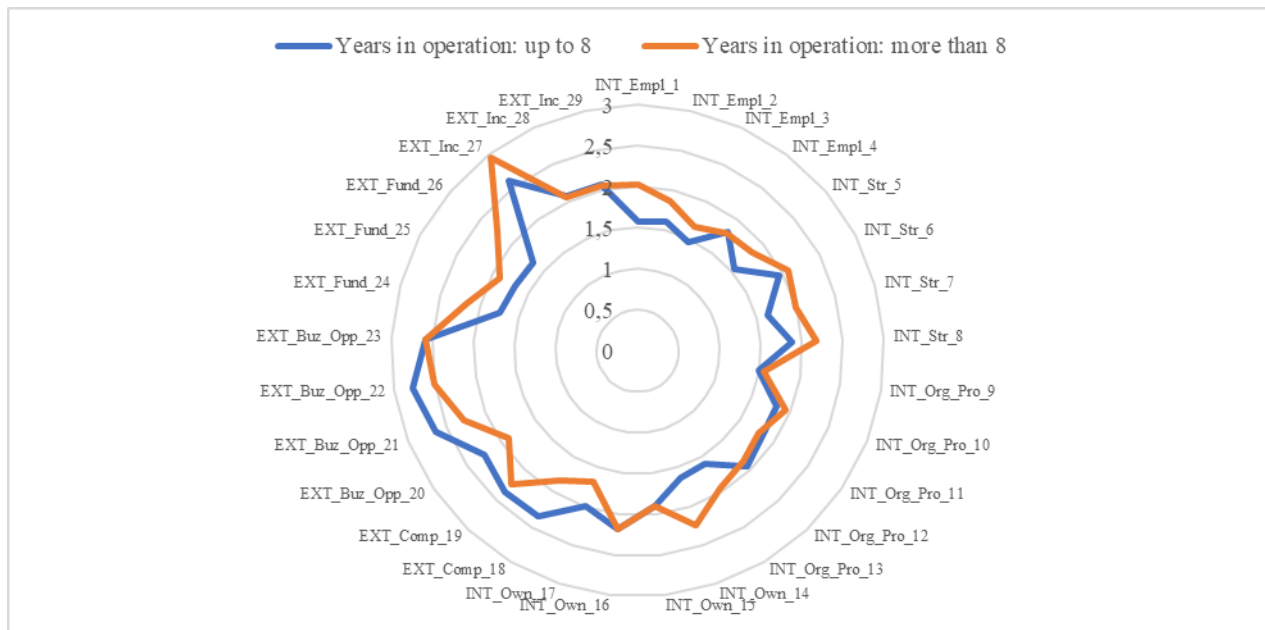


Figure 4: Average of answers to statements related to internal and external factors by years

### Factor analysis

We utilized factor analysis (Bartholomew et al. 2008) to derive the dimensions mentioned in Table 1. Subsequently, we calculated individual score factors for each dimension. The statements int\_empl1-int\_empl4 were employed to derive the dimension "employees," which indicates the extent to which respondents perceive employees' awareness of and engagement with CSR principles. Answers to the statements INT\_Str\_5-INT\_Str\_8 were utilized to derive the dimension "strategy," representing the alignment of the company's strategy with CSR principles.

Concerning the statements pertaining to the company's structure, we derived two factors to capture sufficient variance: Process\_time and Process\_measurement. The former was based on statements INT\_Org\_Pro\_10 and INT\_Org\_Pro\_12, while the latter was based on INT\_Org\_Pro\_9, INT\_Org\_Pro\_11, and INT\_Org\_Pro\_13. Finally, for the internal dimension "Owner," we employed the statements INT\_Own\_14-INT\_Own\_17. Individuals scoring higher on the Owner dimension agree that they are aware of the CSR objectives and promote them within the company, but they tend to not seek employee consultation on the matter.

Similarly, from the statements related to external factors, we extracted one dimension each for "Competitive advantage," "Opportunities," "Funding," and "Incentives." Those who score higher in terms of competitive advantage agree that CSR policies would strengthen the company's market position. Respondents with higher scores on the "Opportunities" dimension are more likely to agree that CSR will help the company capture business opportunities. Individuals scoring higher on the "Funding" dimension strongly believe that the government supports the implementation of CSR policies. On the other hand, "Incentives" refers to the extent to

which individuals believe government agencies provide sufficient incentives and have the appropriate communication strategy.

Table 2 presents the pairwise correlation coefficients between the score factors derived from the internal and external CSR dimensions. Individuals who score higher in terms of opportunities also score higher in terms of competitive advantage, showing a significant positive correlation of 0.74. Furthermore, those who score higher in terms of strategy also score higher in terms of employees' awareness (significant positive correlation of 0.60), funding (significant positive correlation of 0.63), and process measurement (significant positive correlation of 0.30). However, they exhibit a lower correlation with competitive advantage (significant negative correlation of -0.31), and there is no significant correlation with business opportunities. This indicates that, even among supporters of CSR policy implementation, the perceived impact in terms of competitive advantage is not seen as a driving factor.

Table 2. Correlation matrix between score factors of internal and external CSR dimensions

	Employee s	Strateg y	Process_tim e	Process_measur ement	Competitiv e advantage	Opportunitie s	Fundin g	Incentive s
Employees	1							
Strategy	<b>0.6012*</b>	1						
Process_time	-0.1366	-0.1364	1					
Process_measurement	<b>0.3018*</b>	<b>0.3000*</b>	-0.0269	1				
Owner	0.2205	<b>0.296*</b>	-0.093	-0.1394				
Competitive advantage	<b>-0.3192*</b>	<b>-0.251*</b>	-0.1688	<b>-0.2437*</b>	1			
Opportunities	-0.1152	-0.1485	-0.1721	<b>-0.2623*</b>	<b>0.7433*</b>	1		
Funding	<b>0.6383*</b>	<b>0.6514*</b>	-0.2009	<b>0.2525*</b>	<b>-0.2790*</b>	-0.0484	1	
Incentives	0.1701	0.0352	0.1369	0.0900	<b>-0.2712*</b>	-0.2167	-0.0023	1

We now inspect differences in score factors by groups of interest. Process time (i.e. having enough time and competencies to implement CSR policies) is significantly more important for very small companies; in addition, Competitive advantage and business opportunities are significantly more important for small companies (Table 3). We do not find a significantly greater awareness of employees in very small or small companies.

Table 3. Average score factors by company size

	Very Small	Small	Medium	ANOVA (P-Value)
Employees	-0.2	0.01	0.11	0.23

www.icres.net	May 18-21, 2023	Cappadocia, Turkiye	www.istes.org	
Strategy	-0.12	-0.09	0.13	0.18
Process_time	0.17	-0.06	-0.06	0.01
Process_measurement	0.1	-0.04	-0.03	0.32
Owner	-0.07	0.14	-0.05	0.28
Competitive advantage	-0.27	0.26	-0.2	0.00
Opportunities	-0.3	0.21	0.03	0.01
Funding	-0.26	0.1	0.08	0.14
Incentives	0.02	-0.05	-0.02	0.343
Sample size	31	36	56	/

When comparing averages score factors by sector (Table 4), additional insights emerge. Awareness of employees is significantly greater in companies operating in the primary sector. Significantly greater in this sector also the alignment in terms of strategy and funding. Awareness of employees is much lower among companies operating the secondary sector.

Table 4. Average score factors by sector

	Primary	Secondary	Tertiary	ANOVA (P-Value)
Employees	0.52	-0.13	-0.01	0.00
Strategy	0.33	-0.08	-0.02	0.08
Process_time	-0.04	-0.01	0.03	0.80
Process_measurement	0.06	0.02	-0.06	0.54
Owner	0.18	-0.12	0.13	0.05
Competitive advantage	-0.28	0.11	-0.05	0.06
Opportunities	-0.12	0.05	-0.02	0.66
Funding	0.68	-0.25	0.12	0.00
Incentives	0.03	0.00	0.01	0.88
Sample size	18	67	38	/

Next, we present in Table 5 the comparison of average score factors between younger companies (operating for up to 8 years) and older companies (operating for more than 8 years). Older companies exhibit significantly higher scores in the dimensions of employees, strategy, process measurement, owner, and funding. However, older companies find it more challenging to perceive business opportunities and competitive advantage arising from CSR adoption.

Table 5. Average score factors by year in operation

	Older company	Younger company	T-Test (P-Value)
Employees	0.26	-0.18	0.00
Strategy	0.22	-0.15	0.00



Process_time	0.006	-0.004	0.43
Process_measurement	0.06	-0.4	0.08
Owner	0.18	-0.13	0.00
Competitive advantage	-0.16	0.11	0.00
Opportunities	-0.15	0.10	0.02
Funding	0.36	-0.26	0.00
Incentives	-0.002	0.001	0.46
Sample size	51	72	/

## Discussion

The results indicate that globally, internal factors such as employees, owner's awareness, company strategy, and company structure appear to have a stronger influence in preventing the implementation of CSR principles. Moreover, it seems that internal factors have a more significant impact on preventing CSR implementation within small (revenues less than US 1M) and medium-sized companies (revenues less than US 17.5M) compared to very small companies (revenues less than US 300K). Very small companies, according to their owners, are more likely to be receptive to CSR principles. This difference may be attributed to the fact that very small companies are highly results-oriented and adopt a managerial approach directly influenced by their day-to-day operations. Additionally, as these companies generate less than 3 million dollars annually, their leaders may believe that adopting CSR principles provides an opportunity for improvement and capturing market value. Very small companies may also be more flexible in implementing the necessary changes and improvements to integrate CSR principles.

Surprisingly, a significant number of very small companies included in the research belong to the tertiary sector, encompassing activities such as commerce, transport, financial and real estate services, business and personal services, education, and social work. This finding suggests that owners of very small companies perceive CSR principles as likely and easier to implement, as they may not require substantial investments compared to sectors such as primary industries, which involve heavy machinery and complex production processes necessitating significant investments. The presence of sustainability principles in the vision of managers of very small companies highlights the strategic nature of CSR.

Interestingly, the factors influencing CSR practices do not depend on the nature of the company (primary, secondary, or tertiary). This observation aligns with Simpson's paradox, which states that the same phenomenon can occur within different groups but is reversed when the groups are combined.

On the contrary, it appears that the older a company is, the more it tends to blame external factors, specifically funding and incentive issues. It seems that older companies attribute the lack of financial support from the government to their challenges. This could be explained by the fact that older companies may have a solid and

reliable internal structure, while implementing changes may require substantial investments that these companies cannot undertake. For these owners, government support is necessary and seen as a precondition to implementing CSR principles. Another explanation could be that owners of older companies may have already tried to obtain financial support, but it was declined or companies simply gave up due to complex, bureaucratic, and time-consuming procedures.

In conclusion, the results of this first part of the discussion indicate that small or medium-sized companies, regardless of their sector and operating for less than 8 years, are more likely to attribute blame to internal factors. Paradoxically, very small companies that blame internal factors tend to be more prevalent in the tertiary sector. These findings suggest that if the Moroccan government aims to address CSR implementation challenges, it should take into account the company's sector and age.

Older companies (more than 8 years in business) are characterized by significantly higher scores in the dimensions of employees, strategy, and process measurement. This indicates that, first, older companies have more difficulties in perceiving business opportunities and competitive advantages stemming from CSR adoption. Second, their employees, strategy, and internal processes and procedures are not significant obstacles to CSR implementation from the owner's point of view. As a result, the Moroccan government should promote CSR principles to companies that have been in operation for more than 8 years by emphasizing the benefits and competitiveness that come with it. Morocco has recently experienced a breakthrough in the field of corporate social responsibility with the obligation for companies listed on the Casablanca Stock Exchange to include an ESG chapter (environmental, social, and governance) in their annual reports. However, this may not be enough to encourage companies to improve their CSR effectiveness, especially considering that most listed companies belong to the 8+ age tier and are of medium size. Despite the Moroccan government and agencies promoting CSR as a vector for the sustainability of a company's activity in the medium and long term, and its impact on managerial strategy in terms of risk anticipation, efficiency improvement, and cost optimization, the results show that older and established companies are more concerned about the extent to which CSR effectively contributes to competitiveness and return on investments.

On the other hand, paradoxically, competitive advantage and business opportunities are significantly more important for small companies than for medium-sized ones. Combining the previous finding with this one, it suggests that small companies (with revenues between US \$300K and US \$1M) that have been in business for less than 8 years see CSR as a source of competitive advantage and business opportunities. For the Moroccan government, this result indicates that officials should tailor their approach to convince companies to adopt CSR principles by shaping their communication strategy and support, taking into consideration not only the size of the company but also the sector and the number of years in the market. It may be challenging for the government to segment the market based on these variables, but the results show that concerns significantly differ across sectors and company sizes. Additionally, the variable "process time" (having enough time and competencies to implement CSR policies) is significantly more important for very small companies. It appears that very small companies are either prepared to make the necessary changes in their practices to align with CSR

principles or they already possess the necessary competencies to adapt to CSR. Once again, promoting CSR principles among small and medium-sized enterprises (SMEs) to help them adopt these practices depends on multiple variables and requires a thorough and nuanced analysis by the government and public agencies responsible for CSR implementation nationwide.

### **Limitation**

One of the major limitations of this research lies in the relatively small size of the population, considering that 98% of companies in Morocco are SMEs. Moreover, it is unclear to what extent participants genuinely responded to the questionnaire and whether some owners fully understood the questions, as some of them may be illiterate or have a limited understanding of the French language. Another limitation could be the geographical scope, as this study only covers three regions of the country, albeit the most economically active ones. There are several other cities and economic clusters that could be studied and analyzed for a more comprehensive understanding.

### **Conclusion**

CSR is the contribution of companies to the challenges of sustainable development. A company that practices CSR will, therefore, seek to have a positive impact on society while being economically viable. The orientation of the Kingdom of Morocco towards sustainable development is reflected in the text and the spirit of its 2011 constitution. Indeed, the constitution assigns to the state the mission of working towards the achievement of sustainable human development, social justice, and the preservation of national natural resources and the rights of future generations. CSR remains a voluntary and structured approach that allows companies to be part of the sustainable development objectives and work towards their achievement. Each company can, according to its own means, participate in the achievement of CSR objectives.

However, this research shows that CSR adoption by SMEs in the country faces a number of obstacles. These include internal factors such as resources, competencies, shareholders' awareness, and companies' strategy, as well as external factors like government leadership communication to promote and support CSR. The findings indicate that government actions to help CSR development within SMEs should be tailored to the nature, sector, and age of these companies.

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## Project-Based Learning: Teachers' Perception & Learners' Preparedness

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**Abstract:** Earlier at the ICRES 2022 we discussed readiness of teachers of the Chemistry Faculty of the Karaganda Buketov University for the student-centered learning approach lately implemented at the Kazakhstani universities. In particular, we studied the progress made by academic staff in mastering interactive lecturing, case-study, problem-based learning etc. In this study we focus on project-based learning (PBL) and reveal teachers' perceptions regarding the method benefits and challenges as well as preparedness for learning by doing from students' perspective. Academic staff of four Departments as well as students and Master students admitted in such educational programs as "Chemistry", "Chemistry-Biology" and "Pharmaceutical Manufacturing Engineering" were involved in our study. These educational programs train both future teachers and technologists. It was crucial to analyze how both undergraduates and postgraduates of different training programs evaluate the project method efficiency in mastering knowledge in chemical disciplines. Surveys of educators and learners were conducted. The collected data was processed and analyzed. The research results show that the academic staff and learners of the Faculty of Chemistry understand PBL from both positive and negative perspectives. The findings can be beneficial for teachers and students, as they will help them to reflect on their own practice in this educational strategy. There has been demonstrated the need for further research in this direction to better understand teachers' and learners' demands in order to improve the method application at the universities in Kazakhstan.



**Keywords:** Project-Based Learning, Benefits, Challenges, Teachers, Learners

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## Introduction

New challenges in education require teachers to use new ways of learning and teaching. Universities in Kazakhstan replace traditional academic strategies of passive learning by student-centered learning. Our previous research focused on the teachers' methodological readiness for student-centered learning and challenges associated with its implementation (Minayeva Ye. et al., 2022). We also discussed the effectiveness of the student-centered learning approach for students' achievement in universities in Kazakhstan (Sugralina L. et al., 2017).

Project-based learning (PBL) is known as an effective student-centered learning method with the variety of benefits for students despite some difficulties for learners and challenges for educators. PBL is a teaching method that is engaging and motivating (Bell, 2010). It is a learner-driven, customized, and collaborative learning system that leads to transformational learning. Implementation of PBL has contributed to increases in students' retention of concepts, engagement, and academic success (Harrigan, 2014). PBL has the ability to enhance students' learning (Jones, 2007), engage students on a deeper cognitive level than traditional teaching methods. For some teachers and students, PBL is more effective than traditional teaching methods because different learning styles or multiple intelligences are intertwined in the learning strategy (Filippatou & Kaldi, 2010).

There are several positive reasons for integrating PBL in the practical classes. However, researchers have found that some teachers are reluctant to integrate PBL into the classroom. Major challenges for using PBL are time, effort, fairness, assessment, lack of resources, and control (Wirkala & Kuhn, 2011). Some educators find becoming a facilitator a challenge. They feel uncomfortable or even resist letting go of their control (Mitchell et al., 2009). To date, such disputes on PBL have been based mostly on international experience, and there is a lack of research discussing the situation at Kazakhstani universities. It remains unclear how teachers in Kazakhstan implement PBL, and what benefits and challenges of using PBL they identify. At the same time, it is necessary to investigate students' preparedness for learning by doing. Therefore, this study attempts to fill the research gap about the application of PBL in Kazakhstan. This paper aims to reveal the perception of teachers of the Chemistry Faculty of the Karaganda Buketov University towards the PBL approach and discuss students' preparedness to it.

## Method

This is case study research that was conducted to determine faculty perceptions regarding the implementation of PBL, as well as students' readiness to learn in practice. The setting of the study is the Chemistry Faculty of the Karaganda Buketov University. In order to determine teachers' perceptions regarding problems and benefits of PBL implementation, we conducted a survey of the Chemistry Faculty teaching staff in 2022-2023 academic year. We developed our own questionnaire in two training languages, which included 11 closed and open-ended questions. A total of 31 teachers that was 52% of academic staff took part in the survey. A questionnaire for students and master students included 9 questions. A total of 93 students and master students of the Chemistry Faculty took part in the survey. Questionnaires of the teaching staff, students and master students were subjected to subsequent analysis of the data obtained.

## Results

### Information about respondents among teachers

Most of the respondents among teachers, namely 91% have an academic degree. Teachers with teaching experience from 15 to 19 years comprised the largest number of respondents, namely 26%. Representatives of all four departments of the Chemistry Faculty took part in the survey. Teachers of the Department of Organic Chemistry and Polymers were the most active ones (15 persons or 48 %). At the same time, teachers in the position of associate professor showed the greatest activity.

### Teachers' proficiency in PBL

According to the survey results, 77% of academic staff consider themselves PBL proficient and 7% are unsure of their PBL proficiency. At the same time, 16% of respondents among teachers had difficulty answering this question. As regards the periodicity of using PBL in the teaching process, a total of 13 % of academic staff apply this approach consistently, whereas a total of 13% do not apply it in the instructional process. The majority of teachers, namely 74% of respondents use PBL occasionally.

### Self-Evaluation of methodological preparedness for PBL practical implementation

In order to assess the methodological readiness of teachers to implement PBL in practice, chemistry faculty members were asked to rate it on a 0-5 scale. The results are summarized in Table 1.

Table 1. Self-Evaluation of methodological preparedness for the PBL practical implementation

Evaluation from 0 to 5-point scale	Percentage, %
0	3
1	0

2	6
3	39
4	29
5	23

As can be seen from the table a total of 23% of respondents confidently implement PBL.

### The main incentive for teachers to use PBL in teaching/learning process

Among the significant incentives for using PBL in the instructional process, educators cited a desire to increase students' mental alertness and creativity. Other important incentives for using PBL in the teaching/learning process are listed in Table 2.

Table 2. The main incentives for using PBL in the educational process

Incentive	Number of respondents, persons	Percentage, %
Desire to enhance the students' mental activity and creative potential	25	81
Desire to comply with modern trends in education	10	32
Need for continuous improvement of students training	9	29
Need for a successful open session	4	13

### Benefits in the application of PBL in the teachers' practice

In order to discuss the benefits of using PBL in faculty practice, academic staff were asked to highlight a number of benefits of the PBL approach. Faculty responses are shown in Table 3. Respondents could select several options in the response box.

Table 3. Benefits in the application of PBL in the teachers' practice

Benefits	Number of respondents, persons	Percentage, %
Achieving a better understanding by students of what they are doing and why	20	64
Development of critical thinking and creativity in students	16	52
Achieving greater student activity in acquiring knowledge and skills	12	39
Continuous professional development of academic staff	6	19

### Problems which teachers face when implementing a PBL approach

Teachers were also asked to describe problems encountered when implementing PBL in teaching. Teachers' responses are summarized in Table 4. They were able to select several options.

Table 4. Problems which teachers face when implementing a PBL approach

Problems	Number of respondents, persons	Percentage, %
Students' unwillingness to take responsibility for managing projects; activities in the classroom and outside the classroom	18	58
Uneven assimilation of knowledge by students	15	48
Preparing for classes requires more teachers' time	10	32
Difficulty in assessing students' academic achievements	5	16
Noise in the classroom and chaotic organization of the learning space	2	6

### Ways to solve problems arising from the implementation of PBL

To overcome problems associated with the PBL approach implementation, teachers suggested several ideas which are given in Table 5. Teachers could choose several options from the list.

Table 5. Ways to solve problems arising from the PBL implementation

Ways to overcome problems associated with PBL	Number of respondents, persons	Percentage, %
Phased implementation of PBL	13	42
Informing students about the ideas behind PBL	11	35
Methodological assistance to teachers for the implementation of educational innovations from the Faculty and the University	11	35
Application of various forms of stimulating students to independent learning activities	10	32
Giving students enough time to learn at their own pace and empowering learners as mentors to peers	10	32
Comprehensive support for the best experience in teaching for implementation of PBL approaches	6	19

### Information about students

Most of the respondents among students, namely 91% were undergraduate students and 9% were master students. Representatives of first, second, third and fourth year of study took part in the survey. Students of the second and third year of study were the most active. At the same time, undergraduate students and graduate students admitted in such educational programs as “Chemistry”, “Chemistry-Biology” and “Pharmaceutical Manufacturing Engineering” were involved in our study. These educational programs train both future teachers and technologists.

### Practical experience of students in PBL

In this part of the survey, students were asked if they were familiar with PBL. The vast majority of learners (54%) responded that they knew what the PBL approach was, while 34% of respondents were unaware of the method. In addition, students were asked if they had any experience with assignments in the form of project work. A total of 52% of students had completed assignments in the form of a project, while 40% had not.

### Evaluation of PBL effectiveness by students

Students were asked to rate on a 5-point scale how effective their learning was with the PBL approach. The results are shown in Table 6.

Table 6. Evaluation of PBL effectiveness by students

Evaluation from 0 to 5 point scale	Percentage, %
0	16
1	1
2	7
3	14
4	26
5	36

### Self-assessment of student readiness for PBL

Students were asked to self-assess their readiness for PBL assignments on a scale of 0-5 points. The results are presented in Table 7.

Table 7. Self-assessment of students' readiness for PBL assignments

Evaluation from 0 to 5 point scale	Percentage, %
0	18

1	4
2	4
3	20
4	16
5	38

### Self-assessment of student interest in doing PBL

In this part of the survey, students were asked to rate on a five-point scale their interest in completing project assignments in the future. The students' responses are shown in Table 8.

Table 8. Self-assessment of student interest in PBL assignments

Evaluation from 0 to 5 point scale	Percentage, %
0	8
1	0
2	4
3	22
4	22
5	44

### Problems students encountered when completing PBL assignments

Students were also asked to discuss problems they had encountered with PBL assignments. When answering this question, students could select several options in the answer box. The results are given in Table 9.

Table 9. Problems students encountered when completing PBL assignments

Problems	Number of respondents, persons	Percentage, %
You had to study a large amount of additional scientific and educational literature	44	47
It took you a long time to prepare	40	43
You have had difficulty interacting with other team members	20	21
Lack of incentives for independent learning activities	15	16
An increased level of responsibility in carrying out independent work in the form of a project	8	9

## Discussion

To begin, we wanted to find out how well teachers of the Chemistry Faculty are familiar with the PBL approach and how often they apply it in their teaching practice. According to the survey results, most of the teachers surveyed, namely 77% consider themselves to be proficient in PBL, while 7% were not confident about their proficiency in PBL. At the same time, 16% of educators had difficulty answering this question. Regarding the frequency with which project-based learning is used in the classroom, 13% of educators use the approach all the time, while 74% of respondents use it occasionally. A total of 13% of teachers do not use this approach in the teaching process at all.

At the same time, 23% of teachers evaluated their methodological preparedness for the maximum score on a 5-point system, while 39% of teachers, a majority, rated their readiness as a 3-point score. One respondent (3%) of the academic staff stated a complete lack of practical skills in PBL. In addition, among the most important incentives for the PBL approach implementation in the educational process, teachers named the desire to enhance the students' mental activity and creative potential as well as desire to comply with modern trends in education.

In order to explore the attitudes of teachers of the Chemistry Faculty to the PBL approach, we asked them to highlight a number of benefits and discuss problems associated with the PBL implementation into the teaching/learning process. Teachers mentioned the following benefits of a PBL approach:

- Achieving a better understanding by students of what they are doing and why – 20 respondents (65%);
- Development of critical thinking and creativity in students – 16 respondents (51%);
- Achieving greater student activity in acquiring knowledge and skills – 12 respondents (39%).

As regards problems which teachers face when implementing a PBL approach, it is worth to mention the following ones:

- Students' unwillingness to take responsibility for managing projects; activities in the classroom and outside the classroom - 18 respondents (58%);
- Uneven assimilation of knowledge by students - 15 persons (48%);
- Preparing for classes requires more teachers' time – 10 respondents (32%).

To overcome problems associated with the PBL approach implementation, teachers suggested phased implementation of PBL, informing students about the ideas behind PBL, as well as methodological assistance to teachers for the implementation of educational innovations from the Faculty and the University.

Turning to undergraduate and graduate students surveyed, the majority of students (54%) responded that they were familiar with the PBL approach, while 34% of respondents knew nothing about the method. In addition, undergraduate and graduate students were asked if they had any experience with assignments in the form of

project work. A total of 52% of students had completed assignments in the form of a project, while 40% of students had not. These results indicate that the Academic Council of the Chemistry Faculty should look at how to promote the PBL approach in the department and engage students in project-based activities.

Students also assessed how effective their learning was with the PBL approach. The results showed that 36% of respondents considered PBL to be a very effective method, while 16% of students surveyed considered the method ineffective. Students were asked to rate their readiness to perform PBL assignments on a 0-5 scale. A complete lack of practical PBL skills was reported by 18% of the students surveyed, while 38% of respondents were prepared to complete PBL assignments. Students rated on a 5-point scale their interest in completing project assignments in the future. It appeared that 40 students (44%) were confidently interested in doing PBL work in the future, while 7 respondents (8%) stated a complete lack of interest in PBL.

Students also noted that they encountered a number of problems while completing PBL assignments. Learners noted that they had to study a lot of additional scientific and scholarly literature; they needed a lot of time to prepare; and they had difficulty interacting with other team members. Looking for recommendations to improve the practice of the PBL approach in the department, students suggested improving the material conditions for practical assignments in the project method and finding more topics for project work. Surprisingly, the students surveyed chose to work on projects independently rather than in teams.

The results were discussed at the Academic Council of the Faculty of Chemistry. A number of recommendations were developed to improve the practice of using PBL at the Faculty of Chemistry. The obtained results can be useful for teachers and students, as they will help them to think about their own practice of applying this educational strategy. As a result of the case study research, the need for further investigation in this direction was identified in order to better understand the needs of teachers and students and to promote the application of the method in universities in Kazakhstan.

## Conclusion

A total of 77% of the surveyed academic staff of the Chemistry Faculty are confident in PBL, although 74% of teachers use the approach occasionally in their teaching. Only 13% of respondent teachers use this method consistently in their teaching, and 13% of teachers do not use it at all. A total of 38% of students are confidently prepared to do PBL work. A complete lack of practical skills in PBL was reported by 18% of students. PBL is considered an effective tool because it provides students with the opportunity to learn through project activities, although this approach is time-consuming for both teachers and students. Problems with group work and cases of unequal contributions to the course of group work are also mentioned. Reported benefits include: increased engagement and motivation to learn, skill development, collaborative learning environment, and improved academic performance. Students also find PBL to be a method that promotes a better understanding of course content through a hands-on approach. It is important that students enjoy the class and are engaged in the



learning process. The findings can be beneficial for teachers and students, as they will help them to reflect on their own practice in PBL.

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## A Hybrid MCDM Model for Roles Selection in Supporting Talent Development Intervention Programme in Malaysia Public Higher Education Institution

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**Abstract:** The process of retaining leadership succession at higher education institutions (HEI) is crucial since it has entailed the process of selecting the ideal candidate. The goal is to guide universities toward maintaining organizations' excellence for their academic leadership and management (ALM) position. Due to the lack of established standards for assessing the competency of possible successors at their home institutions, many ALM of Malaysia HEIs are difficult to identify the proper replacement for their posts. This study aims to propose a multi criteria tacit knowledge acquisition framework (MC-TKAF) for supporting talent development intervention program in Malaysia HEIs. It will be based on cognitive apprenticeship, socialization and informal learning theory which mostly used in acquiring knowledge from expertise to overcome talent bottleneck among novice. Fuzzy Delphi will be used as the primary methodology in this study to gather agreement regarding the appropriate indicator to measure tacit knowledge competency among ALM at Malaysian HEIs. There are three phases: Phase 1 involves analyzing the current tacit knowledge acquisition (TKA) and identifying the appropriate parameters to build the intended framework. Phase 2 involves using the results of Phase 1 to create a new framework of tacit knowledge acquisition (TKAF) that is appropriate for the HEI environment. Phase 3's final objective is to assess the viability of the Talent Development Intervention Program's (TDIP) Tacit Knowledge Acquisition Framework (TKAF) utilising the Multi Criteria Decision Making (MCDM) approach. This paper's goal is to offer the hybrid MCDM approach as a talent performance indicator for the multi-criteria tacit acquisition framework. The final Phase 3 of the study design will essentially be the subject of this paper. The built-in indicators in this document may be utilised as a guide for the HEI sectors to create talent performance metrics that are appropriate for each TKA applied.

**Keywords:** Hybrid, MCDM, MC-TKAF, HEI, TDIP

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## Introduction

Succession planning and executive transition management have emerged as pressing issues in today's universities and colleges. (Ku, Akmal, & Kamil, 2016; Varhegyi & Denise, 2017). These issues are a direct outcome of the retirement or death of prominent academics in the past. Most of them are from the baby boomer age and will retire and leave the business at some point. Proven abilities and knowledge in academic leadership and management (ALM) at HEIs may benefit the entire institution, not just their assigned departments. Some people in most organizations still don't understand the processes behind the development of intellectual capital and the sharing of tacit knowledge among workers..(do Rosário, Kipper, Frozza, & Mariani, 2015).

For some reason, nevertheless, the ingrained expertise and knowledge of ALM's forerunner cannot be shaped by a targeted acquisition formulation. The transfer of tacit information can be more successful and, in some cases, saved if the underlying cause is identified and addressed through the selection of an appropriate transfer channel. Lack of efficient evaluation of tacit knowledge acquisition, which should be incorporated in the HEI environment as an interpersonal accelerator in Talent Development Intervention (TDI) Program., is a contributing element to this situation. (Khalid, 2019)

In Malaysian HEIs, rules have been established to ensure that faculty members' work is evaluated not just in terms of academic success, but also in terms of their ability and potential, with the goal of fostering growth through an appropriate talent development intervention programme. Academic staff selection at universities and colleges refers to the practise of hiring qualified individuals for teaching and other academic positions A few studies (Khalid, 2019; Matoskova et al., 2013) demonstrate that academics who are picked underwent explicit evaluations, including qualification, experience, and research activities, in the selection process. Academics are not evaluated when they participate in talent development programmes at their university.

## Literature Review

### Selection Process Scenario For ALM Roles in Malaysia HEI

According to Orange Book (Ministry of Education Malaysia (MoE), 2016), in Malaysia, only 9% of faculty at public universities considered themselves to be transformational leaders. That's fewer than the predicted ratios that would have been required in (Ministry of Education Malaysia (MoE), 2016) which is ten (10%) to twenty percent (20%) of faculty members should be qualified to serve as ALMs. The study's readiness factor for several types of professional paths shows that schools of higher education are not yet prepared for these options.

There will be fewer qualified candidates for ALM positions if proactive measures are not taken to intervene in the selection and development of potential candidates at the appropriate time. Having access to a pool of qualified candidates for available ALM roles in HEI is crucial for making important personnel decisions including recruiting, firing, and evaluating employee performance. Both assessments are often done

independently. Both of these situations need for a trustworthy system to evaluate skill and experience levels. The term talent excellence refers to a community of academicians who are inspiring educators, accomplished researchers, entrepreneurial personalities, and transformative thought leaders. These are committed individuals who strive ceaselessly to raise quality standards, embrace professional development, instigate innovative teaching and learning, and excel in research and innovation. They are supported by well-trained, dedicated, and qualified administrative, technical, and support personnel. This academic community will enhance the international stature of the institutions it serves. Institutions are able to consistently recruit high-quality international students, faculty, funding, and research grants due to their global prominence.

The significance of an academic leader's talent development role is comparable to his or her teaching and research duties. Each academic leader is responsible for fostering the character and skills of their students, motivating them on a personal and professional level, and ensuring that their knowledge, skills, and resources are fully utilised and developed. It is their institutional duty to cultivate a pool of academic leaders who will continue to fuel development and enhance the quality of Malaysian HLIs in order to produce exceptional academic outcomes. Each academic administrator is also obligated to cultivate exceptional Malaysians capable of advancing the nation's mission and Vision 2020 objectives. Thus, there is currently no established methodology for evaluating the tacit knowledge competency that academics insist upon possessing in order to function effectively as academic leaders or managers. In the next section, we'll discuss in greater depth the reasoning behind this proposed model: The next section will presents the Multi-Criteria Model for the Acquisition of Tacit Knowledge.

### **Multi Criteria Tacit Knowledge Acquisition Framework (MC-TKAF)**

Competency is one of the required elements in evaluating potential ALM in an academic setting background such as managerial competence (Potgieter, Basson, & Coetzee, 2011) and leadership competence (Scott, Coates, & Anderson, 2008a). However, the skill and experience can only be gained from the process of acquisition and elicitation (Yau'Mee Hayati Hj Mohamed Yusof, Ruzaini, & Awanis, 2019) which is known as the tacit knowledge competence. Assessing tacit evaluation is crucial for establishing the level of tacit knowledge competence in novices, but it requires the use of intuition, judgement, and emotion. More thought needs to go into this kind of evaluation. However, this is the type of assessment that is most likely to measure how successfully employees apply tacit knowledge in their work.

We propose a method based on five theoretical frameworks for selecting the most appropriate indicator of ALM applicants' progress in developing tacit knowledge. Table 1 provides explanations of the terms used in Cognitive Apprenticeship Model (CAM), Socialization: SECI, Informal Learning, Self-Efficacy Theory, and Dreyfus Model. The elaboration about this framework was explained in details in (Yau'Mee Hayati Hj Mohamed Yusof et al., 2019). The next section will discuss on the method that was used to verify the criteria to evaluate proposed model by using Fuzzy Delphi Method in next section.

Table 4. MC-TKAF Underlying Theory

Author	Theory/Model	Parameter
(Collins, Brown, & Holum, 1991)	Apprenticeship (CAM)	Coaching
(Nonaka & Toyama, 2003)	Socialization (SECI)	Mentoring Job rotation
(Kirkpatrick & Kirkpatrick, 2009)	Informal Learning	On Job Training (OJT)
(Dreyfus, 2004)	Expertise	Novice Advanced beginner Competent Proficient Expert
(Bandura, 1998)	Self-Efficacy	Cognitive Motivational Affective Selection

### Fuzzy Delphi Method (FDM)

The idea of traditional Delphi, which takes a lot of time, has been given a new twist. (Ishikawa et al., 1993) to avoid flaws like repeated surveys of experts, which are expensive and lead to a lower answer rate, especially if the survey is hard. According to (Ishikawa et al., 1993), as it is proposed, the Fuzzy Delph Method has the advantage of reducing: 1) Fuzziness, which is always present in the results; 2) the number of surveys; 3) the semantic structure of forecast items is made clear; and 4) the individual characteristics of the expert (forecaster) are made clear. The change is made to fix the flaws in the standard Delphi Method (DM), which lead to low agreement on the results, the loss of important information, and a slow investigation.(Saffie, Amirah Nur', & Rasmani, 2016).

Because this study can be done in many different ways, the FDM has been used as one of the tools to check the criteria to find expert agreement. The criteria that have been picked for this MCTKAF by experts through consensus are explained in this (Yau'Mee Hayati Hj Mohamed Yusof, Arshah, & Romli, 2020a). Figure 1 depicts the selection tree for selecting the consensus view. The following section will discuss the MCDM techniques selected for this study.

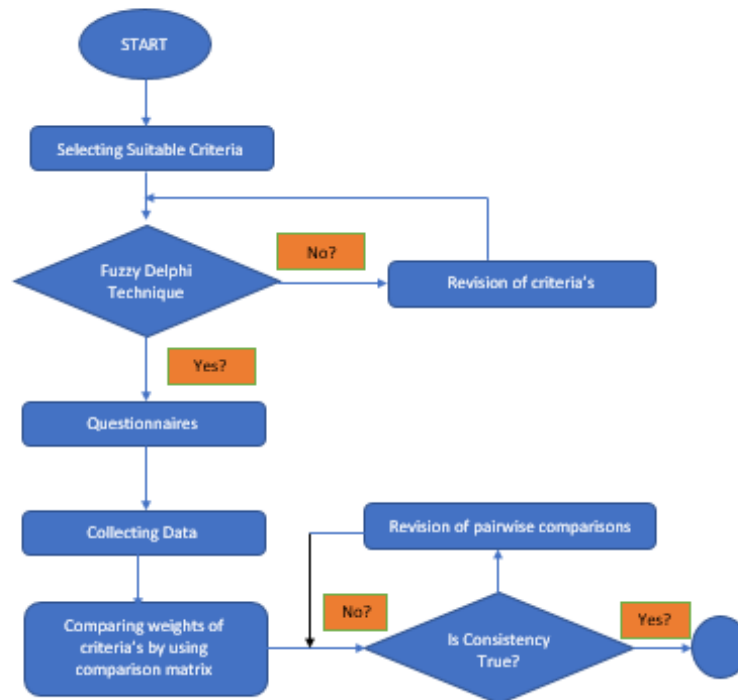


Figure 15. Fuzzy Delphi Method

### Hybrid MCDM

The method of multi-criteria decision-making (MCDM) addresses the decision-making process in relation to multiple objectives. A decision-maker (DM) must select from numerous quantifiable or non-quantifiable criteria. One of the primary goals of MCDM is to assist DMs in integrating objective measurements with value judgements that are not dependent on the perspective of individuals but on collective thoughts. (Aruldoss, Lakshmi, & Venkatesan, 2013). This method provides powerful decision-making in areas where the best option is extremely complicated (Aruldoss et al., 2013). Generally, the objectives are incompatible, so the solution must be a compromise based on the preferences of the decision-maker. There are numerous situations in which weighing contending factors prior to making a decision is necessary. In MCDM models, a decision-maker must typically rank and select from a finite number of options. Frequently, it is also necessary to weight a limited number of criteria according to their relative importance. As demonstrated in Table 2, MCDM techniques have been utilised in a range of human selection applications to determine the optimal course of action. This study's primary objective is to apply MCDM as a talent performance indicator for selecting academic administration positions for aspiring academics. Several authors (Afshari, Mojahed, & Yusuff, 2010; Kolios, Mytilinou, Lozano-Minguez, & Salonitis, 2016; Mimi, Alias, & Abdullah, 2017) have discussed each method in MCDM which has different kind of formulas and objective to be fulfilled based on the areas needs as illustrated in Table 2. Due to many methods in MCDM, researchers make list of criteria to choose which one is the best to be used

according to area of application. According to (Eldrandaly, Ahmed, & AbdelAziz, 2009), different MCDM strategies are suited to various decision circumstances. AHP is recommended, for instance, when individuals cannot quantify their preferences for various criteria and alternatives. Numerous inexperienced users have difficulty determining which MCDM technique is most appropriate for their particular decision situation.

Table 5. MCDM Approach in Personal Selection as Academician

Area/Applications	Criteria	Source of Criteria's	SAW	TOPSIS	ELECTRE	CFPR	AHP
<b>Finding the Right Personnel in Academic Institutions</b>	Qualification Marks Experience in years Salary Expectation Ability handle different subject Research Activities Technical Skill Presentation/Communication Skill	NONE	(Kumar, Radhika, & Suman, 2013)	(Kumar et al., 2013)			(Kumar et al., 2013)
<b>Academic Staff Selection</b>	Individual Factor Academic Factor Work Faculty	NONE			(Rouyende		
<b>Evaluation of Personnel Selection Criteria Using Consistent Fuzzy Preference Relations</b>	Activity Fee Education Internal Factors Business Factors	NONE				(Ozdemir, Nalbant, & Basligil,	
<b>Academic staff promotion in higher education by using Analytic Hierarchy Process (AHP)</b>	Teaching and Supervision Research and Publication Administration and Management Professional Contribution to Society Scholarly Recognition	NONE					

<b>Fuzzy</b>	Personal and Interpersonal	(Scott, Coates, & Anderson, 2000)							(Jantan, Yusof, & Ishak, 2019)
<b>Analytic</b>	Outcomes								
<b>Hierarchy</b>	Learning and Teaching Out-								
<b>Process for</b>	comes								
<b>Multi-criteria</b>	Recognition and Reputation								
<b>Academic</b>	Financial Performance								
<b>Successor</b>	Effective Implementation								
<b>Selection.</b>									

For example in the study done by (Kolios et al., 2016) in area of real estate and land management, they used seven (7) methods such as (ELECTRE), (MAUT), (ANP), (MACBETH), (AHP), (TOPSIS), (PROMETHEE) and four (4) criteria of choosing MCDM method that is suitable for the proposed model. Another study (Aruldoss et al., 2013) also comes with numerous methods and criteria such fuzzy TOPSIS, fuzzy VIKOR, and fuzzy GRA for evaluation on urban mobility projects. As proposed by (Aruldoss et al., 2013), the best alternative method can also use the veto rule to select. In other word, the alternative(s) that the majority of methods rank the highest will lastly be selected. The summary can be seen from Table 3.

Hybrid MCDM is widely used by many researcher in order to find the best solution in their prospect (Alguliyev, Aliguliyev, & Mahmudova, 2015; Chatterjee, Zavadskas, Tamošaitiene, Adhikary, & Kar, 2018; Dahooie, Abadi, Vanaki, & Firoozfar, 2018; Sitorus & Brito-Parada, 2020). For example in (Şenel, Şenel, & Aydemir, 2018), compared to the ELECTRE approach, the TOPSIS method provides more accurate and trustworthy findings in personnel selection. Comparison between MCDM method also been used in (Zhou, Wang, Lim, He, & Li, 2018) pertaining to the proposed hybrid fuzzy The DEMATEL-AEW-FVIKOR method demonstrates its flexibility with regard to the decision-maker's preference. Six techniques of MCDM, SAW, WPM, AHP, TOPSIS, CFPR, and ELECTRE, have been discovered to solve the nature of the MC TKAF, as shown in Table 4. As shown in Table 4, each MCDM technique has its own set of formulations and objectives based on the requirements of the various regions. Since there are numerous MCDM approaches, researchers compile a list of parameters to determine which one is optimal for a given application domain. According to (Eldrandaly et al., 2009) different for instance, AHP is recommended in situations where individuals are unable to measure their preferences for different parameters and alternatives. MCDM approaches fit different types of the decision situation. While CFPR is purposely used for simplifying the pairwise comparison (Mimi et al., 2017) and ELECTRE (Şenel et al., 2018), is used when comparing binary, superiority between different decision points for each rating factor, is employed. Many new users struggle to determine which sort of MCDM technique is optimal for their situation. Each technique's functions, calculation stages, and formulas are listed in the table below.

Table 6. MCDM Criteria Selection

Author	Area	Criteria of MCDM Selection
Kolios, A., Mytilinou, V., Lozano-Minguez, E., & Salonitis, K. (2016) (Kolios et al., 2016)	real estate and land management	The weighting of variables (optional action) Determining the framework of expected properties



		Calculation of the overall index of suitability The identification of the method best suited to resolve the decision-making problem
Aruldoss, M., Lakshmi, T. M., & Venkatesan, V. P. (2013) (Aruldoss et al., 2013)	urban mobility projects	the alternative (s) that is ranked as the highest by the majority of methods

**Methodology**

**Research Design**

As shown in Figure 2, the three sections of this study consist of Phases 1, 2, and 3. In phase one, three subphases of the current tacit knowledge acquisition (TKA) are analysed: document analysis, validation, and the fuzzy Delphi technique, in that order. In Phase 2, the findings of Phase 1 are utilised to develop a framework for Tacit Knowledge Acquisition Framework (TKAF) that is compatible with the HEI environment and employs Fuzzy Delphi to achieve consensus agreement. Using a multi-criteria decision-making procedure, the final stage of Phase 3 is to evaluate how well the Talent Development Intervention Programme (TDIP) will complement the Tacit Knowledge Acquisition Framework (TKAF).

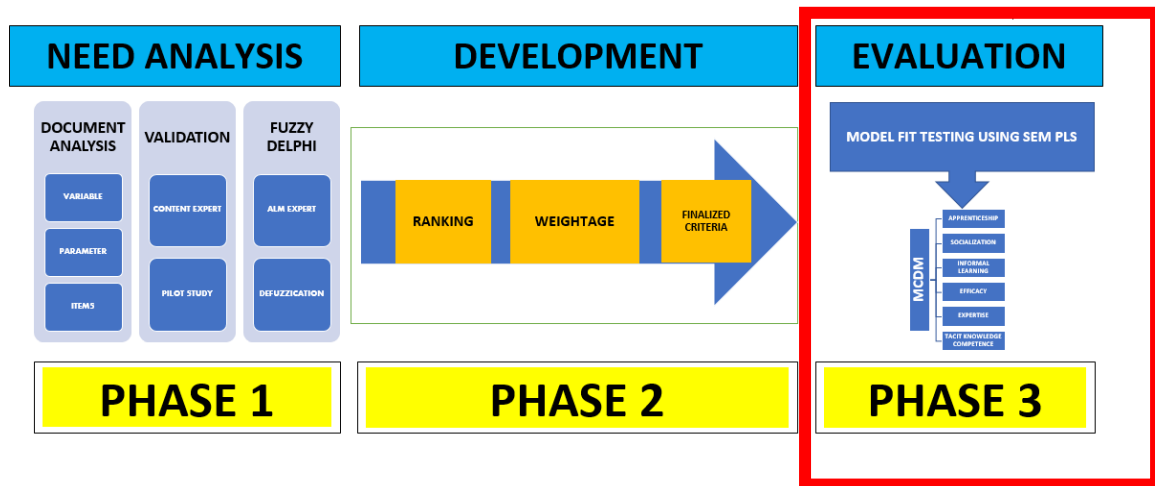


Figure 16. Research Design

**Research Framework**

The Proposed framework of MCTKAF will be evaluated by using Smart PLS 4.0. Five independent variables, and one Dependent variable have been chosen to be our proposed framework as illustrated in Figure 1.5. The parameter used for each indicator are based on (Odell, 2011) for coaching,(Pfund, Byars-Winston, Branchaw, Hurtado, & Eagan, 2016) for mentoring ,(Lu & Yang, 2015) for Job Rotation,(Dhliwayo, Nyanumba, &

Shepherd, 2014) for On Job Training,(Garcia & Garcia, 2015),(Chen & Gully, 2001),(Platt, 2010),(Bandura, 1998) for Efficacy,(2005, 1986) for Expertise and (BĂNACU, BUŞU, & Alexandra Cătălina, 2013) for Tacit Knowledge Competence. The result of the proposed framework will be discussed in our incoming paper. The figure 3 below show our model in this study.

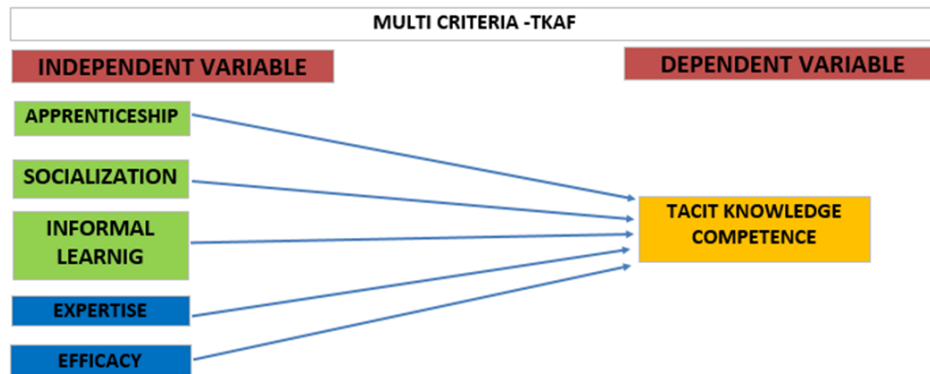


Figure 17. Research Model MCTKAF

**Proposed Hybrid**

*Model*

Decision Support System on MCTKAF are based on the flowchart in figure 4 below. The algorithm within the system will allow the decision maker to choose the right candidate to fill in the roles.

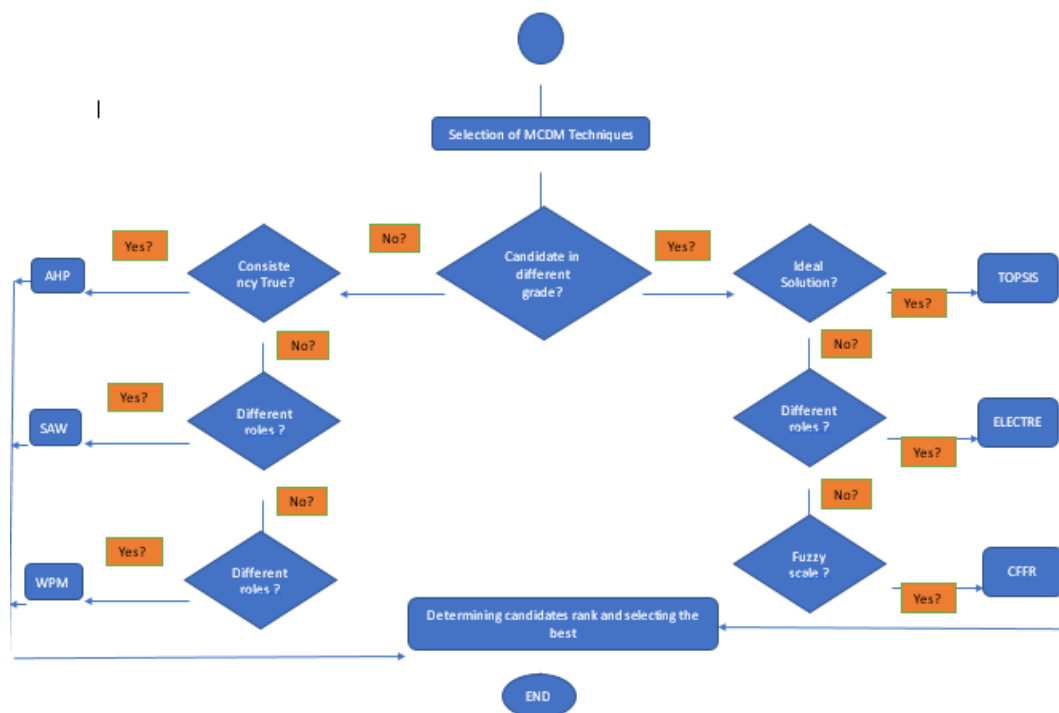


Figure 18. Hybrid MCDM Selection

## Results

The finalized result has been transformed using six(6) different techniques of MCDM in which almost all of the techniques to produce similar result . The conclusion of the each of technique has been explained in TABLE 5.

Table 7. Result

	CFFR	ELECTRE	SAW	WPM	AHP	TOPSIS
<b>Result</b>	In this case UITM1 is the best personnel for the position of Deputy Rector followed by UITM2, and UITM3  Further discussion on results can be referred to (Yau'mee Hayati Hj Mohamed Yusof, Arshah, & Romli, 2021)	So in this case, by using ELECTRE formula, UITM1 is the best personnel for the position of Deputy Rector followed by UITM2, and UITM3  Further discussion on results can be referred to (Yau'mee Hayati Hj Mohamed Yusof et al., 2021)	SAW formula showed that UITM3 is the best personnel for the position of Deputy Rector followed by UITM2, and UITM1  Further discussion on resultscan be referred to (Yau'Mee Hayati Hj Mohamed Yusof, Arshah, & Romli, 2020b)	WPM formula finalized UITM 1 as the first choice, followed by UITM2, and UITM1  Further discussion on results can be referred to (Yau'Mee Hayati Hj Mohamed Yusof et al., 2020b)	AHP formula finalized UITM 1 as the first choice, followed by UITM2, and UITM1  Further discussion on results can be referred to (Yau'Mee Hayati Hj Mohamed Yusof et al., 2020b)	TOPSIS formula finalized UITM 1 as the first choice, followed by UITM2, and UITM1  Further discussion on results can be referred to (Yau'Mee Hayati Hj Mohamed Yusof et al., 2020b)

## Sensitivity Analysis

To rank the candidates, the final normalized weight is computed. The candidate for that position who ranks first or has the highest final weight value is shown. The three candidates will be ranked for possible jobs as stated in TABLE 5 based on the final weight results for all procedures.

Table 8. Summary of Integrated MCDM

	SAW			WPM			TOPSIS			AHP			CFFR			ELECTRE		
CANDIDAT E	UITM1	UITM2	UITM3	UITM1	UITM2	UITM3	UITM1	UITM2	UITM3	UITM1	UITM2	UITM3	UITM1	UITM2	UITM3	UITM1	UITM2	UITM3
PERFORM ANCE	9.01	9.36	9.5	8.94	8.89	8.89	0.76	0.25	0.22	16.13	15.73	15.73	58.04	57.35	57.35			
RANK	3	2	1	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

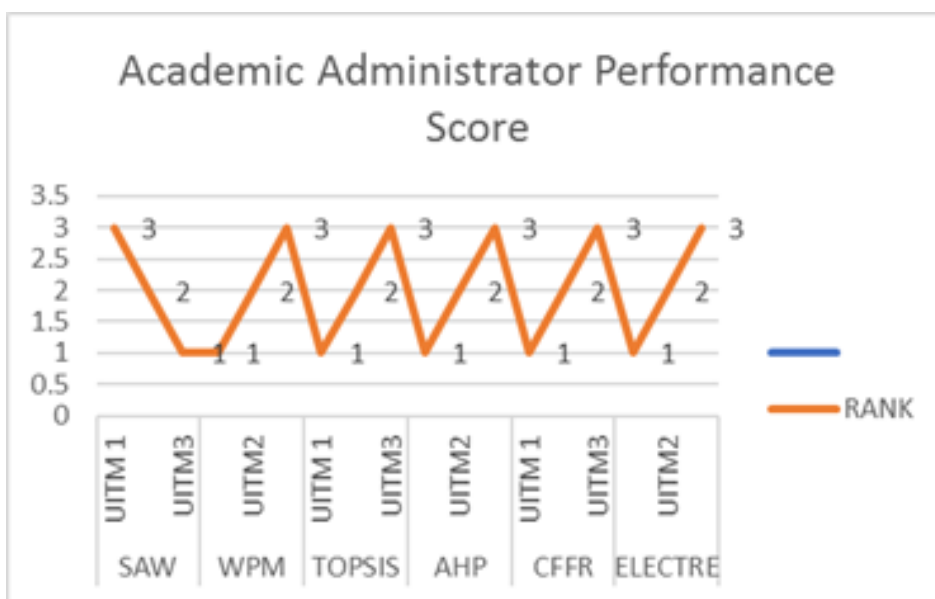


Figure 19. Academic Administrator Performance Score

The results of Table 6 and Figure 5 show that the selection for majority techniques provides a solution for the academic administrator jobs (Aruldoss et al., 2013) is consistent for candidate UITM 1 (ELECTRE,CFRR,WPM, AHP and TOPSIS) as the first choice. As proposed by (Aruldoss et al., 2013) the best alternative technique can also use the veto rule to select. In other words, the option(s) that the majority of ways score the highest will be chosen last. The criteria of selection are based on the technique that must support Multicriteria, Linguistic Fuzziness, and including the Fuzzy Delphi process as suggested by (Kolios et al., 2016)and (Aruldoss et al., 2013). According to (Aruldoss et al., 2013), selection of which MCDM technique is based on the study of own scope performance, for example, the method has to be chosen in such a way for different problems that have to be solved. This is equivalent to (Kolios et al., 2016) said that one technique outperforms the remainder since predictive precision depends on the nature of the issue, as well as the collection and handling of information in a manner that best suits each technique and implementation. Candidate UITM 1 (WPM, AHP, TOPSIS, CFPR, and ELECTRE) is the first choice in the majority of methods (Aruldoss et al., 2013) solution for academic administrator jobs selection. We can use the recommendation of (Kolios et al., 2016) and (Aruldoss et al., 2013)to choose which result is the best suit to the case. The next section will explain the hybrid MCDM that we would like to be integrated based on decision support system (DSS) on MCTKAF.

*Database Structure*

In proposed Decision Support System (DSS), the following ERD diagram is developed to create the structure of the database. Hybrid MCDM algorithm has been coded into the DSS for making the candidate selection is much able to seen via pattern rather that numbers.

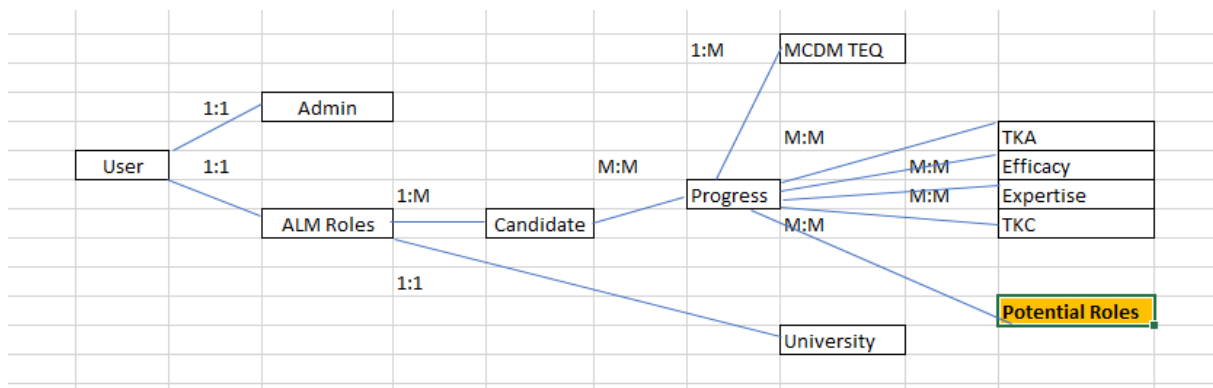


Figure 20. Database Structure in DSS MCTKAF

The following is the Personalization Interface for each candidate as shown in Figure 7.

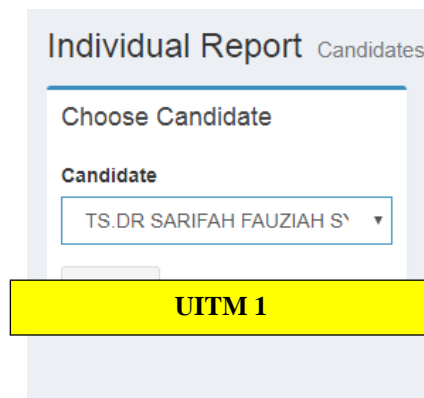


Figure 21. Personalization Interface

The following is the Candidate Progress Interface for each candidate as shown in Figure 8.

Choose Candidate

Candidate

Please choose

Submit

Candidate Info

Name: **UTM 1**

Identity Number: 12345

University: Universiti Teknologi MARA

Duration: 1 Year

---

Potential

Based on latest progress only

Marks: 362

Potential: HEAD OF CENTER (Ketua Pusat)

---

Progresses

No TOPSIS and ELECTRE result will be shown since it has to be compared with all progress from other candidates at the same timeframe. Please refer to Compare Latest Progress for those data

#	Date	SAW	WPM	AHP	CFFR
1	2020-02-08	9.93	9.89	10.5	61.89

Basic Data

---

Techniques Comparison

Figure 22. Candidate Progress

The following is the Candidate Comparison Progress for each candidate as shown in Figure 9.

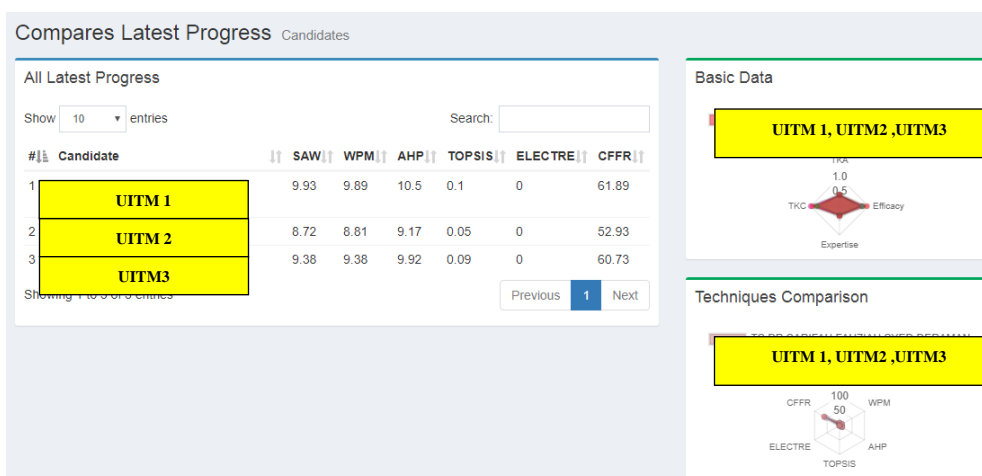


Figure 23. Candidate Report

**Post Evaluation on Proof of Concept (POC)**

Three assessors from three (3) categories of Malaysian public university have been approached to test practicality of the system. They have been asked to use the DSS MCTKAF to key in the profile of their suitable successor and get analysis from the system. The profile of each evaluator can be referred from this Table 6.

Table 9 Evaluator Brief Description

EVALUATOR	POSITION	TYPE OF MALAYSIAPUBLIC UNIVERSITY
1. UC EVALUATOR	RECTOR	COMPREHENSIVE
2. UF EVALUATOR	DIRECTOR	FOCUS
3. UR EVALUATOR	PROGRAM COORDINATOR	RESEARCH

Seven (7) questions on system usage been asked in Google Form (Content, Implementation, Need of Study, Phenomenon, Behaviour, Suitability and Overall ) with the result of the evaluation may be referred on the following Table 7.

Overall, three(3) evaluators from three(3) different universities has been asked to use the POC of DSS MC-TKAF, all of them believe this POC has potential to be incorporated in Malaysian Public HEI Talent Development Intervention Program in order to retain the successor in academic and leadership line with some suggestion to add on some elements on explicit knowledge which will be considered later in other phases.

Table 10. Descriptive Analysis

UNIVERSITY CATEGORY: COMPREHENSIVE, FOCUS, RESEARCH							
ITEM	CONTENT	IMPLEMENTATION	NEEDS OF STUDY	PHENOMENON	BEHAVIOUR	SUITABILITY	OVERALL
MEDIAN	4	4	4	4	4	5	ACCEPTED

## Conclusion

All of these ranked criteria can be used to select the ALM, and they will shed light on the relative importance of various features for each role. The proposed implementation of DSS MCTKAF might provide managers and HR with insights based on patterns rather than raw data. Managers and human resources departments may have a clear mental image of how they would use these factors to evaluate personnel. Thus, to assist decision-makers, MCDM researchers can utilize the recommendations of (Aruldoss et al., 2013), (Kolios et al., 2016) to determine which outcome is the best. The hybrid MCDM proposed in this paper yields UITM1 as the first successful candidate. Next up is UITM2, then UITM3. The ALM can be chosen based on these prioritized criteria, which also serve to illuminate the significance of specific aspects for their respective functions. The proposed implementation of DSS MCTKAF might provide managers and HR with insights based on patterns rather than raw data. Managers and HR departments may have a clear mental image of how they would evaluate people using these standards.

## Recommendations

The proposed hybrid MCDM, which now a Decision Support System of MC-TKAF, aims to provide fresh perspective to the ALM for intervening in talent acquisition by targeting a new approach to building an intervention programme to foster talent development at a public university institution. This will deepen and broaden our knowledge of ongoing and future studies on this subject, which is especially useful for determining viable alternatives to existing talent development intervention programmes in higher education.

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## Assessment Method for Potential Educational Technology Competency Standard Based on TPCK in Malaysia Higher Education Institutions

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**Abstract:** Technology in education is purposely designed to help both educators and students in knowledge transfer and knowledge gain simultaneously. In many aspects, technology in education is supposed to prove that education can be delivered effectively and efficiently. However, there are cases in which technology in education can be frustrating and annoying for both parties. Government and university management have invested a lot of money to ensure that educators and students can really benefit from the technology. In spite of huge investment on educational technology tools (hardware and software) over the past decades in various education initiatives, the potential of technology usage in university level has not reached the desired level among educators and students. What is the missing link for the realization of the expected return-of-investment? The outcome of this study proposes an Educational Technology standard to be applied in university setting using TPCK (Technological Pedagogical Content Knowledge) as the basic framework. However, this paper will only discuss a part of our standard development in which highlighting the assessment method that was used during the implementation of ETC standard in our institutions.

**Keywords:** Educational Technology; TPCK, ICT Standard, University, Educators, Student

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## Introduction

For tertiary students, improved educational outcomes are a result of instructional technology. It is considered to be able to prepare this population for a bright future. Technology in education is intended to support knowledge transmission and knowledge acquisition for both teachers and students at the same time. And it supposed to demonstrate in numerous ways that instruction may be delivered successfully and efficiently. But there are times when using technology in teaching may be irritating and frustrating for everyone. Technology alone does not necessarily result in increased learning. Even though Massive Open Online Courses, or MOOCs, are a convenient way to learn and provide free education worldwide, they cannot instantly transform a person into a scholar. Another example is presenting information on an interactive whiteboard without engaging audience members. Educational technology contributes to the improvement of educational outcomes for postsecondary students. It is believed to be able to provide a bright future for this population. Technology in education is intended to facilitate knowledge transfer and knowledge acquisition simultaneously for both educators and students.

Occasionally, technology in education can irritate and frustrate both sides. To guarantee that instructors and students can fully benefit from the technology, the government and university administration have made major financial investments. Despite significant investments in Education Technology instruments (hardware and software) by various education initiatives over the past few decades, the potential for technology use among university educators and students has not yet reached the desired level. The pandemic Covid-19 that occurred within the past two years has drastically altered the majority of aspects of physical education. During the Covid-19 epidemic, educators were forced by their institutions to complete self-training in order to make sure they could give their lessons online or through another medium. What is missing in order to realize the anticipated return on investment? How are educators' ICT competencies in higher education assessed both before and after the Covid-19 pandemic?

Past and recent research (Ahmed & Rasheed, 2020; Chaiya Akarawang, Kidrakran, & Nuangchalerm, 2015; Hersh, 2014; Matherson, Wilson, & Wright, 2014; Zainani, Esfijani, & Damaneh, 2016) indicates that the issue stems from educators' lack of technical ICT skills and knowledge of effective pedagogical practice. Researchers in a variety of education-related disciplines have discussed the need for educators to have a solid ICT Competency standard (Fong, Ch'ng, & Por, 2013; Sani & Arumugam, 2017). Rarely is research conducted at the Higher Education Institutions (HEI) or University level, with the majority of studies focusing on pre-teacher education. The assessment strategy that will be used when the ETC standard is implemented at our institutions, however, will be the only topic covered in this paper, which will only cover a small part of the standard development process. In accordance with the Malaysia Education Blueprint 2015 - 2025 (Higher Education), it is predicted that university management will be able to evaluate and control educational technology initiatives intended to raise standards for teaching and learning.

Utilising modern IT is intricate and multifaceted, and psychological research shows that cognitive models may not fully account for the antecedents of conduct (Beaudry & Pinsonneault, 2010; Maatuk, Elberkawi, Aljawarneh, Rashaideh, & Alharbi, 2022). Researchers have discovered that the value of educational technology is directly proportional to the technological knowledge of educators, such that the greater the educators' technological expertise, the greater the students' ability to comprehend it (Guasch, Alvarez, & Espasa, 2010; Hechter, Phyfe, & Vermette, 2012; Hennessy, Harrison, & Wamakote, 2010; Herrero et al., 2015). This has no significant educational advantage over conventional whiteboards. In comparison to the price of a traditional whiteboard, the interactive use of interactive whiteboards to actively engage students with the subject matter through technology would likely justify the additional cost, schools in the United Kingdom, the United States, Australia, South Korea, and other countries are already largely equipped with interactive whiteboards (Kim, Kim, Lee, Spector, & DeMeester, 2013).

It is generally acknowledged that students who are actively involved learn and remember more material. Class enrollments have increased in response to tighter budgets and growing pressure to offer a high-quality education at a competitive price. While technology has the potential to increase student engagement, it should not replace traditional teaching methods (La Roche & Flanagan, 2013). Technology integration encompasses attitudes and behaviours affiliated with technology use. Therefore, if technology and teaching approaches are combined, instructors' technological pedagogical views may have an impact (Liu, 2011). In addition, the majority of teachers indicated that internal factors (such as a passion for technology and a problem-solving mindset) and external support (administrators and personal learning networks) influenced their practises significantly (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Since the advent of educational technologies in the classroom, teacher education has been faced with the task of improving in-service teacher education. As a result, it's crucial for the institution to prepare teachers for the delivery of teacher education in a constructivist learning environment and to give student teachers a welcoming, nonthreatening atmosphere in which to successfully integrate computer instruction, since the challenge of improving in-service teacher education has been present in the field of teacher education (Sang, Valcke, Braak, & Tondeur, 2010). Consequently, professional development programmes must look past first-order barriers to the intrinsic, more complex second-order barriers of teachers' beliefs and how they influence ICT implementation in the classroom if teachers are to implement the type of pedagogical change outlined in current educational reform agendas (Prestridge, 2012).

This study aims to answer the question of which TPCK elements can serve as the basis for establishing Educational Technology Competency Standards in our institution. The primary objective of this study is to establish Educators' Technology Competency (ETC) Standards at our local university using TPCK as the foundation (Yau'Mee Hayati, Sarah Syazwani, & Nur Hazwani, 2015). This paper will, however, only discuss the findings of the pre-development of this study to guide educators' use of ETC Standards regarding the elements that should be included in the standard. It is envisaged that this paper will serve as a guide for a thorough ETC Standard in academic contexts, which will ultimately help to maximise the use of educator-student learning. One aspect of our standard development that will be proposed as a Competency Assessment Based System is the clarification of the assessment method that will be used throughout the implementation of

ETC standards in our institutions. In accordance with the Malaysia Education Blueprint 2015 - 2025 (Higher Education), it is anticipated that university administration will be able to review and regulate efforts to improve the educational technology standards in teaching and learning. There are two questions that has been asked in the beginning of the study which are as following:

1. What is the elements in TPCK which can used as standard in UiTM(CT) ?
2. How to use TPCK to produce a practical standard for UiTM(CT) ?

## Literature Review

### Competency Standard

Standards are used in the field of educational technology to assess the potential qualities a teacher or student must possess in order to pass a specific competency level or proficiency. It is necessary for them to upgrade their abilities because doing so is a crucial part of self-development. All educators agree that a standard is an essential requirement before a new educator may join the education queue. Most of the criteria (as stated in Table 1) are frequently applied to ICT training programmes for teachers in elementary and secondary schools. Some of them, nevertheless, focus on postsecondary education. It is obvious that the ET/ICT Standard can be implemented into professional development programmes for educators of the highest calibre. The instruments of the standard can be used in training courses to prepare new educators and advance the abilities of experienced educators. As a result, it is possible to evaluate educators' proficiency with the standards, which is necessary for professional development. Competency standards would improve in-service teacher training courses that are in line with competency standards and would reduce teachers' gaps in ICT proficiency (Fong et al., 2013).

Table 1. Prominent ICT Standard

Standard	Description
UNESCO ICT Competency Framework for Teachers 2018(Fallis, 2018)	The UNESCO ICT Competency Framework for Teachers was created by UNESCO in 2018 with the purpose of offering recommendations for structuring teacher preparation courses and training to help prepare teachers or to promote professional growth in ICT-integrated pedagogy. The three main parts of the UNESCO ICT Standard are knowledge production, knowledge deepening, and technology literacy.
ISTE STANDARD (International Society for Technology in Education, 2008)	The International Society for Technology in Education has created a formal standard that many American institutions will use when providing ICT teacher training.

<p>NATIONAL PROFESSIONAL STANDARDS FOR TEACHERS</p>	<p>The "NATIONAL PROFESSIONAL STANDARDS FOR TEACHERS: ICT Elaborations for Graduate Teacher Standards," published by the Australian Institute of Teaching and School Leadership, serves as a manual for future educators before they start their fieldwork in classrooms.</p>
<p>CHINA ICT STANDARD</p>	<p>China Educational Technology Standards (CETS) were developed and adopted in 2004. A new set of necessary teacher's certificate requirements has been put into place. The development of in-service teacher training programmes was funded by the Chinese government, which also kept an eye on it. The government chose regional testing and training institutes authorised for certification through a competitive tendering process. The pre-service teacher training courses were updated as a result.</p>

To train graduates, pre-service teachers, and some in-service teachers, all of these criteria are generally used in elementary and secondary schools. There aren't many current criteria that concentrate on the levels of colleges and other higher education institutions. This can be because research is valued more highly in higher education than teaching and learning. But now that ICT tools and applications have advanced, instructors in higher education institutions need to be prepared with the abilities and information required for their own professional development.

**Technological Pedagogical Content Knowledge (TPACK)**

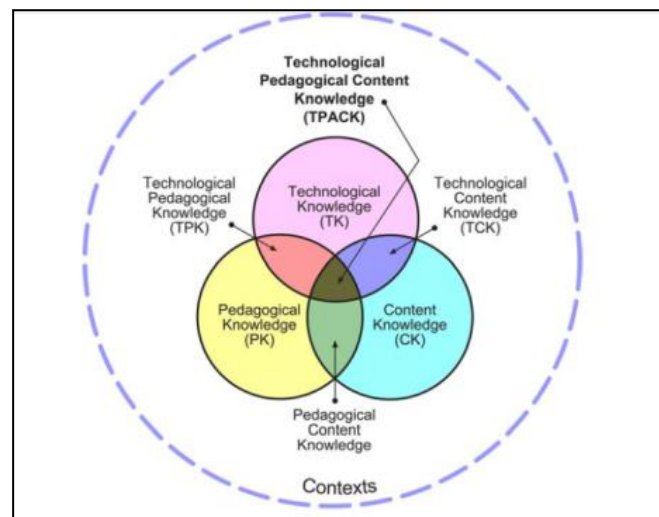


Figure 1. TPACK Framework (Adopted: The components of the TPACK framework (graphic from TPACK - Technological Pedagogical Content Knowledge, 2010).)

Technology Pedagogy Content Knowledge, or TPACK (as shown in Figure 1), is a framework that emphasises the importance of educating future teachers to use technology wisely while delivering a particular lesson to a particular group of students. This approach contends that technology integration spans a continuum of teaching and learning philosophies rather than calling for a particular pedagogical orientation (Becuwe et al., 2017). The

TPCK framework is helpful for giving instructors the information they need to incorporate technology into the classroom and how to grow this expertise (Baran, Chuang, & Thompson, 2011). The accompanying Table 2 lists the seven (7) components of this framework.

Table 2. Seven (7) Components Included in the Framework

Technology knowledge (TK)	The ability to use a variety of technologies, from low-tech ones like pencil and paper to digital ones like the Internet, digital video, interactive whiteboards, and software.
Content knowledge (CK)	Knowledge of the actual subject matter that teachers need to be knowledgeable about in order to teach.
Pedagogical knowledge (PK)	Knowledge of teaching techniques and procedures, such as lesson planning, assessment, and classroom management.
Pedagogical Content Knowledge (PCK)	PCK is an awareness of how certain subject-matter aspects are organised, modified, and portrayed for instruction. It is the merging of content and pedagogy.
Technical Content Knowledge (TCK)	Technical content knowledge (TCK) is an understanding of the relationship between technology and content. Technology limits the types of representations that can be used; however, newer technologies frequently allow for newer, more varied representations and provide users with a higher degree of flexibility while exploring these representations.
Technological Pedagogical Knowledge (TPK)	Technological pedagogical knowledge (TPK) is the understanding of the existence, elements, and capabilities of various technologies as they are applied in learning and teaching environments, as well as the potential effects on teaching of the usage of particular technologies.

A class of knowledge called TPCK is essential to technology instructors' work. Topic matter experts who are technologically savvy, technologists with limited topic or pedagogical understanding, and instructors with limited subject or technology knowledge are unlikely to possess this knowledge (Koehler & Mishra, 2009).

The TPCK framework has received a great deal of support from both scholars and practitioners in the majority of countries (Jang & Chang, 2016; Kihzoza, Mandela, Zlotnikova, & Bada, 2016; Wu, Hu, Gu, & Lim, 2016). The framework has offered a useful tool for planning teacher education programmes and evaluating teachers' expertise in technology integration. An obvious aspect of the TPCK's global effect as an emerging research and development tool for teachers and educators is the interest in using the TPCK framework and the TPACK survey for designing and assessing teachers' knowledge in various international teacher education contexts. According to Larsen (2014), TPACK is a theoretical framework for evaluating educators' understanding of how to use technology, and it is still applicable today, post-pandemi



**Malaysia Education Blueprint 2015 – 2025 (Higher Education).**

The overall percentage of Malaysians enrolled in higher education in 2021 was 48%. With 1.2 million students enrolled in public and private HLIs, such as public universities, polytechnics, community colleges, private universities, private university institutions, and private colleges, this marks a 70% increase in enrolment over the previous ten years. The number of students enrolling in bachelor's degree programmes climbed sixfold between 1990 and 2019, while the number of students enrolling in master's and doctoral degrees increased tenfold. According to the Executive Summary Malaysia Education Blueprint 2015–2025 (Higher Education) (Kementerian Pengajian Tinggi Malaysia (KPM), 2012), Malaysia currently ranks third among ASEAN countries for enrollment in Master's and Doctoral programmes, after Singapore and Thailand. Integrated learning models will spread throughout all HLIs as a common pedagogical approach in order to maintain the standard of HLI education at the neighbourhood university.

The strong cyber infrastructure that underpins innovations like videoconferencing, live streaming, and Massive Open Online Courses (MOOCs) will be advantageous to students. Malaysian HLIs will engage in worldwide MOOC consortiums in addition to creating MOOCs in their own fields of expertise, building the reputation of Malaysian education abroad. In terms of effectiveness, the Ministry aims to maximise the return on investment in higher education and sustain the existing level of government spending per student across all public institutions. The Ministry will work with HLIs to strengthen the capacities of the academic community in order to achieve these goals, and it will also take into consideration creating a national e-learning platform to oversee and direct content creation. Higher education is experiencing a huge disruption due to new digital technologies and delivery methods on a global scale. This chapter underlines crucial prerequisites for online learning in Malaysia's higher education system going forward. With the support of globalised online learning (GOL) platforms, Malaysia hopes to be a top educational hub. These platforms will improve education for Malaysians and the rest of the world in terms of accessibility, equity, and quality. Additionally, they will boost Malaysia's international education brand, enable more effective course delivery, and raise the profile of Malaysian HLIs, particularly in specialised disciplines.

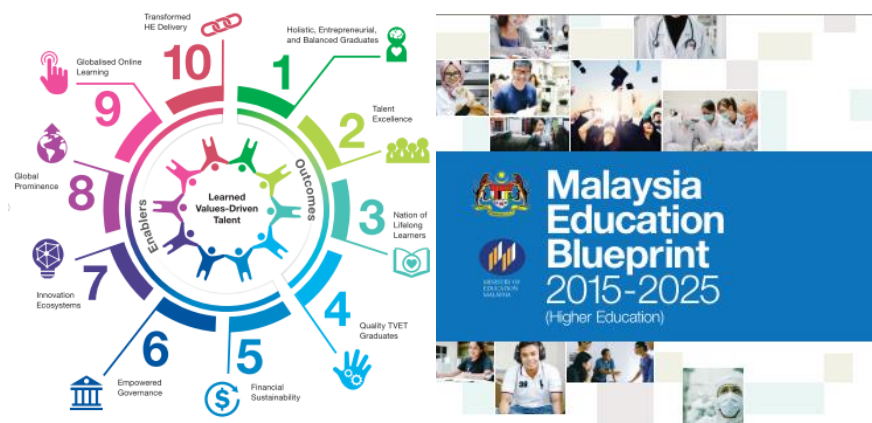


Figure 2. Malaysia Education Blueprint 2015-2025

Launching

MOOCs on

Malaysia-specific disciplines such as Islamic banking and finance in collaboration with renowned international MOOC consortiums like EdX and Coursera to strengthen Malaysia's international reputation; Making blended learning models a requirement for up to 70% of programmes; making online learning an essential part of higher education and perpetual learning, starting with the conversion of typical undergraduate courses into MOOCs; creating the necessary cyber infrastructure (physical network infrastructure, information structure, platform, devices, and equipment); and improving the academic community's capacity to deliver online learning on a large scale. In Malaysia, HLI has used e-learning as a tool for education in one of two ways: entirely through e-learning or through blended learning, which blends traditional and online learning. The main method of instruction at Open University Malaysia (OUM) in Malaysia is e-learning through blended learning. OUM began operations in 2001 with 753 students; however, this figure rose sharply throughout the course of the year. This data indicates that there is interest in e-learning among students. It also shows that e-learning has achieved parity with conventional education without sacrificing the standard of instruction. According to *Persidangan Meja Bulat E-Learning, IPTA*, held in 2008 at UiTM, very few HLIs in Malaysia have created their own policy, guidelines, or standard for the implementation of e-learning facilities within their institutions. However, after the COVID-19 global campaign, many universities have come up with a lot of creative ways to use and improve their e-learning facilities.

### **Multi Criteria Decision Making (MCDM)**

The multi-criteria decision-making (MCDM) approach takes into account the decision-making process with numerous goals. A decision-maker (DM) must choose from a variety of quantitative or qualitative criteria. One of the main objectives of MCDM is to help DMs combine objective measurements with value assessments that are based on group consensus rather than individual viewpoints (Aruldoss, Lakshmi, & Venkatesan, 2013). When the best course of action is extremely complex, this strategy makes effective decision-making possible (Aruldoss et al., 2013). Generally speaking, the goals are incompatible; hence, the best course of action is a compromise depending on the decision-maker's preferences. There are many circumstances where it is vital to analyse conflicting factors before making a choice.

In MCDM models, a decision-maker often has to rank and choose among a limited number of possibilities. In many cases, it is also required to assess the relative relevance of a small number of factors. Researchers develop a list of criteria to decide which MCDM approach is best for a particular application because there are so many different MCDM methods available. Seven (7) methods, including (ELECTRE), (MAUT), (ANP), (MACBETH), (AHP), (TOPSIS), and (PROMETHEE), were used in the study by Kolios, Mytilinou, Lozano-Minguez, and Salonitis (2016) in the area of real estate and land management; Four (4) criteria were also used to choose the MCDM method that is best suited for the proposed model. In the assessment of competency, different approaches have also been applied (Chung & Chang, 2015; Heidary Dahooie, Beheshti Jazan Abadi, Vanaki, & Firoozfar, 2018; Lin & Kuo, 2022). Due to their ease of calculation, SAW and WPM have been employed in our suggested methodology.

Table 3. MCDM Approach in Training Evaluation

Area/Applications	Criteria	Source of Criteria's	SAW	TOPSIS	ELECTRE	CFPR	AHP
<b>Finding the Right Personnel in Academic Institutions</b>	Qualification Marks	NONE	(Kumar, Radhika, & Suman, 2013)	(Kumar et al., 2013)			(Kumar et al., 2013)
	Experience in years						
	Salary Expectation						
	Ability handle different subject						
	Research Activities						
	Technical Skill						
<b>Academic Staff Selection</b>	Individual Factor	NONE			(Rouyendegh &		
	Academic Factor						
	Work Faculty						
<b>Evaluation of Personnel Selection Criteria Using Consistent Fuzzy Preference Relations</b>	Activity	NONE				(Ozdemir, Nalbant, & Basligil, 2017)	
	Fee						
	Education						
	Internal Factors						
<b>Academic staff promotion in higher education by using Analytic Hierarchy Process (AHP)</b>	Teaching and Supervision	NONE					
	Research and Publication						
	Administration and Management						
	Professional Contribution to Society						
<b>Fuzzy Analytic Hierarchy Process for Multi-criteria Academic Successor Selection.</b>	Personal and Interpersonal Outcomes	(Scott, Coates, & Anderson. 2008)					(Jantan, Yusof, & Ishak, 2019)
	Learning and Teaching Out-comes						
	Recognition and Reputation						
	Financial Performance						
	Effective Implementation						

For example in the study done by (Kolios et al., 2016) in area of real estate and land management, they used seven (7) methods such as (ELECTRE), (MAUT), (ANP), (MACBETH), (AHP), (TOPSIS), (PROMETHEE) and four (4) criteria of choosing MCDM method that is suitable for the proposed model. Another study (Aruldoss et al., 2013) also comes with numerous methods and criteria such fuzzy TOPSIS, fuzzy VIKOR, and fuzzy GRA for evaluation on urban mobility projects. As proposed by (Aruldoss et al., 2013), the best alternative method can also use the veto rule to select. In other word, the alternative(s) that the majority of methods rank the highest will lastly be selected. The summary can be seen from Table 3.

### UiTM-CT ETC Standard

The first campus of UiTM (Terengganu), often known as UiTMT, was established in Sura Gate, Dungun, on

July 1, 1975. The cornerstone ceremony in Sura Hujung was conducted on October 19, 1978, under the direction of the late Sultan Ismail Nasiruddin Shah. The major campus expansion was carried out over time in a number of phases. UiTMT has successfully developed the entire seaward area and 500,000 square metres across the lake as a result of putting the four phases and physical development indicated in the sixth and seventh Malaysian plans into practise. UiTM (Kuala Terengganu) was founded as a branch campus in 2008, and UiTM (Bukit Besi) followed in 2012. The UiTMT campus has been given full liberty to manage its own administration, stage by stage, by the Vice Chancellor of UiTM by 2013. The list of ICT training that has been provided in the past and is still being provided today via online webinar is shown in Table 4 below. Each educator at our institutions must complete 42 hours of training over the course of a year, including ICT training, as shown in Table 5.

Table 4. Pre-Pandemic

Course	Types	Frequency in a year
<b>E-Learning</b>		
Blended Learning	Software	4 times per year
Web 2.0 Tools	Software	3-5 times per year
<b>Application for Productivity and Professional Software (APPS)</b>		
Ipad for Teaching & Learning	Hardware	Once a year
Web Development :- Joomla	Software	Once a year
Microsoft Productivity Suite	Software	1-2 times per year
Image and Video Processing	Software	1 time per year
Research Productivity Suite	Software	3-8 times per year

\*Details above are based on iLQAM (Terengganu) Working Calendar 2015

(Source: iLQAM (2015), UiTM (Terengganu))

Table 5. Training Requirement for each educator in UiTM

Senarai Latihan / Kursus anjuran ILD/iTraining yang telah disertai bagi Tahun 2022			
Tiada Maklumat			
Maklumat Jumlah Jam & Bilangan Penyertaan Latihan			
Jumlah Jam Kompetensi			
Umum	Khusus	ICT	Tiada Kategori
40.5 jam	76 jam	14 jam	2 jam

We have come across the need to choose two forms of knowledge: internal and external expertise within our institution, in order to set the standard for our regional institution. External expertise relates to educators outside of our institution who are knowledgeable about the history of our institution, whereas internal expertise refers to our local educators within our university. These are chosen on a volunteer basis based on two criteria: experience and a strong interest in using ICT and ET in the classroom. Selected experts have received a number of the elements used in the initial draught of the proposed standard.

## UiTM(T) ETC STANDARD

1

**Vision :** This UiTM(T) ETC standards aims to be ensure that all educators in Universiti Teknologi MARA have the **skills and capacity** to solve the complex problems facing students education nowadays and in the future especially when using Education Technology in Classroom.This Educational Technology Standard guides efforts to enhance teaching through the integration of technology and academics. It also provides a framework that supports the learning process.

2

**Mission :** This UiTM ETC standards will define the **skills(technology) ,knowledge (content), and pedagogy** that an educator need in order to teach, work, and learn in an increasingly connected global and digital society for current trend and in future.

3

**Objective of UiTM(T) ETC Standard:**

- 1) To fulfill university expectations for educators to acquire standard ICT/ET hours of training at least 12 hours per year.
- 2) To measure ICT/ET training effectiveness among educators in their classroom implementation within 6 months after training completion .
- 3) To provide guidelines for Training Unit/Department to direct appropriate ICT/ET training programme with minimum one educator per six (6) training per year.

Figure 3. UiTM(T) ETC Standard interface - 1

**Technological Pedagogical Content Knowledge :TPCK** represents a class of knowledge that is central to teachers' work with technology. This knowledge would NOT typically be held by technologically proficient subject matter experts, or by technologists who know little of the subject or of pedagogy, or by teachers who know little of that subject or about technology (Koehler, & Mishra, 2009)

**SIGNIFICANCE**

1. University shall use technology standards as part of quality professional development training programs for educators
2. Instruments described in standards are incorporated into training programs to prepare new educators and to enhance the capability of senior educators;
3. Assessment of educators mastery of the standards is done accurately; and
4. Demonstration educators technology competence is required for professional development.

**HOW?**

1. This UiTM(T) ETC Standard should be applied in each ICT/ET Training conducted in UiTM(ET)
2. To ensure effectiveness, pre and post assessment shall be applied before and after attending Training
3. Educators should answer Pre and Post Assessment which is developed based on this UiTM(T) ETC Standard
4. Analysis for each Training will allow the Developer Team to monitor effectiveness for each Training.

Standard	Details	Focus Area
STANDARD 1 (7 Focus Area)	Technology knowledge (TK): Knowledge about various technologies, ranging from low-tech technologies, such as pencil and paper, to digital technologies, such as the Internet, digital video, interactive whiteboards, and software programs.	Awareness of technology's value Concept Skills Designing and implementing technology-supported lessons and activities Self Assessment Concepts of lifelong learning Using technology to support teaching and management, research and professional development, and media collaboration and communication
STANDARD 2 (4 Focus Area)	Content knowledge (CK): Knowledge about the actual subject matter that teachers must know about to teach.	Progressional Knowledge Core Knowledge Strategic Knowledge Facts, Concepts, Principles and whole structure of the subject.
STANDARD 3 (5 Focus Area)	Pedagogical knowledge (PK): Knowledge about the methods and processes of teaching such as classroom management, assessment, lesson plan development, and student learning.	Range of appropriate instructional tools Teaching approaches for different styles of students Ability to create atmosphere for appropriate interaction Teaching based on students' levels of comprehension Different teaching approaches to the content
STANDARD 4 (4 Focus Area)	Pedagogical Content Knowledge:PCCK represents the blending of content and pedagogy into an understanding of how particular aspects of the subject matter are organized, adapted, and represented for instruction	Teaching expertise Multiple teaching approaches Effective teaching approaches Classroom Management
STANDARD 5 (4 Focus Area)	Technological Content Knowledge: Technological content knowledge (TCCK) is knowledge about the manner in which technology and content are reciprocally related.	Content Delivery Promote teaching activities for a specific course unit Technology Content Adaptive Collect or organize information
STANDARD 6 (5 Focus Area)	Technological/Pedagogical Knowledge: Technological pedagogical knowledge (TPK) is knowledge of the existence, components, and capabilities of various technologies as they are used in teaching and learning settings, and conversely, knowing how teaching might change as the result of using particular technologies.	Teaching activities for interaction. Enhance teaching effectiveness Motivate the students to learning and help them learn efficiently Enrichment of teaching materials and content. Technology Pedagogy Adaptive

Figure 4. UiTM(T) ETC Standard interface - 2

URL : <http://uitmt-etc.weebly.com>

The best term and description for the focal area, description, and ICT Elaboration must be chosen and validated by specialists. Expertise had two weeks to complete the three rounds of their evaluation. The changes were made in accordance with the advice provided by the experts. This paper (Yau'Mee Hayati Mohamed Yusof, Abdullah, & Hamidah, 2019) draws conclusions from the analysis and proposes an educational technology standard to be implemented in university settings using TPCK (Technological Pedagogical Content Knowledge) as the foundational framework through the Deplhi method.

The proposed standard's shared mission, vision, and national aspiration for advancing technology in education make it potentially useful in a range of academic situations. This suggested standard needs to take into account a variety of factors, including 1) tailoring standards to local needs and circumstances, 2) creating better indicators to evaluate ET/ICT training programmes, and 3) raising educators' ET/ICT competency.

### Pre and Post Evaluation Training

The pre-test is a set of inquiries given to participants before the training begins to ascertain their level of familiarity with the course material (I-Tech, 2010). Prior to the start of the programme, participants took a pre-test to gauge their level of familiarity with the course material. Participants take a post-test that either has the same questions or questions of a similar level of difficulty after finishing the course. The training provider can establish whether the training was successful in improving participants' knowledge of the training subject by comparing the post-test scores of participants to their pre-test scores. Pre- and post-testing material was chosen using a set of instruments (Table 6) created by Albion, Jamieson-Proctor, and Finger in 2010 and Jamieson-Proctor et al. in 2013.

Table 6. Pre and Post Assessment are Based on Set of Instrument

Items	Number of Items
A Interest in and Attitudes toward using ICT	5
B Confidence	2
C ICT Applications	20
D Digital Technologies (ICT) Competence	7
E The Professional Capabilities of the ICT Vocational Self Efficacy Scale	12

The training provider can establish whether the training was successful in improving participants' knowledge of the training subject by comparing the post-test scores of participants to their pre-test scores. Five ICT/ET courses were offered at random in order to achieve this. The band is then categorised as follows using the pre- and post-results: Beginner ( $x \leq 0$ ), Intermediate ( $0 < x < 1$ ), and Advanced ( $x > 1$ ) in accordance with Table 7. The sum of the trainees' scores within each band is shown in Table 8 as a number.

Table 7. Band

Band	Mean Score
Beginner	$x < 0$
Intermediate	$0 > x < 1$
Advanced	$x > 1$

Table 8. Band According to Items

Band	Total Achiever based Category Items		
	ICT Application	Digital Technologies (ICT) Competence	Professional Capabilities of the ICT Vocational Self Efficacy Scale
Beginner	18	6	0
Intermediate	11	21	3
Advanced	15	8	32

**Standard Self-Acceptance Test**

Only 35 respondents have completed their pre- and post-assessments out of a total of 75 who participated in pre- and post-assessments delivered in five distinct ET/ICT courses with an average of 15 students in our local institutions. These selected respondents will then be assigned our proposed UITMT ETC criteria for self-acceptance based on their mean pretest and post-evaluation scores, which are then filtered through three categories: Beginner, Intermediate, and Advanced.

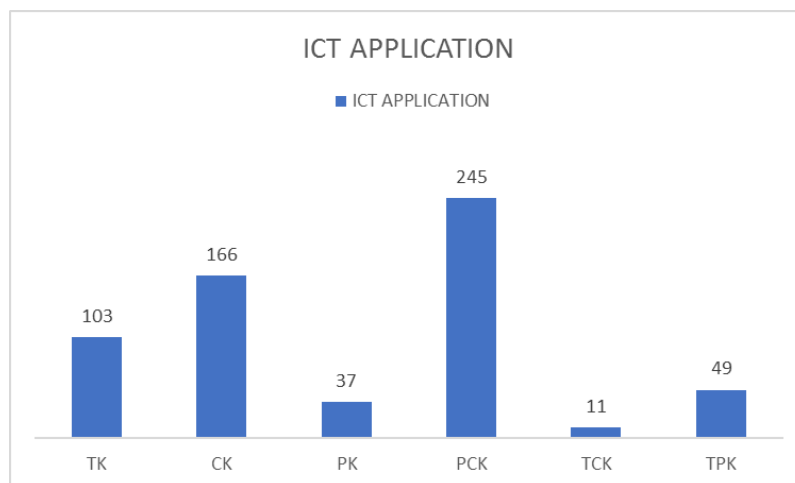


Figure 5. ICT Application

This division's purpose is to ensure that the standard can be adopted in ICT/ET training for our university educators' ET/ICT training in the selected areas: ICT APPLICATION, DIGITAL COMPETENCIES COMPETENCE, and PROFESSIONAL CAPABILITIES OF THE ICT VOCATIONAL SELF EFFICIENCY

SCALE, irrespective of band score. Only 19 individuals are able to complete the Standard Self-Acceptance Test, allowing us to deduce how they perceive themselves in comparison to the standard. The learner must select the scale (ranging from extremely good to extremely poor) that best shows his or her acceptance of the criteria. The results of the STANDARD SELF ACCEPTANCE TEST for the ICT trainees in our local institutions are depicted in Figures 4, 5, and 6 below. These figures elicit a GOOD score.

Findings in the ICT Competence category reveal that individual in the Beginner to Advanced range rate their adoption of the UiTMT ETC Competency Standard as GOOD, as shown in Figure 5. TCK and PK, on the other hand, receive the lowest scores among the elements in the UITMT ETC standard, whereas the other aspects are generally highly received by trainees.

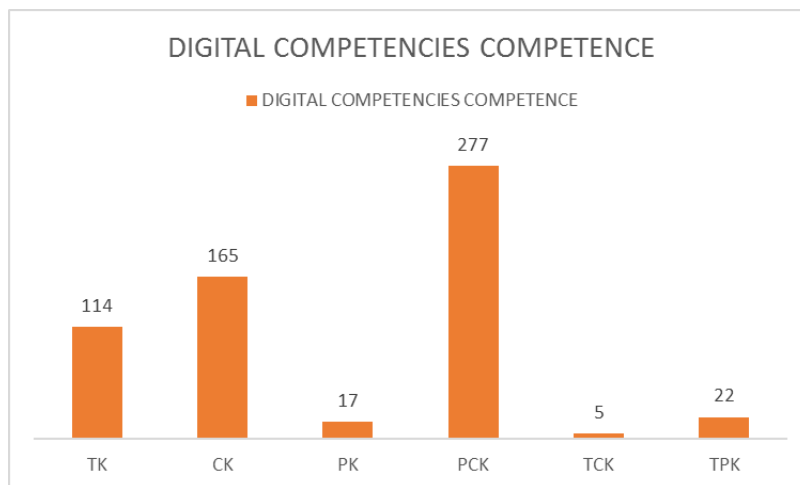


Figure 6. Digital Competencies Competence

The majority of people who rate themselves as GOOD in terms of accepting the UiTMT ETC Competency Standard in the Digital Competence category range from Beginner to Advanced, as shown in Figure 6. TCK and PK, on the other hand, receive the lowest scores among the elements in the UITMT ETC standard, while the other aspects are generally well-received by trainees.

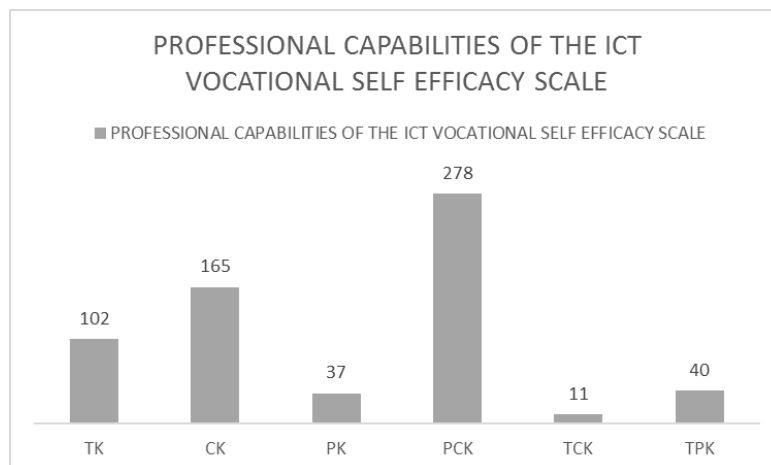


Figure 7. Professional Capabilities of the ICT Vocational Self Efficacy Scale



According to results from the Professional Competency Self Scale category, persons who rate themselves as Beginner to Intermediate rate themselves most frequently as GOOD in terms of their acceptance of the UiTMT ETC Competency Standard, as shown in Figure 7. The UITMT ETC standard's TCK and PK elements, however, receive the lowest scores overall, whereas the other elements are generally well-received by trainees.

*Summary of the UITMT ETC Standard*

According to Figure 8, majority of the educators at our institutions are able to accept the elements and criteria in our proposed UiTMT ETC Standard, as evidenced by the descriptive result using pre- and post-mean scores as band categories; this assessment approach is considered good towards our proposed standard. The results show that TCK (Technology Content Knowledge) and TPK (Technology Pedagogical Knowledge) are the most SCORE:GOOD components that are least accepted. This result appears to corroborate previous studies (Chaiya Akarawang et al., 2015; Bibi, 2017; Hersh, 2014) that suggest the knowledge of good pedagogical practises among educators may be lacking in technical ICT skills, which may prevent the potential for technology usage in universities from reaching the desired level among educators and students. It demonstrates that these components are crucial for combining technology, content, and pedagogy and should be emphasised during ICT/ET training at HEI. Due to the small number of sample respondents that were tested at our institutions, the descriptive analysis in this study should not be generalised as an overall response from educators in HEI in Malaysia.

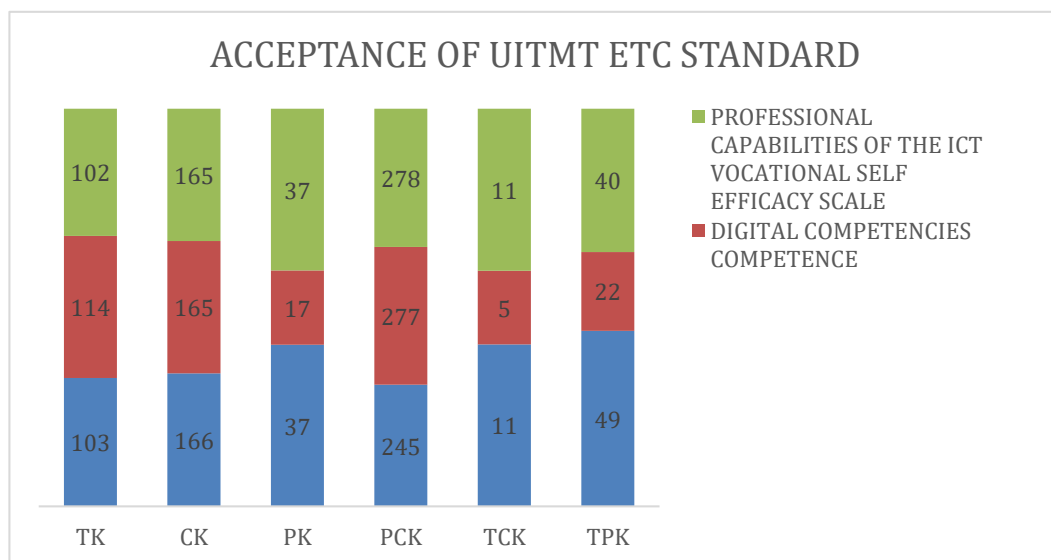


Figure 8. Acceptance of UiTMT ETC Standard

**Research Methodology**

Science philosophers have suggested that one of the most significant roles played by theoretical frameworks is

that they direct observation. In order to make sense of the complicated web of relationships that emerges when educators try to apply technology to the teaching of subject matter, we used TPCK in our research. The study technique that will be used to generate the Educational Technology Competency Standard (ETC), which will be used in university settings, is depicted in Figure 8.

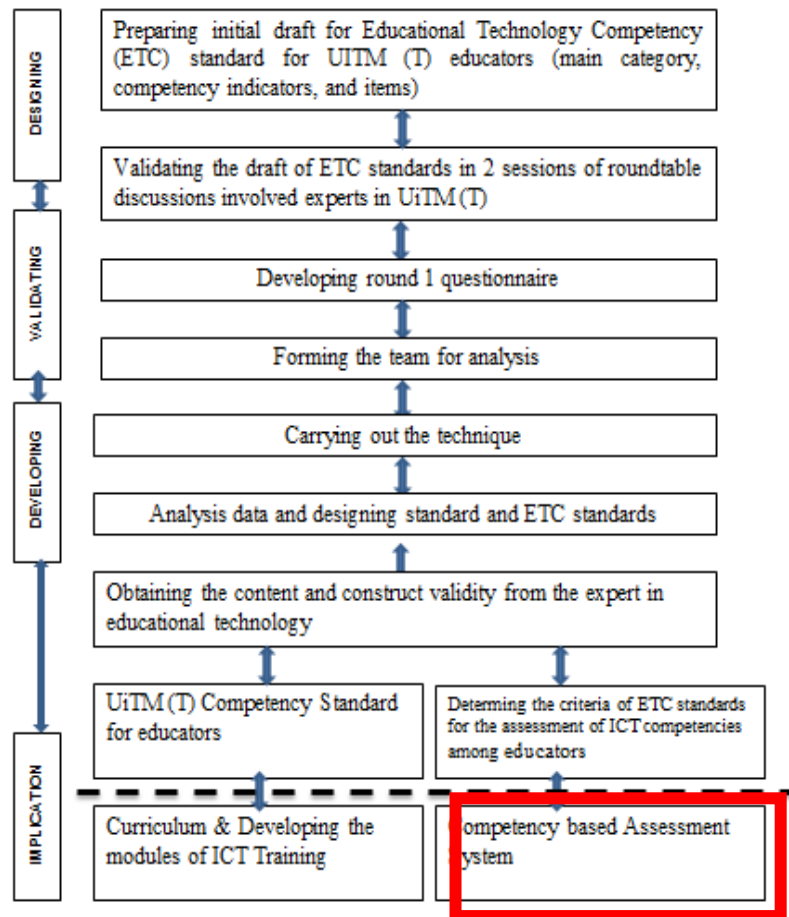


Figure 9. UITMT ETC Standard (Adopted: Research Methodology in Fong, Ch'ng, Por, & Abu Saada (2011) )

This study also incorporates elements of the Delphi technique, which uses a group procedure to conduct surveys and gather expert opinions on a given subject (Hsu & Sandford, 2007). Using a variety of data collection and analysis tools, the Delphi technique is an iterative, multistage procedure used to reach consensus among experts (Fong et al., 2013). It is used whenever the basis for policies, programmes, or concepts must be sound judgement. Creating an instructional model is one of the reasons the Delphi technique is used (Linstone & Turoff, 2002). Figure 9 illustrates the process used to design, validate, and develop the instruments and items for the proposed ETC standards in our institutions using three (3) rounds of Delphi methodologies. The phase to which this paper refers is depicted by the red box square.

**Problem Formulation**

One trainee UiTMT ETC report who has taken three ICT-related training sessions was employed in this case

scenario.

The steps of using any MCDM technique begin with the following 13 steps: -

1. Identifying the suitable weights.
2. Among the different methods of calculating weights, Geometric Mean Method is popular because of its simplicity and consistency.
3. Find the relative importance of different attributes concerning achieving the goal.
4. Construct a pairwise comparison matrix by taking a suitable scale as given in Figure 4.
5. When there is an M number of attributes the relative importance matrix is a square matrix of size M X M.
6. All the diagonal elements Relative Importance matrix are 1 Because the attribute is checked by itself.
7. The remaining elements are to be filled from table 0.11. By following the rule  $A_{1ij} = 1 / A_{1ji}$ . Where A1 is Relative importance matrix.
8. Calculate the Geometric mean and weights
9. Calculate A3 and A4 matrices such that  $A_3 = A_1 \times A_2$   $A_4 = A_3 / A_2$   
Where A1 is the Relative Importance matrix and A2 is weight matrix [ w1,w2, ...,wj up to j attributes]
10. Calculate the maximum eigenvalue  $\lambda_{max}$ , by taking the average of A4 matrix.
11. Determine Consistency index  $CI = \lambda_{max} - M / M-1$ .
12. Obtain the Random index value from Figure 10 for the required attributes.

Matrix size	Random consistency index (RI)
1	0.00
2	0.00
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

Figure 10. Random Index Value

13. Calculate Consistency ratio:  $CR = CI / RI$

In general CR value <0.1 is acceptable, if CR value is greater than 0.1, then we have to rethink the relative importance.

To each of the attributes in MC TKAF, the decision-maker assigns the important weights which become the coefficients of the variables. The steps are the following:

1. Determine Criteria from Alternative (Table 9)
2. Weightage for each criterion (Table 10 & 11)
3. Develop Normalization Matrix (Table 12)

4. Preference (which is the result is based on MCDM techniques used)

By using the assumption weightage, the result is based on the following table:

*Pair Wise Comparison*

Table 9. Weighted Normalized Decision Matrix

Weighted Decision Matrix	Normalized							Weight	Average	Consistency Measures	
Weight Criteria	TK	CK	PK	PCK	TCK	TPK					
TK	1.00	2.00	3.00	3.00	3.00	3.00	0.19	0.03	12.87		
CK	2.00	1.00	2.00	3.00	3.00	3.00	0.18	0.03	12.86		
PK	2.00	2.00	1.00	3.00	3.00	3.00	0.18	0.03	12.86		
PCK	2.00	2.00	2.00	1.00	3.00	3.00	0.16	0.03	12.92	CI= 4.93	
TCK	2.00	2.00	2.00	2.00	1.00	3.00	0.15	0.03	13.08	RI= 1.24	
TPK	2.00	2.00	2.00	2.00	2.00	1.00	0.14	0.02	13.36		
TOTAL	11.00	11.00	12.00	14.00	15.00	16.00	1.00			C Ratio = 3.98	

Decision Matrix

Evaluate Alternative

Table 10. Base Data

Base Data	35	20	25	20	20	25
	TK	CK	PK	PCK	TCK	TPK
TRAINING A	20	15	15	15	15	15
TRAINING B	30	15	15	15	15	15
TRAINING C	25	20	20	10	10	20

Table 11. Normalised Data

Normalised Matrix	35	20	25	20	20	25
decision	TK	CK	PK	PCK	TCK	TPK
TRAINING A	0.57	0.75	0.60	0.75	0.75	0.60
TRAINING B	0.86	0.75	0.60	0.75	0.75	0.60
TRAINING C	0.71	1.00	0.80	0.50	0.50	0.80

Table 12. Weight for attributes

TK	CK	PK	PCK	TCK	TPK
0.19	0.18	0.18	0.16	0.15	0.14

## SAW

This method can help in decision making for a certain case, and the calculation that generates the greatest value will be chosen as the best alternative (Karlitasari, Suhartini, & Benny, 2017). It is based on based on the weighted average (Jafari, Jafarian, Zareei, & Zaerpour, 2008). The formula using SAW are based on following criteria:

**Hata! Burada görünmesini istediğiniz metne Caption uygulamak için Giriş sekmesini kullanın..1**

$$S^* = \{S_i \mid \max_i \sum_{j=1}^n \mu_j^{c_i}(x) \times \mu_j^i(x) / \sum_{j=1}^n \mu_j^i(x)\}$$

Pi = normal (i)

Where wj is weight matrix, Mij Normal is a normalized matrix of basic table.

Formula for Normalization Matrix as following:

**Hata! Burada görünmesini istediğiniz metne Caption uygulamak için Giriş sekmesini kullanın..2**

$$x_n = \left\{ \frac{x_n}{\max_i x_j} \right.$$

$$x_n = \left\{ \frac{\min x_n}{x_j} \right.$$

The decision maker can then obtain a total score for each alternative simply by multiplying the scale rating for each attribute value by the importance weight assigned to the attribute and then summing these products over all the attributes SAW (Jafari, Jafarian, Zareei, & Zaerpour, 2008).

Table 13. SAW

	TK	CK	PK	PCK	TCK	TPK
TRAINING A	0.11	0.13	0.11	0.12	0.11	0.08
TRAINNG B	0.16	0.13	0.11	0.12	0.11	0.08
TRAINING C	0.14	0.18	0.14	0.08	0.08	0.11

## WPM

Weighted Product Method (WPM) is similar to SAW Method but instead of addition, there is multiplication in the model. The normalized values are calculated and each normalized value is raised to the power of relative weight. The alternative with highest Pi is the best alternative among others.

Pi= [ normal ] w j (ii)

**Hata! Burada görünmesini istediğiniz metne Caption uygulamak için Giriş sekmesini kullanın..3**

$$A^{*WSM} = \max_i \sum_j^m a_{ij} w_j$$

**Hata! Burada görünmesini istediğiniz metne Caption uygulamak için Giriş sekmesini kullanın..4**

$$R\left(\frac{A_k}{A_l}\right) = \prod_{j=1}^n \left(\frac{a_{kj}}{a_{lj}}\right)^{w_j}$$

Table 14. Rank of Training Type

	TK	CK	PK	PCK	TCK	TPK	
TRAINING A	0.90	0.95	0.91	0.95	0.96	0.93	0.66
TRAINNG B	0.97	0.95	0.91	0.95	0.96	0.93	0.72
TRAINING C	0.94	1.00	0.96	0.89	0.90	0.97	0.70

The final normalized weight is calculated to rank the training type. The highest value of final weight indicates the first rank of the training type. The final weight results for all techniques will be used to rank the three (3) training type for the best result on educators training program as shown in Table 14 respectively.

Although we can infer from this chart that Training B (Figure 11) has had a greater impact on this trainee's UiTMT ETC Standard Competency than any other sort of training, there is some consistency in the results. However, based on the regularity of the results, we can state that this trainee succeeded in adapting to the UiTMT ETC Standard at a very Excellent level.

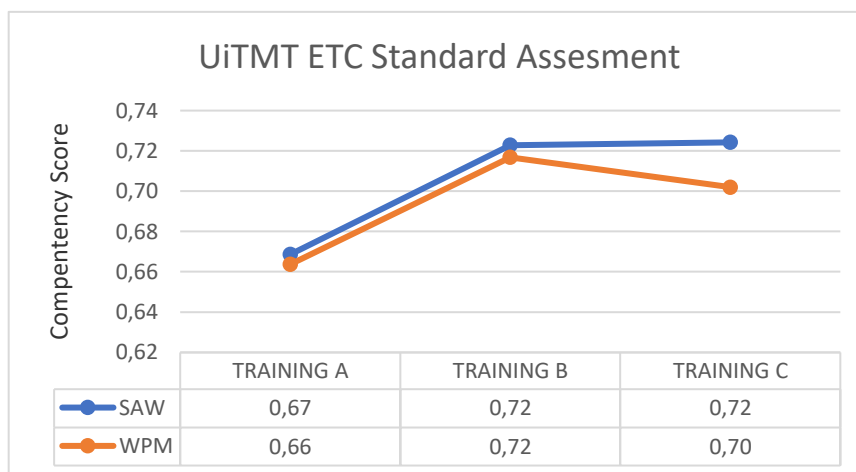


Figure 11. UiTMT ETC Standard Assessment

### Digital / ICT Training Competency Based Assessment System

Below is the proposed Training Competency Assessment Based System (Figure 12) that been proposed to help

the university administration to monitor their educators Digital/ICT Competency. This proposed flow chart is hoped to make the university administration are clear with their Digital /ICT training direction towards upgrading their educators in public HLI institutions to meet with Malaysia Ministry of Higher Education Blueprint 2015-2025 vision and mission.

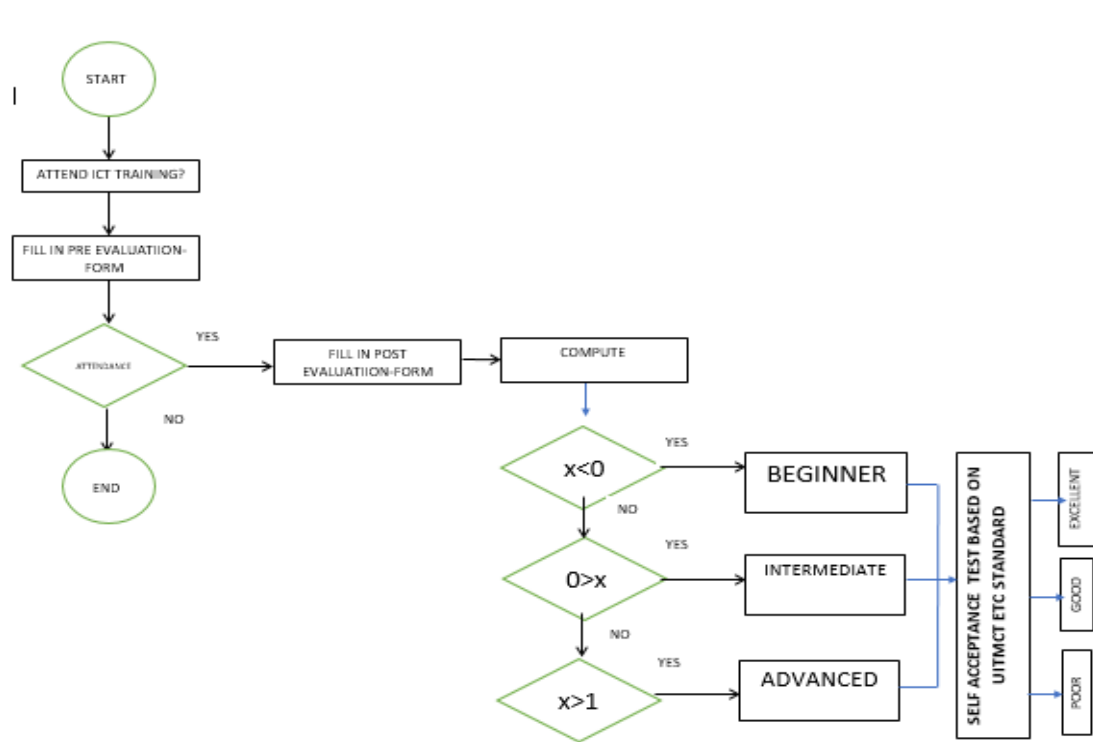


Figure 12. Flow Chart Training Competency Assessment

## Discussion

To emphasise the significance of taking into account technological possibilities in light of developmentally appropriate practises and specific learning objectives in ICT/ET training provided for educators in HEI in Malaysia, it is nonetheless suggested that this assessment and study's findings be used as a guidance method for ETC Standard implementation in university settings. In this study, it is hoped that the following questions will be addressed:

1. What is the elements in TPCK which can used as standard in UiTM(CT) ?

A Standard using TPCK for UiTM (T) Educator as Educational Technology Competency Standard has been developed using delphi method via three round of analysis. Almost most elements in TPCK are accepted by the expert choice.

2. How to use TPCK to produce a practical standard for UiTM(CT) ?

Analysis the sample of Educators who used the standard be done, and the result showed that UiTMT ETC standard were well received by the respondents. This finding seems to support the research done by (C Akarawang, 2015) that indicates that the gap between technical ICT skills and the knowledge of good pedagogical practice among educators might disallow the potential of technology usage in University to reach the desired level among educators and students. It shows that these elements should be stressed out during the ICT/ET training in HEI as it is the most needed elements in integrating technology-content – pedagogy. The descriptive analysis in this study however should not be generalized as a whole response from educators in HEI in Malaysia due to limitation of sample respondents that has been tested in our institutions. Further detail analysis must be taken to carry out realistic result of the effectiveness of this proposed standard.. However to make sure that this UiTMT ETC Standard much more practical to be used, we would like to propose a Digital / ICT Training Competency Based Assessment System to evaluate educator competency using multi criteria decision making approach such SAW and WPM based on the standard.

## Conclusion

However, the utilisation of ICT/ET instruments in the classroom is entirely dependent on the training and skills of our local educators. Therefore, it is imperative for UiTMT to establish a firm competency standard for their educators in order to ensure that the use of educational technology in the teaching and learning process is a worthwhile endeavour. In order to maximise the potential of Educational Technology instruments in Malaysian universities, this study will cast light on the context of the Educational Technology Competency (ETC) standard in a university setting. The findings of this study will contribute to the full utilisation of educator-student learning by introducing strategies that can be guided by the application of ETC Standards.

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## Mirror, Mirror on the Wall, Which Skills Are Most Important in Aviation World?

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**Abstract:** Communication is treated as one of the most important issues in all aviation professions, including aircraft maintenance, where passenger safety is paramount. Employer dissatisfaction with the performance of engineers, including aviation graduates, as communicators in the workplace remains controversial. Therefore, this study was conducted to examine the types and functions of communication skills required in the aircraft maintenance workplace. Twelve participants, consisting of aircraft maintenance technicians and licenses aircraft engineers (LAE), were involved in semi-structured interviews. The data were analysed thematically and managed using ATLAS.ti software. The results showed that seven sub-themes were identified in relation to oral communication activities and five sub-themes in relation to written communication a written communication is as important as oral communication for aircraft maintenance personnel. In addition, both written and oral communication are expected to be clear, concise and precise. The identified need for communication skills would help aviation institutions develop solutions to meet the needs of the aviation industry.

**Keywords:** Communication Skills, Aircraft Maintenance, Oral, Written.

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### Introduction

Communication skills are considered a significant skill for any profession, including the aviation industry. It is a fundamental prerequisite for aviation personnel to disseminate information, expertise, and experience to others.

They need to communicate on a frequent basis with their supervisors, colleagues, customers and team members. One of the most important components of worksite safety is communication (Yusof & Misnan, 2019). All aircraft workers must communicate in English to avoid accidents.

In the aviation industry, effective communication is important to ensuring timely flight operations as well as safe takeoff and landing (Torquato, 2004). This is also true in the aircraft maintenance industry, which requires strong English communication to avoid accidents (White, 2018). Miscommunication or a misunderstanding of communication can lead to death. According to Dalkilic (2017), as stated by Shukri et al. (2021), the average percentage of aircraft accidents related to maintenance issues was about 10% between 2009 and 2013. Notwithstanding the fact that maintenance problems cause only a very small proportion of commercial aviation incidents, accidents are often tragic (Cacciabue et al., 2003). This illustrates why maintenance works are crucial to aircraft safety and economic costs. Several aviation maintenance activities involve a significant amount of English, and maintenance personnel must be fluent in English to guarantee that tasks are performed accurately and smoothly (Shukri et al., 2021). Therefore, the communication skills of aviation personnel should be developed and refined during their studies.

Universities should work closely with industry to identify their communication needs and modify the curriculum to give aviation people the necessary profile of a technician or engineer. Hence, this study was conducted to investigate the functions that both oral and written communication skills perform in the workplace of aircraft maintenance. This study was also carried out to find out which skills are most important for maintenance technicians and licensed aircraft engineers in the aviation sector. The findings from the study should help educational institutions prepare their students for the future and ensure that their students have the professional skills they need to enter the workforce in the near future. This will be very important and helpful to the aviation sector, as there is still a lack of this type of study in Malaysia, especially in the field of aircraft maintenance.

## Literature review

One of the things that leads to globalisation is aviation. It connects the world and makes it more accessible and open. The language of aviation is English. Aviation English is a highly specialized language used mainly in aviation or aeronautics. Since aviation is a restricted and highly contextualised perspective, efficient English for Specific Purpose (ESP) approach taught through content (Basturkmen, 2006). Aviation English has numerous applications and it is used not only by pilots and crews, but also by ground staff such as aircraft maintenance technicians.

The aviation industry needs to prioritise safety issues because there are many aircraft that need to be properly maintained so that hundreds of passengers can fly safely every day. To ensure this, the industry needs to hire qualified aviation maintenance professionals who are responsible for maintaining aircraft, performing routine maintenance, and repairing any defect parts that are discovered during inspection. Aircraft maintenance

technicians are considered to be hands-on workers. It is also worth noting that good aircraft maintenance personnels have excellent communication skills.

The disparity between what students have to learn and what industry requires implies that there is still a gap between students' skills and real situation in the industry (Kahirool et al., 2010). The study is similar with earlier findings in that it suggests that the communication skills of engineering graduates are generally poor, although engineering departments have explicitly worked to improve the communication skills of their staff (Donnel et al., 2011).

Lack of communication skills and a lack of understanding of the Aircraft Maintenance Manual (AMM) are two issues faced by aircraft maintenance students during their internships in the industry (Sasila & Mahmood, 2017). The findings of this study in the Malaysian context appear to be comparable to previous studies that found that polytechnic students in aircraft maintenance have not yet mastered certain oral and written communication skills and oral presentation skills (Sanmugam & Kadir, 2019).

Compared to studies explaining what engineering schools could do for communication education, there is little discussion of industry expectations for engineering graduates' communication skills, including in aviation (Donnel et al., 2011). Therefore, more focused research into the specific communication skills required by industry should help educational institutions rethink their approaches to training students to be better communicators.

Graduates must be able to write reports, letters, and emails in English (Masduki & Zakaria, 2020). Companies expect careful planning and confident presentation of work results. Employers expect detailed preparation and confident presentation of work results, using good non-verbal communication to gain and maintain audience attention and build rapport to achieve business success (Lenard & Pintaric, 2018). However, the study did not focus on a specific engineering industry, and the research was also conducted with a limited sample of participating employers. The data also revealed general feedback and no further action was taken in response to industry participants' input.

Employers require engaged listeners, capable first language speakers, and English-speaking facilitators, according to a study by Lenard and Pintaric (2018). In addition, the study discovered that employees are required to adhere to email etiquette, have excellent grammar and style in both written and oral communication, as well as use proper non-verbal communication methods. However, this study used a survey as its research method, which contained closed-ended questions that may be less valid than open-ended questions. In addition, this study did not focus on the perspective of the aviation stakeholders, which was highlighted in the problem statement in the previous section.

For the reasons stated above, this study was done to identify the various types and functions of communication skills used by aircraft maintenance personnel.

## Method

### Design of the study

The semi-structured interview, which is commonly used in qualitative research, was used in this study. It is one of the most often used qualitative data collection strategies to gather information about communication skills issues and needs in any industry. It provides a good representation of the main events as well as insights from the participants.

### Participants

Purposive sampling was used to choose twelve (12) aviation workers for this study. They are all currently employed by twelve different Malaysian aviation companies that specialize in aircraft or helicopter maintenance, aircraft simulation, and aircraft parts manufacturing. The identity of the companies was not disclosed. Most of them were between 23 and 45 years old. To hide their identities, the participants were given pseudonyms such as "Boy" and "Moon.". A pseudonym is a fictional persona that is frequently employed by researchers or authors to preserve the anonymity of participants (Allen & Wiles, 2016). There were ten (10) male participants and two (2) female participants in this study. Most of them have 2 to 24 years of experience in the industry. Table 1 provides an overview of the aircraft technicians and engineers who were interviewed for this study. It shows the pseudonyms used in this study, as well as their age, years of industry experience and their position in the companies.

Table 1. Participant background information.

No	Pseudonym (Male/Female)	Years (Working experience)	Position
1	Mir (M)	3	Technician
2	Hah (F)	2	Junior technician
3	Moon (F)	5	Technician
4	Boy (M)	9	Senior engineer
5	Keman (M)	3	Assemble technician
6	Tony (M)	8	License aircraft engineer (LAE)
7	Mezar (M)	5	Industry engineer
8	Kerol (M)	2	Simulator technician
9	Ad (M)	9	License aircraft approval
10	Pejol (M)	24	License aircraft engineer (LAE)
11	Mad (M)	16	License aircraft engineer (LAE)
12	Kemal (M)	14	License aircraft engineer (LAE)

These participants were chosen for this study because they had prior knowledge in their respective professions and had completed their courses in aircraft maintenance at a Malaysian aviation school approved by the Malaysian Civil Aviation Authority (CAAM).



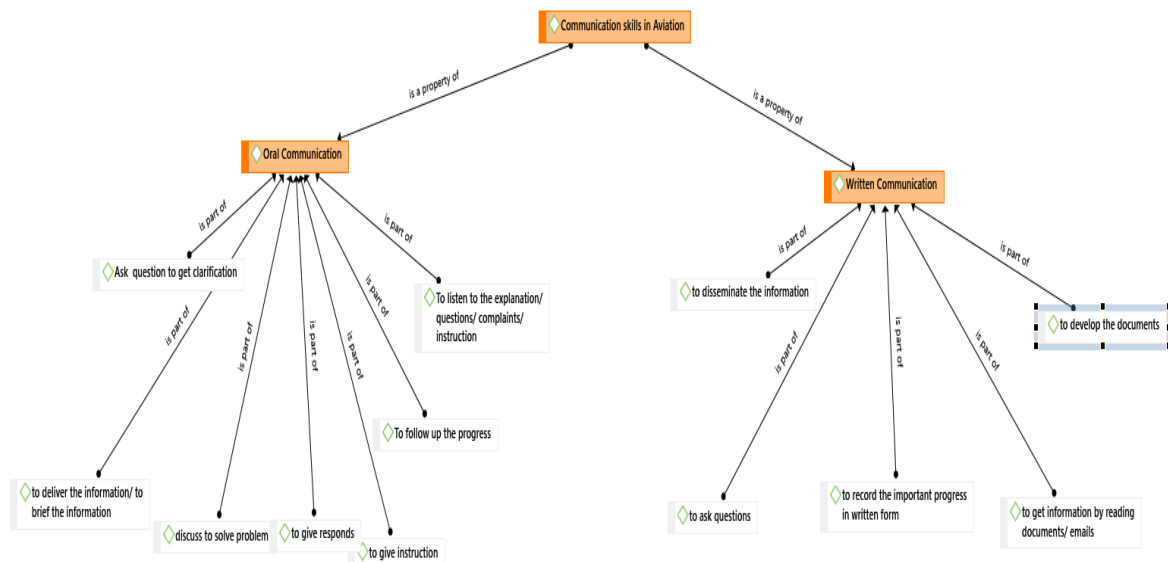
**Data collection and analysis**

All participants were interviewed individually as part of the data collection process. Each interview lasted 60 to 80 minutes, and they were asked questions about function of oral and written communication that they commonly experienced. They were also asked what skills were most important in the industry in terms of communication.

Following the interview, it was transcribed verbatim and distributed to participants for editing, refinement, addition or revision. The data were analyzed using a six-step thematic analysis (Braun & Clarke, 2006) and ATLAS. It helped with data management and presentation.

**Results**

The results of the qualitative research revealed two significant themes that emerged from the transcribed data and were categorised as oral communication and written communication. Based on the interviews conducted with twelve aviation personnel, 7 sub-themes were identified in relation to oral communication functions and 5 sub-themes in relation to written communication functions. Figure 1 shows the three themes of aviation industry workplace communication.



**Figure 1.** Network view of the communication skills in aviation

**Theme 1: Oral Communication**

*To ask questions*

All participants agreed that oral communication is essential for workers in the aviation industry, especially in aircraft maintenance, to ensure that all instructions and descriptions of work procedures and tasks are thoroughly

understood and that misunderstandings can be avoided, thereby preventing accidents in the workplace. Most of them said that they prefer to ask questions directly if there is confusion or they do not understand the tasks they have to perform. One of the participants shared that, as the leader of an engineering team, he preferred for his team members to just ask him directly when something was not clear, adding that two-way communication is important in teamwork.

*..... We are quite straightforward, so if there's anything you don't understand, please ask us again. We had also two-way communication, whatever it was.... (TONY)*

One of the participants also mentioned that after the morning briefing, which they had every day, the leader asks the team members if they have any problems before they start the maintenance tasks. This shows that although the maintenance team has to deal with machines, planes, tools and equipment and can refer to manuals, they still have to use oral communication to make sure they are doing the right job.

*..... After the briefing, he will ask on the floor, "Any questions or problems, just tell me," to which we all listen. As a result, we make inquiries or offer suggestions. (MIR)*

#### *To deliver the information/ brief the information*

Besides that, the aircraft maintenance technician and engineers also use oral communication to deliver or to brief the information. A team briefing brings leaders and their teams together face-to-face to share information, ask questions, and gather feedback. One of the technicians involved explained that the briefing is important for the team to be informed about the current progress of the project and the team's target for production in a given week or period.

*.....He will typically give us a briefing on Monday about how many components or wings we need to manufacture each week. So, the information is conveyed to the subordinate or another staff member using communication. ensuring that the staff is informed about the project's progress... (KEMAN)*

#### *To discuss and solve problem*

In addition, the maintenance team also uses oral communication to discuss and solve problems they face while performing the task. Discussion is important for teamwork as it encourages the team to work together and coordinate their efforts. It fosters a climate where everyone can present their point of view on the chosen topic, creating a productive environment for teamwork. One of the technicians involved explained that discussions with the partners or team members are important to ensure that he is doing the job properly without wasting time or even the cost.

*...As you clarify the work you want to do, talk with your partner, or teams, and the engineer from the*

*quality department to solve a specific problem... (KEMAN)*

*To give responds*

Participants also agreed that they needed to know how to react and respond to the questions of others, such as their supervisors, clients, and team members. Hah mentioned that her supervisor observes her work and makes sure she is doing it right by asking questions. Therefore, she needs to make sure that she knows how to respond to these questions.

*...I have to respond and explain to everybody who questions me. Listen to the briefing in the morning. After reading the work scope at the beginning of the day, the SV will ask me what I understand or have a team member have a conversation with me. I will then explain, carry out the assignment, and the SV will sit next to me and watch what I did... (HAH)*

*To give instructions*

In addition, one of the participants agreed that he uses oral communication to give instructions to his teammates and ensure that they can complete the tasks in the allotted time. He shared his strategies and different approaches to avoid the culture of procrastination or that the company has to pay penalties to the clients if the work is not done in the given time.

*... Similar to what I previously said, I usually talk in a normal tone to give instructions at the first level, and if there is still no action at that point, I will give more strict instructions. I need everything finished in a half-hour. Please do that for me... (TONY)*

*To follow up the progress*

Moreover, some of the engineers involved in the interviews agreed that they use face-to-face conversations to get updates from their technicians or other engineers on the current status of certain projects. Face-to-face communication conveys a wealth of information, including non-verbal cues and body language, and allows for immediate feedback that is as rich as the initial message. One of the engineers mentioned that he always uses face-to-face communication to get updates on the status of certain projects, as he learns about the progress immediately.

*It is important for me to communicate with my team member to know about the progress of project. If I just let them do the job without follow up, we might miss the deadline that we need to complete the job. Then, we might get the penalty from the clients.... (TONY)*

*To listen the explanation/ questions/ complaints/ instruction*

Furthermore, most participants also agreed they must have good listening skills to understand the instructions , questions, explanations or complaints from the others to ensure that they perform a proper job as a team. One of the participants called his position as the mediator between the technicians and top managements. The technicians usually will approach him to complaints about certain problem during work and he will discuss with the top management to come out with better solutions.

*....So, the industrial engineer is the one who they may complain to most easily. Alright, Mezar , these two improvements can be made to this tool. They therefore take note. The meeting will then be called and announced to all departments. There will be an improvement as a result of our conversation....*  
(MEZAR)

In conclusion, this study has uncovered seven different functions of oral communication that aviation personnel frequently use. They must also rely on oral communication in their practical work to ensure that tasks are completed successfully and without incident.

## **Theme 2: Written Communication**

Written communication is one of the communication skills that people use to convey information because it is a very tangible type of evidence. The accuracy of the information transmitted remains the same for all recipients, as the information does not differ from person to person.

This study describes five functions of written communication used in industry among maintenance technicians and engineers. These functions of written communication are described in detail below.

### *To disseminate the information*

Sharing certain information with a group of people or with individuals, internally or externally, is important in the workplace, whether through printed or electronic documents. Most of the participants agreed that they need to use English when they write emails or write reports. One of the participants said that she has to write a report before passing the tasks to the other person in the next shift. She also added that she has to write an email to the person in charge of another department if there are major problems.

*English only. Usually when I have to hand the task over before the shift is finished. Make a report. In addition, I have to mention a part failure when necessary. We must therefore write in English. Well, um, it is required that I use English in my email correspondence with the PIC for the Engine Department. (HAH)*

It seems that written communication is important to pass on information to others when working in a team. To

ensure that they completed the task, they also had to use written communication.

#### *To ask questions*

In addition, the maintenance technicians and engineers involved in this study agreed that they use written communication to ask questions, especially by email and also by WhatsApp. Emails and letters are written records of communication that can be used to keep important emails. This can be useful if we need to refer to something someone said in a previous message and provide evidence.

One of the participants mentioned that sometimes he sometimes received task from foreign centres and when he has a problem, he contacts another technician from a foreign centre to get the suggestion to solve the problem.

*When working with a foreign technician, the task is frequently requested from another centre, such as Singapore, Hong Kong, and so forth, via email and TEAMS. I gave a brief explanation of the situation and requested their suggestions for how to resolve it. (KEROL)*

#### *To record the important progress*

In addition, written communication is also important to record certain stages or progress in certain tasks. It can serve as a guide or reference for other staff. At the same time, it is also important for audits that are carried out at certain periods. There are many types of reports that the aircraft maintenance technician and engineers need to complete when doing certain tasks. For example, Inspection Report Card (IRC), Job Scope, Letter of Intent, Task Card and Shop Order. One of the engineers shared his experience of doing the repair based on the report written by another person in the quality department. This shows that report writing is one of the written forms of communication used from one person to another to fix certain defect.

*...The PIC from the quality control department comes to inspect the product. If a defect is discovered, the PIC will produce a report describing it. For example, in one unit, the sealant has a problem and is damaged. The PIC will record the defect as a result. As the technician, it is my responsibility to fix the defect and then document what I did in the report... (KEMAN)*

#### *To get information by reading documents*

Besides that, all participants felt that written documents are important in their position as they rely heavily on documentation before starting a work process, such as the aircraft maintenance manual, work scope and technical log, service bulletin, manufacturing order, task card and many others. One participant noted that he started his day by studying the manual before starting maintenance work to ensure that he followed the necessary steps and procedures.

*All of the manuals must be read because they must be printed out before we can begin the task. We do the tasks in pairs. Our partner read the instructions before we started the job. We need to communicate to one another regularly. After reading it, take this and this out. One other listen and completes the task...(MIR)*

*To develop the documents*

Moreover, one of the engineers involved in this study explained that he is responsible for developing the manuals and policies of the company, as the company is new and everything is still in the early stages. He develops the manuals based on the aircraft the company will be working with. Then he sends them to the authorities and prepares the presentation to get approval.

*...Yes, I am the one that write the policy, manual. Because this company is new company, so everything start from the scratch. (BOY)*

To summarise, although written communication has fewer subtopics than oral communication, it is still important to use them as official documents so that people in aviation can quickly recognise what is right and what is wrong.

*Written communication is as important as oral communication.*

This study also revealed that most participants felt that written communication was as important as oral communication and that they could not be separated. Since they need to refer to the manual before starting maintenance tasks, they still need to consult verbally with teammates and supervisors to make sure they will do the right thing. The same goes applies to the oral communication. They cannot simply carry out tasks based on the verbally delivered message but must refer to the written documents to avoid misunderstandings and communication obstacles such as the noise that often occurs in their workplace. In addition, the important documents prove that there are references to the performance of certain tasks, such as the instructions in the email sent.

*...Balance. To complete the task, we must first check the written text. Then, to comprehend the tasks, we listen to the instructions, ask questions, and chat with others. The task is then reported, written...(MIR)*

*...In my role, I communicated through two different channels. written and verbally. You must put both of these into practise if you work in the industry. Then it will be finished. Because we wouldn't be able to fully understand what was said if we only provided a written report. If we just communicate verbally,*

*we must be incorrect or have forgotten what was said previously. Perhaps after talking about this and that, we forgot what he had just said?... (AD)*

## Discussion

As mentioned above, the participants considered both written and oral communication equally important. They agreed that the success of task performance depends on how effective communication is at work. Good communication skills in engineering are becoming increasingly important as the engineering industry evolves. Good communication skills are needed to explain ideas and projects to a wider audience. These skills are important to ensure that all project participants are on the same page and working towards the same goal. Communication skills should be valued equally with technical expertise especially for those who want to move up to the position of manager or team leader. For example, the leader discuss new projects with clients and their own supervisors. They also pass on project specifications and deadlines in their reports, while keeping their bosses and clients informed. Misunderstandings, frustration, tension, and even accidents can be the result of poorly delivered messages.

Based on the findings discussed in the previous section, this points to the importance of English language use in the industry, as it involves not only local companies but also international companies from all over the world. Engineering students who were fluent in English were able to progress in their careers and compete in the industry (Chan, 2019; Saleh & Murtaza, 2018 and Zahari et al., 2016).

Asking questions is one of the functions of oral communication in the workplace to ensure that technicians and engineers follow the correct procedure. By asking questions, they are given the opportunity to understand others' perspectives and work authentically with individuals. Employees must be willing to ask questions and actively participate in team interactions to improve their general abilities (Zakaria et al., 2018).

Apart from this, it is also important to have a high level of self-confidence in the task done and to explain it properly to answer the supervisor's request or relate the task done. People with a lot of confidence are needed because they can captivate others and convince them of their point of view or reasons (C. Alih et al., 2018).

Everyone in aviation, from technicians to aircraft engineers to senior engineers in management positions, has to read and produce a variety of documents. This includes developing structured reports to communicate data. One of the technicians mentioned that after completing a task, she has to write down information to indicate an error, a defect, or an additional action that the next person should take. The logbook is one of the official records of all aircraft data, and the information it contains is used to assess the condition of the aircraft, the date of inspection, and so on (Terenzi, 2021).

Nevertheless, writing activities in aviation schools do not adhere to the structure required by the aviation industry and students are not adequately prepared to write reports or other work related to their assignments

(Vieira & dos Santos, 2010). According to Ruiz (2004), the written assignments in aviation schools should accurately reflect the type of communication that these professionals may encounter in their work. According to Terenzi (2021), this is consistent with Yusuf et al. (2018) that English writing skills are important in today's global business environment, especially when writing memos, emails, notices, minutes, agendas, contract documents, reports (technical, daily, and problem reports), and contracts. Consequently, institutions need to pay more attention to this issue and improve in order to train future aviation employees who are well prepared before they enter the industry.

Both written and oral communication must be clear, concise, and precise. When messages are clear, concise, and precise, there is no opportunity for misinterpretation or change of message, which reduces the potential for conflict. If conflict does occur, effective communication is essential to ensure that it is resolved in a respectful manner.

## **Conclusion**

The study found that aircraft maintenance graduates need oral and written communication skills to succeed in the industry. The study has helped to identify the functions of oral and written communication and the types of situations in which employees need to communicate in the industry. It can help stakeholders, especially teachers and curriculum developers, improve university English courses by identifying the types of communication skills used in the workplace and carefully considering which aspects should be retained and which should be improved or outsourced. Language training modules that teach functional skills to aircraft maintenance students help them meet employment standards.

## **Recommendations**

This study used a qualitative technique with semi-structured interviews to get a complete picture of the case. The generalisability of industry players' perceptions of communication skills in the workplace was not the intended aim of this study due to the small number of participants. Furthermore, this study was mainly concerned with communication skills in the aviation industry, particularly in aircraft maintenance. Future studies should investigate workplace communication skills with a larger sample size, both qualitatively and quantitatively. Additional research is needed to evaluate the effectiveness of university courses that focus on communication skills from an employer's perspective and meet industry needs.

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## Research on a Learner Assessment Model in Online Learning for Higher Education

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**Abstract:** The COVID-19 pandemic has tackled global sustainability without prejudice or geographical constraint. It has also prompted people to advance to the post-pandemic era. However, it is possible that in the future, extreme negative effects in response to crisis, especially during a pandemic, would recur. In fact, it might worsen. This situation has forced the education sector to adjust its teaching and learning approach in order to implement a new solution based on a selected component, namely assessment. In such case, the implementation of assessment has been activated for online learning platform. Hence, it is crucial to refer and study the current environment mode of the E-Assessment model in view the of the model development perspective and the features of the assessment concept for model development. The seven features that make up the degree of assessment conceptual dominance in online learning are authenticity, responsiveness, practicability, adaptation, transparency, alignment, and affordance. In accordance with the overall analysis of the conceptual features, the possibility of frequent and synchronized usage may be extended in detail for further investigation.

**Keywords:** E-Assessment, online learning, model

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### Introduction

Assessment is an essential component of learning as it is a useful method to visualize the engagement between learners and educators (Taras, 2005). Respectively, assessment can improve teaching and learning, as well as can be used to hold learners and institutions accountable (Talib et al., 2020). Assessment in the twenty-first century should encourage students' use of critical thinking, analysis, synthesis, and inference (Segers et al., 2003). Hence, it is key to prove if an education system is producing the desired outcomes for learners, the economy, and society at large (Clarke, 2012). In response to the online learning environment, it is relevant to consider the E-Assessment component. Learners' E-Assessment is the process of testing students' knowledge

and abilities using information and communication technology (ICT) for all assessment processes, including design, implementation, reaction recording, and feedback provision as perceived by learners, teachers, lecturers, and tutors (Wuisan & Wibawa, 2019). Meanwhile, Gaytan contends that technology, delivery, pedagogy, learning styles, and learning outcomes all play a role in the positive E-Assessment outcomes (Gaytan, 2005). Pursuant to this, assessment has brought various positive perspectives that are not just confined to the platform approach. Due to the emergency shift, the most recent assessment case study in the digital world showed negative views when assessment activities have the potential to cause discontent, irritation, and anxiety in the summative assessment approach (Losad et al., 2020).

### **The Highlighted E-Assessment Changes in Response to the Crisis**

The changes brought about by emergency remote teaching and learning (ERTL) are indeed compulsory and from different perspectives. These perspectives may vary depending on the context and individual experiences of learners and educators.

Firstly, the emergency remote teaching and learning (ERTL) strategy has been activated generally without assessment. Although there must be drastic changes, the factor of relevancy has presented challenges for both educators and learners. With the current issue, it is clear that perspectives toward assessment need to be tolerated. The COVID-19 pandemic has activated the emergency transition mode when it dreadfully disrupts the education sector. An online learning activation mode by minimum plan, zero plan, or unexpected condition within a limited timeframe is referred to as an emergency transition, specifically to the education domain as remote teaching (ERT) (Bozkurt & Sharma, 2020; Nassr et al., 2020). Respectively, ERT's uniqueness is the new response phase discovery for the COVID-19 pandemic due to its global impact on the education sector, without prejudice at any level. As opposed to the prior crisis, the local effects were due to events like earthquakes, protests, severe floods, conflict, Ebola, and SARS.

The second problem lies in the status and level of assessment necessity in relation to the teacher and the student. The COVID-19 pandemic sample crisis initiates learning assessment adjustment activities. Applying online evaluations to courses meant for face-to-face instruction is challenging. The major challenge is the struggle to evaluate learners using the continued existing assessments that are assigned in a normal situation (Mumtaz et al., 2021). The worst adjustment occurs when the assessment is cancelled and the institution has to claim it as less important (Burgess & Sievertsen, 2020). Furthermore, during ERT, an assessment was identified from two (2) different perspectives (Jankowski, 2020a). First, since assessment is optional, it was set aside while professional development focused on online instruction and technology rather than on assessment or learning. Secondly, the administration should consider skipping the evaluation if it causes the faculty to be overburdened under normal circumstances and the grading evaluation letters to pass and fail are diverted (Jankowski, 2020b; Means & Neisler, 2020; Watermark, 2020). The learners were given the option of grading their assessments using pass-fail or grading conventions in detail (Means & Neisler, 2020). 60% might have opted for grading pass-fail to

grade, 6% chose mandatory pass-fail, and 34% had no choice but to continue receiving a letter grade (Means & Neisler, 2020). For example, in reaction to the Canterbury earthquake, the final test and take-home assignment had been cancelled and their weighting were redistributed among other evaluations (Agnew & Hickson, 2012).

Thirdly is the assessment methodology and pedagogical. During COVID-19, various adjustments had been made according to several different case studies. Most case studies were based on surveys. Henceforth, the assessment was done in light of the learner demand (Jankowski, 2020b; Rice, 2020), frequent technology use (Rice, 2020), the extension of the report deadline (Jankowski, 2020b; Rice, 2020), and the modification of assessment planning activities for the future (Rice, 2020). Furthermore, educators must also be flexible when determining the number of outcomes they assess (Watermark, 2020). On top of that, the necessity of a management assessment system is made much more pressing during a crisis (Watermark, 2020). The increased workload and pressure during a crisis can lead to a breakdown in communication, decision-making, and collaboration. Uniquely, there is also an assessment approach to capture a wide range of learner learning evidence, including field experience and other clinical practice measures (Watermark, 2020). Moreover, formative assessments are used, and surprisingly, the students performed well on tests and quizzes (Chen et al., 2021). Another viewpoint claims that assessments can be roughly divided into timed, remotely proctored exams, and open-ended tests (Guangul et al., 2020). A variety of learning management systems, such as series of quizzes, open-book, take-home assessments, professional presentations or demonstrations, annotated bibliographies, fact sheets, and e-portfolios can be used to administer remotely proctored exams. Meanwhile, open-ended assessment is another applicable concept of E-Assessment. The valid concept of open-ended assessment is suggested based on 11 guidelines: ask more conceptual questions; eliminate multiple-choice and fill-in questions; change the numbers, names, or scenarios if using problems from textbooks; randomize discrete parts of the problem when applying for an exam; avoid questions that consist of only simple computations; clear about the rules for take-home exams; remind students of the academic integrity policies; ask learners to sign the college academic integrity intent prior to the take-home exams; set time limits for the take-home exams to prevent contract cheating and help seeking; and offer learners to ask for clarification when necessary (Guangul et al., 2020).

On top of that, as more and more educational institutions and organizations move towards online learning and remote assessments--crucially because of emergency transition--cheating is a growing concern (Daniels et al., 2021; Durcheva & Rozeva, 2019; Gamage et al., 2020; Hamdan et al., 2021; Hickson & Agnew, 2013; Hosseini et al., 2020; Meccawy et al., 2021; Ng, 2020; Peytcheva-Forsyth & Aleksieva, 2021). However, the study's findings showed that the three contexts under study--face-to-face exams, submission of paper assignments prepared without a teacher, and submission of online assignments without the presence of a teacher--have different effects on the opportunities for dishonest behavior in assessment. Nevertheless, technology primarily modifies cheating methods rather than promoting academic lying or dishonesty (Peytcheva-Forsyth & Aleksieva, 2021).

It is crucial to note that there are indeed two main approaches--learner academic integrity and software-based

measures—for preventing and verifying cheating in online assessments. According to Hosseini, the important contributing factors to academic integrity include learner behaviors, attitudes, perceptions, understandings of deserving greater attention, and the effectiveness of institutional practices in helping students avoid academic misconduct (Hosseini et al., 2020). As a result, students who commit academic misconduct for the first time will, at the very least, be given a "0" for their task, or the lecturer may award an "F" to them for the course. Additionally, the specific institution enforced their code of conduct and severely penalize individuals who violated it (Meccawy et al., 2021). Not limited to the learner, Meccawy stresses that the educator has been trained to detect the cheating method. In addition, a case study by a researcher showed that learners prefer face-to-face assessments because educators transfer their experiences and methods for evaluating students from face-to-face to online settings without adapting and changing for the latter's particulars (Peytcheva-Forsyth & Aleksieva, 2021). Furthermore, the educator can create and ask a different set of questions as another manual for use in online assessments to prevent cheating (Verhoef & Coetser, 2021a).

Ideally, software-based measures should emphasize two timelines; pre-cheating and post-cheating. As an example, Turnitin (or text similarity) is used as a post-cheat software. On the contrary, pre-cheating or online monitoring software based on automated monitoring that runs on the computer of the test-taker can automatically analyze the data from their screen, video, and audio stream to notice any undesired activities (ProctorEdu, 2023). These, nevertheless, may end up being ineffective and reduce lecturers' statuses from educators and instructors to policing officers (Verhoef & Coetser, 2021a).

## **The Recognition of New Normal Phase**

New normal phase is getting significant now that COVID-19 has brought about the prolonged suspension, cancellation program, and uncertainty. Although the phrase “new normal” is not new, it requires exclusive attention as a consequence of the pandemic. On the other hand, moving forward for crisis preparation and adaptation without suspension or cancellation is a solution for sustainability and reliability. Previous research claims that the new normal, which has been defined and applied to the diversity of climates or the occurrence of weather events, is not what it used to be (Lewis et al., 2017; Trenberth et al., 2015). In contrast, when this differs from the scenario that existed prior to the commencement of the crisis, a new normal is a state to which an economy, society, and others settle after a crisis (International Labour Organization, 2020). It is used to compare to the normal situation or an old normal. Additionally, the research of COVID-19 in education has identified a particular new normal term as a way in which education is anticipated to occur in the post-COVID-19 era that will be distinct from the manner education was typically exercised during the pre-COVID-19 days (Xiao, 2021). The new normal phase has brought about several changes to the way education is delivered, including the increased use of technology and online platforms, the adoption of new pedagogical approaches that emphasize student-centered learning, and the recognition of the importance of mental health and well-being in the learning process. Therefore, it is important to adjust every single aspect, including E-Assessments in teaching and learning.

## Methodological of Analysis

The purpose of this article is to demonstrate the method applied for article analysis, which helps with the construction of the E-Assessment model development. It is useful to ensure that the associated track is followed in a way that allows for the systematic and target-oriented development of the E-Assessment model. It is important to preview the model that has previously been thoroughly explored based on four main factors: objectives, conceptual criteria, approaches, and procedures. In actuality, the respective factors have been extracted from ten (10) different E-Assessment models throughout the course of eleven (11) years of updates. Subsequently, it is anticipated that the criteria will assist in establishing a reference methodology flow scheme that is legal to practice. Therefore, the flow scheme that can be referred to is in Figure 1 below.

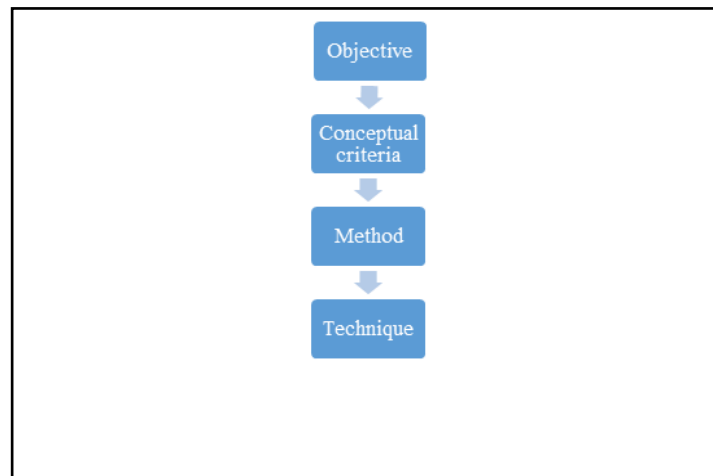


Figure 24. Methodology of Flow Scheme

On the other hand, Table 1 shows the range of eleven (11) years update from 2009 to 2020. Therefore, the significant trend of environment discovery for the E-Assessment model is in the pre-crisis or normal case. The development is well-planned in mode. To date, there is no preparation to deal with environmental uncertainties within the associated time frame. Therefore, the exploration is attempting to delve in-depth into another associated factor.

Table 1. E-Assessment Models

Reference	Title	Environment Discovery
(Schiller, 2009)	Practicing Learner-Centered Teaching: Pedagogical Design and Assessment of a Second Life Project	Pre-crisis
(Sewell et al., 2010)	Online assessment strategies: A primer	Pre-crisis
(McCracken et	Principled Assessment Strategy Design for Online Courses and	Pre-crisis

al., 2012)	Programs	
(Tinoca et al., 2013)	A conceptual model for E-Assessment in Higher Education – authenticity, consistency, transparency, and practicability	Pre-crisis
(de Villiers et al., 2016)	Principles of Effective E-Assessment: A proposed model	Pre-crisis
(Barana & Marchisio, 2016)	Ten good reasons to adopt an automated formative assessment model for learning and teaching Mathematics and scientific disciplines	Pre-crisis
(Padayachee et al., 2018)	Online Assessment In Moodle: A Model For Supporting Our Learners	Pre-crisis
(Amante et al., 2019)	E-Assessment in Portuguese Higher Education: Model and Perceptions of Teachers and Learners.	Pre-crisis
(Pauli & Gill, 2020)	The Future of Assessment: Five principles, five targets for 2025	Pre-crisis
(Philips et al., 2020)	New Digital Assessment Model and resource gateway	Pre-crisis

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When the needs and abilities of two direct stakeholders, the learner and the educator, are synchronized on concepts, activities, and learning outcomes by technology, device, and application support, this offers another intriguing perspective that is able to advance smart education. The chaos in teaching and learning in response to the crisis trigger on survival with a minimum of or without achieving the targeted learning outcome and concept, as well as the level of technological familiarity and devices, come first.

## Analysis Component

The analysis component is capable to explore the E-Assessment model from multiple scholars in depth and with interest. On top of that, the justification of the model development should be clear so that other scholars may use it to enhance on a different perspective in order to collaborate, upgrade, or improve prior limitations. The specification must therefore include the criteria for the objective, concept, method, and approach.

## Objective

Initially, the necessary objectives of the previous studies need to be described. Based on the main purpose of development, the trends of model construction can be categorized into two: first, the intention to meet the needs and requirements of the direct stakeholders; and second, the advancement of technology movement. Hence, nine (9) models that fulfilled the needs and requirements of the direct stakeholders, such as learners, instructors, educators, or course designers, were reviewed (Amante et al., 2019; Barana & Marchisio, 2016; de Villiers et



al., 2016; McCracken et al., 2012; Padayachee et al., 2018; Philips et al., 2020; Schiller, 2009; Sewell et al., 2010; Tinoca et al., 2013). As a result, the model's priority is designed from the perception of the medium and the lowest hierarchy of stakeholders. Moreover, there are direct implementers who react to the viability of the adopted model. Most of the selected models believe that the adaptability of both educator and learner is the main preference when the indicated elements of concept are to optimize performance of the implementer. In contrast, there was a single E-Assessment model that aimed to facilitate technological innovation with human factor ignorance (Pauli & Gill, 2020).

Therefore, for the objective justification of the model, the limitations of the learner and the educator as a result of crisis should be taken into account.

### Concept

The next component or concept involves the highlighted factors of the associated E-Assessment conceptual model. The factors are represented as an element, a dimension, a principle, or a strategy. They are compulsory components because they serve as the main reference for activity design and learning outcomes. The justification of the activities must be in line with the factors that have been assigned so that changes in activities are controlled consistently to achieve the desired result. With respect to the crisis situation, the reference of E-Assessment conceptual model to be used for drastic transition activities during emergencies is still unclear. In addition, it can be challenging to ascertain the rationale for the emergency transition criteria, which executes the suspension of physical teaching and learning. E-Assessment is therefore a viable option for surviving in an online platform.

The factors that are regularly implemented in the preceding models must therefore be addressed first. However, it is crucial to note that the implementation is limited for pre-crisis environments. For each model, various factors have been incorporated. However, the factors that are most consistent may be adopted in the future model. If the same element appears frequently in at least two (2) separate models, it is to be introduced into the future model. The Schiller model in Table 1 is thus excluded from Table 2 because the dedicated factors are inconsistent with other models. According to Table 2's authors (Amante et al., 2019; Barana & Marchisio, 2016; de Villiers et al., 2016; McCracken et al., 2012; Pauli & Gill, 2020; Sewell et al., 2010; Tinoca et al., 2013), the consistent factors are authenticity, responsiveness, practicability, adaptation, transparency, alignment, and affordance. Six (6) models established authenticity, four (4) models established responsiveness, two (2) models established practicability, adaptation, and affordance, and three (3) models employed transparency and alignment. Despite the consistency of the appropriate factors utilized at least twice, there is no assurance of robustness in the context of the pre-crisis, crisis, and post-crisis phases. Therefore, it is relevant to propose an additional new factor that will influence each of the selected factors to be sufficiently functional and effective throughout all phases. Table 2 lists seven (7) factors of nine (9) E-Assessment models. The keyword of terms is elaborated in Table 3. Moreover, definitions of represented factors are concluded based on the selected models. (1) authenticity refers to the use or application of actual contexts and real tasks in learning and E-Assessments while

taking situational constraints and the online environment into consideration, (2) responsiveness refers to the speed and quality of feedback in E-Assessments that is timely, informative, and encourages positive attitudes towards future learning amongst students in the online environment, (3) practicability refers to the feasibility of the E-Assessment strategies in terms of effective management and assessment complexity from stakeholders' perspectives. This dimension is particularly important to design E-Assessments competently and efficiently given the complexity of its design in the online learning context, (4) adaptation to the application of multiple E-Assessment approaches including platforms by allowing a diverse range of opportunities for students to adequately exhibit learnt competencies and skills, and to enhance their learning to address the limitations of online assessments, (5) transparency refers to the explicit description and mutual comprehension of E-Assessment criteria, goals, procedures, and expectations by both educators and learners, (6) alignment refers to the learners' ability to demonstrate that they have achieved the learning outcomes in E-Assessments, and (7) affordance refers to the E-Assessment management system's capacity to deliver formative, diagnostic, or summative assessments and feedback, similar or equal to alternative technologies or assessment tools.

Table 2. The E-Assessment Model Factors

	Factor	Auth	Res	Pra	Ada	Tra	Ali	Aff
Nu	Author							
1	(Sewell et al., 2010)	√	√					
2	(McCracken et al., 2012)	√	√			√	√	√
3	(Tinoca et al., 2013)	√		√		√		
4	(de Villiers et al., 2016)	√			√		√	√
5	(Barana & Marchisio, 2016)		√		√			
6	(Padayachee et al., 2018)							
7	(Amante et al., 2019)	√		√		√		
8	(Pauli & Gill, 2020)	√						
9	(Philips et al., 2020)		√				√	

Table 3. Terms and Keywords for Factors

Num	Term	Keyword
1	Aut	Authenticity
2	Res	Responsiveness
3	Pra	Practicability
4	Ada	Adaptation
5	Tra	Transparency
6	Ali	Alignment
7	Aff	Affordance

## Method

In these particular models, the incorporation of various methods was applied, including mixed quantitative and qualitative methods. In addition, experience is the most crucial factor to be assessed when justifying the validation method with reference to the nine (9) selected models. The role and the experience are two more aspects on the criteria that will be considered as the approach is developed.

Due to an experience factor, 70% of the models were validated wholly (pure-method) or partially (mixed-method) by qualitative techniques (Barana & Marchisio, 2016; de Villiers et al., 2016; Philips et al., 2020; Schiller, 2009; Sewell et al., 2010; Tinoca et al., 2013). In contrast, 20% of the models (Amante et al., 2019; Padayachee et al., 2018) used quantitative approaches. Although Padayachee E-Assessment model adopted a quantitative approach, it is important to note that the categorization of questions has been divided into two (2) distinct categories, namely open-ended and close-ended, to accommodate the stakeholders' varied and broad experiences (Padayachee et al., 2018). In contrast, Barana and Marchisio's only study employed close-ended questions to measure experience (Barana & Marchisio, 2016). Furthermore, a unique case occurred when Pauli and Gill conducted their study using the rationale of professional experience to produce the outcome of an E-Assessment model (Pauli & Gill, 2020).

On the contrary, the main respondents involved were from five (5) different stakeholders, including educators, instructors, learners, and course or content designers. Despite the fact that there were many different stakeholders, the problem solving strategy was started from the bottom up by taking into consideration the experiences of each stakeholder.

## Technique

These techniques indicate the meaningful assessment activities that are pertinent to the concept mapping (Gaytan & McEwen, 2007). Furthermore, numerous studies concur that one of the assessment techniques' capabilities is to be exemplary and guide learners towards achieving the desired learning outcomes in a virtual environment (Kucina et al., 2014; Sewell et al., 2010). As a conceptual evaluation guideline, the eight (8) traits

of authenticity, difficulty, coherence, engagement, respect, responsiveness, rigor, and validity are evaluated with exceptional precision (Huba & Freed, 1999). Meanwhile, the learning experiences that learners have while using the learning strategies contribute to the ultimate learning outcome, including what they have learned and how effectively they have learned it (Weimer, 2002).

E-Assessment and innovation are being used in a variety of effective ways, which strengthens their capacity to drive learning processes and outcomes (Romeu Fontanillas et al., 2016). If an E-Assessment activity adheres to the assessment standards, learning objectives, and applicable E-Assessment guidelines, it is deemed to be fully compatible (Tinoca, 2012; Wuisan & Wibawa, 2019). Various E-Assessment strategies, assignments, and evaluators should also be included. E-Assessment could be viewed as reliable if it is assumed to be constant. (SAQA, 2001). Therefore, there is validity in the correlation between three (3) different perspective criteria, namely assessment techniques, learning outcomes, and concepts, with consistency being the primary criterion.

Unfortunately, adopting the alternative assessment activities as a crisis response without violating pre-crisis principles has avoided the issue of alignment status from the perspective. Constructing the activities through the learning outcomes and the concept is the key step in the creation of assessment using the bottom-up methodology. The precise correlation between assessment activities, learning outcomes, and concept criteria is henceforth shown in Figure 2, which is shown below.

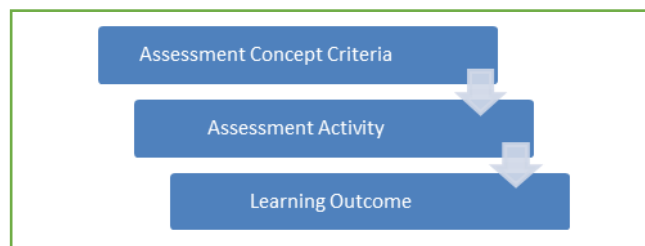


Figure 2. The Correlation Component of E-Assessment Model

## Conclusion

With the advent of technology, it has been seen that the numerous E-Assessment conceptual model developments have produced the climactic result for quality learning. On top of that, it has the ability to generate an efficient assessment that benefits the learner, instructor, and educator, as well as a layer for implementation effect.

It is crucial to note that prior studies only discovered instances of the development of an E-Assessment conceptual model in usual circumstances. It is intriguing to note that according to mathematical perspectives, the pre-crisis and the crisis meet in the new normal phase. First, directly duplicating the offline assessment activities to the online environment will raise reliability and validity concerns as this approach is utilized to raise

performance and learning standards. Second, there is a possibility that misalignment occurs when amendments to assessment activities are not in line with learning concepts and outcomes in a way that allows for continual progress for survival. To reset the significant factors that complement both phases, a novel solution known as the normal phase has been devised. Figure 3 is a new normal Venn Diagram that might help to visualize the concept of phase complementary.

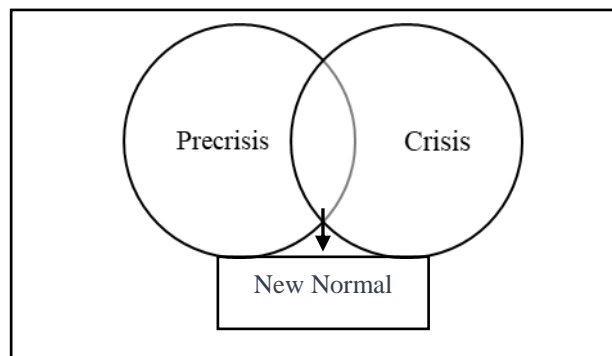


Figure 3. The New Normal Phase in Venn Diagram Imagination

An E-Assessment case study during an emergency determines that it is supposed to tolerate or be flexible with learning outcomes in order to survive (Reimers & Andreas, 2020). However, can the assessment method survive and still produce optimum quality with unparalleled concepts and activities? Accordingly, a study concluded that designing the assessment becomes an intriguing choice when offline assessment cannot be substituted by an online assessment with the same learning outcomes and concepts utilizing a technological approach (Joshi et al., 2020). Due to the critical phase of the multiple detrimental effects on teaching and learning, we also need to accept that now is the moment to utilize the complementary nature of offline and online platforms.

Additionally, a process and procedure for assessment should be designed that can be used with both platforms without the need for an emergency adjustment phase and is dependable to take into account any circumstances in the new normal phase. This kind of planning can quantify the degree to which online and offline platforms complement one another. It is vital to establish that flexibility is the main factor that able to influence the seven devoted factors that conceptual E-Assessment model relies on to endure the tolerability of emergency in the new normal phase. On top that, this is a novel solution to remain consistent and relevant with both phases and technological orientation.

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## The Impact of Preschool Education on the Administrative and Educational Competencies of Students in the First Cycle of Basic Education in Oman


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**Abstract:** The research used a descriptive-analytical method and a sample of (350) female field teachers to examine the effects of preschool education on the administrative and educational competencies of students in Oman's first cycle of basic education. The research came to the following conclusions: Students who entered preschool education had a high arithmetic average of (3.93) for administrative competencies, and their educational competencies were also rated highly as the arithmetic average reached a high level (3.85). Administrative skills were ranked in the following manner for the first axis: (Planning, Communication, Organization, and Leadership). In terms of the second axis, which is concerned with educational skills, the study's results for reading, listening, and writing all fell within a high degree (3.67–4.09) of the arithmetic mean. This result is consistent with many international studies and trends in all countries, which concurred on the significance of the preschool education stage. Despite its significance, the research indicated that this stage is still optional in the Sultanate of Oman. The research suggests that the Ministry of Education makes preschool education mandatory by supplying and utilizing all the resources.

**Keywords:** Preschool education 1, Administrative competencies 2, Educational competencies 3, First cycle 4, Basic education 5.

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### Introduction

Childhood is a crucial stage in a person's development because it has been shown by numerous researchers and psychologists to have an impact on a child's personality (Abdul Hadi, 2006), and numerous studies have shown

that the idea of education at this stage is attractive to scientists and researchers. (Lonis, Abdullah, 2019). Early childhood education is a field of educational theory that deals with the formal or informal instruction of children from birth to age eight. It is also referred to as primary education or preschool education. (Mcdevitt, 2016). In most societies, this stage results in reading difficulties, and in some other societies, their prevalence is believed to be between 15% and 20%. (Qarhoush and Bedawi, 2020).

The studies done by researchers on preschool children and the effects of their education and academic achievement and the importance of preschool care (2018, Becton) prove the significance of the kindergarten stage in developing the child's personality and giving them various learning skills like reading and arithmetic skills as well as the development of their multiple intelligences: such as intelligence Mathematics, visual intelligence, and linguistic intelligence. (Rasmi, 2019). This was supported by the studies of Bazrawi (2021) and Al-Saedi (2020). Numerous research studies point to the importance of the kindergarten stage on the one hand and the importance of learning reading skills on the other as a gateway to learning other educational materials, a tool for self-expression, feelings and needs, and a tool for social communication.

We are driven to give this kind of education particular attention for a number of fundamental reasons that led to the establishment of kindergartens. Al-Qabbali (2021) and Abu Hassoun (2021) outlined these as follows: social goals, which entail fostering a supportive social setting for children to interact in, and they simultaneously experience Children whose parents hold certain types of jobs, with a home environment that makes up for the things they used to find in their families, and with a fundamental psychological drive that shapes the child's personality by fostering a sense of balance and through which it has a significant influence on how the child will live their next life, as well as a drive for education that is crucial and does important work. The process of preparing a child for the new environment of classroom learning includes kindergarten.

Consequently, the study's significance is clear. determining how preschool education affects first-cycle elementary school pupils' administrative skills (leadership, communication, organization, planning). To identify the quality of preschool education, its current curricula, and their role in highlighting the educational and administrative personality of the child, as well as to identify the role of preschool education in developing educational competencies (reading, writing, and listening), as well as to come up with a good recommendation for pre-school education in those skills.

### **Theoretical background**

The child was put at the fore of the future of nations and the cornerstone of their formation due to the various changes that affected societies in various social, political, and cultural areas (Al-Mufti, 2006). Care for the child and his childhood and caring for him are necessary for him to grow up as a healthy and balanced individual. This concern is not limited to the educational and health aspect only, but also includes the educational aspect, especially the linguistic aspect. Many different events affect the development of their personality, language, and morals. (Bel Abbasi, 2020) I concur that the majority of educational scholars emphasize the significance of

kindergarten as a stage that comes before the first stage of education. (Abdul Wahed, 2015).

One of the most crucial times in a person's existence is kindergarten. The importance of this stage must be accompanied by a growing belief and conscious appreciation of the enormity of responsibility and the highness of the message that kindergarten teachers aspire to because of its significant impact on what will come in the subsequent educational stages and because it is during this stage that the child's personality is formed; one of the most crucial components for accomplishing kindergarten objectives (Souman, 2014). According to Prestige (2021), this stage is the child's first interaction with the outside world and the beginning of personality development as the child learns about society, forms relationships apart from his family, and starts to pick up new skills.

As a result, we discover that childhood is the first crucial stage in a child's life during which he or she learns about the world around him and displays his or her feelings, behaviors, and mental abilities. Numerous studies have also shown that education imparts a variety of skills that help a person develop their perceptions, and they have all emphasized the significance of pre-school education. (Abdullah, 2019). The Ministry of Education in the Sultanate of Oman has not disregarded this, as it has given early education great attention, worked to increase enrollment rates in early education institutions by encouraging investment in private education, and implemented the (preparation classes) project in some government schools of the first cycle in the academic year (2005/2006). (1-4). The Ministry has also worked on developing a unique curriculum for this level. (Al-Rahbiyah, 2018).

Statistics show that there is a noticeable increase in these institutions and an increase in the enrolment of children in early education institutions, as the number of children enrolled in the academic year 2021–2022 reached (71018), and as a result, the number of female teachers in these institutions increased (Yearbook of Education Statistics, 2021/2022). The education of children in the Sultanate of Oman is provided by private early education institutions, which are constantly expanding.

### **The development of preschool education**

The evolution of education and care from birth until the eighth year throughout history can be seen in the history of early childhood education and care. (UNESCO, 2006). Ibn Sina wrote in his book *Al-Qanun* about the necessity of working to give the child the opportunity to play until he turns six, just as Imam Al-Ghazali loudly proclaimed the need to work to make space for the child to play without affectation, signaling the beginning of the Arabs' interest in studying the characteristics of children. (Hariri, 2015) Additionally, the researcher Comenius (1592-1670) thought of working to establish schools for young children, as well as work to take care of them and give them special care. He worked on the necessity of entertaining the child, in addition to educating him, and he also thought of working to establish schools for children. (Badran, 2000).

The Berry Pre-School Project, which was implemented in the 1960s in Ypsilanti, is one of the oldest social

experiments in the field of early childhood education. It has had a significant impact on politics in the United States of America and around the world. 128 children were subjected to an experiment in African Americans bet, and before 1960, the method of educating young children was carried out in the first place as being within the responsibility of families within the home. This population was divided into a treatment group and a control group at random. Active study days during the week for the therapy group included 2.5 hours per day of instruction. The goal is to enhance parent-child interactions at home in addition to instructors' weekly 1.5-hour visits to the kids' homes (Our, 2019; Council, 2015; Schweinhart et al., 2005). (Heckman, and all, 2019).

Preschool education changed in terms of growth and development rather than remaining in its familiar shape. The first person to work on creating a prestigious kindergarten was Ferdik Frewell from Germany, and that was in the first part of the twentieth century, starting in 1984 AD. (Al-Duailij, 2008). Since 2004, the majority of American preschoolers spend a portion of their days away from their parents, the majority participate in some kind of center-based program before entering kindergarten, and in 2001, 52% of three- and four-year-olds were enrolled in preschool or another program. Prior to starting school, the enrollment percentage for four-year-olds in 2001 matched that of five-year-olds in 1970. (Alaa, 2020).

As a result of their favourable effects on children's behavior and educational achievement, pre-school and kindergarten are regarded as essential factors that must be taken into account. Despite the fact that kindergarten and pre-school education are extremely important, the ministries in charge of education did not want to make this period of a child's life mandatory by working to organize kindergartens and provide their study materials. (Hourani, 2022).

### **The importance of Preschool education**

The preschool education stage is a crucial one in a child's life because it prepares them for entering a new environment—the official school environment—with its established rules, procedures, and topic laws. At this stage, the child learns some fundamental abilities that will help him later in life as he embarks on his next educational adventure, both psychologically and emotionally. (Al-Qebzi, 2022). As a result, its significance can be seen in what it does to create a diverse learning environment, which is based on games like disassembling and reassembling and other technical tools like educational spaces and corners that are intended to foster children's mental and skilled development. (Schuman, 2008).

Because this stage, according to psychologists, is the crucial one that shapes the student's personality, it must meet special standards in terms of buildings, facilities, and spaces such as playgrounds, gardens, and equipment. This stage is regarded as the fundamental preparation for the child to accept the school later. In order to practice all activities that achieve integration, balance, and inclusion of the various aspects of the child's personality development (physical, cognitive, linguistic, and social), it is also necessary to take into account their physical, cognitive, emotional, and social characteristics. As a result, the idea of integrated education is achieved by implementing all fundamental activities. ( Atef, 2005).

The significance of kindergarten lies in its ability to inspire and support the development of pre-school students' administrative and educational competencies in a variety of skills (mental, social, emotional, skilled...) that make up the child's administrative and educational life and aid in its refinement in various ways and multiple ways, and among those are: The following fundamental abilities help children improve their administrative and academic competencies: (Rehab, 2005), (Al-Arabi, 2012), (Tarik, 2008), (Abdul Qader, 2007), and (Karkoush, 2008) (Mustafa, 2009).

**Language skills:**

The development of language skills starts at a young age. Children don't start out speaking a language, but after 10 months they can recognize speech sounds and speak in the baby's language. Children typically acquire receptive language skills before oral or expressive language abilities. The internal processing and comprehension of language in the brain are known as receptive language skills. Al-Nashif (1996) divided these skills into speaking, listening, listening, reading, and writing and explained that it is important to deal with each skill separately in order to provide the child with the appropriate activities. As receptive linguistic abilities continue to grow, the expressive (spoken) language begins to develop slowly. This was supported by the research of Karkoush (2008), who found that language plays a significant part in interaction between children and others and has a relationship to other skills.

**Technical skill:**

Technical methods are one type of self-expression, and they give the child a variety of ways to learn, which in turn aids in the development of his skills and views of creativity and imagination. Therefore, the child's drawing process is a complex process in which the child combines multiple forms and different symbols from his prior experiences and experiences to make something new and meaningful out of them (Abdul Aziz, 2016). He views artistic activities as a dynamic and comprehensive process with a vital role in educating children. She emphasizes that every action a child takes is motivated by a desire to accomplish an objective. As a result, we discover that when we make comments about someone's behavior, he responds in a manner that makes sense. In actuality, we were the ones who were unable to comprehend the reasons behind his actions and what motivates him to do them. With this task, we need to understand the purpose or significance of a particular behavior in order to explain it.

**Social skills:**

Whereas these abilities are viewed as a fundamental pillar that influences a child's personality in the preschool stage, through which the child can engage with others, integrate with them, play with them, and work alongside them to achieve goals, as well as learn the concepts of self-independence and self-reliance. In many of the jobs and duties he completes, he also gains the ability to engage in play, problem-solving, and emotional participation with his peers. The ability of a child to communicate and interact with his peers in a tactful, respectful, and intelligent manner as well as the capacity to handle situations, whether positive or negative, and appreciate conversation are referred to as social skills. Therefore, it is crucial for children in pre-primary education to develop and acquire social skills. Accepting the other can also help people overcome traits like

stubbornness, loneliness, and timidity. According to Al-Farhat (2014), social abilities are helpful in a variety of ways, which I have outlined below:

- One of the most crucial elements in assisting children in their process of social assimilation within the groups to which they are innately belonged as well as society is their social skills.
- Children who possess social skills are better able to solve many of the issues they face and control how they engage with others.
- Children who have social skills appreciate the activities they participate in and meet their psychological needs.
- Children who develop their social skills have greater liberty, self-reliance, and enjoyment of their free time.
- Children who are socially adept are more likely to participate in activities that are within their realm of competence and to develop their own sense of self-worth.
- Developing social skills, the ability to engage positively with fellows, and engaging in creative and innovative endeavours within the confines of their mental and physical capacities.

**Study Procedures:**

**Research Delimitations:**

**The topic:** Preschool education

**The implementation timeframe:**2022/2023.

**The Study Population:** The study population represents basic education female teachers in the first field in the schools of the first cycle from (1-4) and their number is (5802) according to the statistics of the Statistical Book of the Ministry of Education for the year (Ministry of Education, 2022).

**The Study Sample:** The sample of the study was chosen randomly, and it consisted of (350) female teachers in the first field of basic education schools, the first stage from (1-4).

**The Scale:** The researcher used the five-point Likert scale, which is symbolized by: (Lowly agree - Moderately agree - Highly agree - Disagree - Strongly disagree). Where the data were coded according to the following table:

Table 1. five-point Likert scale

average	1–1.8	1.81- 2.60	2.61–3.40	3.41–4.20	4.21–5
the level	very low	Low	Medium	High	very high

**The study instrument and its validity:**

The study tool was created by the researchers by creating and constructing a tool that was derived from other

tools, and before applying the tool, it was displayed to (5) experts as the tool initially comprised of (2) axes and (35) items: (19) items. The tool's final version included (16) items in the first axis for administrative competencies and (12) items in the second axis for educational competencies. Following the experts' process, the researchers made changes in accordance with what they had noticed.

### The study instrument stability

The tool was given to roughly (60) male and female teachers from different basic education schools during the first cycle in the Sultanate of Oman to evaluate the tool's validity. The results are shown in the accompanying table.

Table 2. The stability of the study tool

#	Domain	Items	Stability coefficient
1	Administrative Skills	16	0.83
2	Educational skills	12	93
	<b>the total</b>	28	0.86

According to Cronbach's alpha scale, which measures the coherence of the tool's expressions, the average value obtained by the previous axes, which is (0.86), confirms that the stability coefficient of the two axes came close to and is categorized with high stability as shown in Table 2.

### Data Analysis

After being pulled by Excel, the data were encoded by the well-known statistical program SPSS. What percentage of elementary education students who got preschool instruction are currently using administrative competencies? The arithmetic means and standard deviations for the percentage of basic education students who got preschool instruction were extracted to provide an answer to this query.

Table 3. Arithmetic means and standard deviations for the competence of administrative

#	Items	SMA	SD	level	Order
<b>Leadership</b>					
1	The personality of the student within the class tends to lead his classmates	3.08	0.879	Medium	16
2	The student likes to dominate his peers	4.22	0.889	Very high	2
3	The student relies on himself to complete the work assigned to him.	4.15	0.799	High	4
4	The student can influence his fellow students.	3.20	0.878	Medium	15
<b>Connection and communication</b>					
5	The student is excited to participate and discuss the class	4.20	0.895	very high	3
6	The student loves to participate in the school's social and	4.12	0.887	High	5



recreational activities					
7	The student is characterized by a cheerful and jovial spirit in the classroom.	3.94	0.678	High	12
8	The student has an interesting style while speaking.	4.00	0876	High	10
Organization					
9	The student is distinguished by keeping and organizing his tools	4.11	0.923	High	7
10	The student maintains a good appearance and behavior	3.65	0.789	High	14
11	The student is calm and disciplined in class and school	3.90	0.897	High	13
12	The student organizes his speech when answering questions	4.10	0.854	High	6
Planning					
13	The student attends his daily lessons continuously.	4.23	0.823	very high	1
14	The student directs his answers towards the given question.	4.03	0.678	High	9
15	The student plans future classes accurately	3.97	0.874	High	11
16	Few errors occur from the requester during execution	4.09	0.789	High	8
<b>The Total</b>		3.93	0.826	High	

As shown in Table 3, the average of the administrative competencies axis had an arithmetic mean of (3.93) and a standard deviation of (0.826), which denotes a high degree. Accordingly, the planning-related item No. 13 ranked first with an arithmetic mean of (4.23) and a standard deviation of (0.823), which denotes a very high degree. The second order definition of leadership is "the student likes to impose his control over his peers," with an arithmetic mean of 4.22 and a standard deviation of 1. (0.889).

Item (3) regarding leadership, the student relies on himself in carrying out the tasks entrusted to him in the fourth order, with an arithmetic mean (4.15) and a standard deviation (0.799), it is of a high level. Item (5) related to communication, the student is enthusiastic about participation and class discussion, came in the third order, with an arithmetic mean (4.20) and a standard deviation (0.895), which represents a high degree level. The researchers explain this by saying that the students have developed a self-reliant society. The student can impact his fellow students, according to leadership item #4. It has an average level with an arithmetic mean of 3.08 and a standard variation of 0.879. This, according to the researchers, is since kids at this age are all striving for glory and elevation, and it also demonstrates that students have a certain degree of awareness thanks to kindergarten.

To answer to the second question: "What is the degree of the practice of basic education students of educational competencies who receive preschool teaching?", The arithmetic means and standard deviations were extracted for the degree of basic education students' practice of educational competencies who received preschool teaching as shown in table (4).

Table 4. Arithmetic means and standard deviations for the educational competencies axis.

#	Items	SMA	SD	Level	Order
<b>Reading</b>					
1	The student reads the words correctly	4.27	0.846	very high	1
2	The student pronounces the letters according to their correct exits	4.25	0.889	very high	2
3	The student reads the texts consecutively without mistakes	3.99	0.799	High	5
4	The student distinguishes between the pronunciation of consonants.	3.87	0.878	Medium	7
<b>Writing</b>					
5	The student wrote the words correctly	4.15	0.895	High	3
6	The student differentiates between writing hamzas in the word.	3.36	0.887	Medium	11
7	The student draws the letters correctly	3.98	0.678	High	6
8	The student distinguishes between the tied and the open "T".	3.20	0.876	Medium	12
<b>Listening</b>					
9	The student listens carefully while listening.	4.09	0.923	High	4
10	The student answers the teacher's questions after listening.	3.85	0.789	High	9
11	The student remembers a lot of the information he listened to.	3.70	0.897	High	10
12	The student analyses the situations listened to carefully.	3.84	0.854	High	8
<b>The Total</b>		3.85	0.839	High	

The average of the educational skills axis had an arithmetic mean (3.85) and a standard deviation (0.839), which is a high degree, according to table (4). The reading-related item No. 1, "The student reads the words correctly," appeared in first place and had an extremely high degree of accuracy (arithmetic mean: 4.27; standard deviation: 0.846). The researchers' credit this to the student's kindergarten instruction in word reading and the effective reading curricula because it shows the child's family's ongoing interest in and commitment to correct reading, and phrase No. (2) showed up. In relation to literature, "The student pronounces the letters according to their correct exits" came in the second place, with an arithmetic mean (4.25) and a standard deviation (0.889), which represents a very high degree.

A high degree level was also demonstrated by item (5), which was linked to reading and in which the student correctly spelled the written words. This item appeared in the third order and had an arithmetic mean of 4.15 and a standard deviation of 0.895. The student pays close attention to what they are hearing as they attend, according to item (9). In the fourth position, with a high level arithmetic mean (4.09) and standard deviation (0.923). The habituation trait that the student gained during the preschool educational stage is credited by the researchers as the cause of this. The last thing was number four, which has to do with writing. The student distinguishes between the bound and open letters. With an arithmetic mean (3.20) and a standard deviation (0.876), which is of an average level. The researchers attribute this to the fact that the preschool stage is in which students find it difficult to distinguish between the pronunciation and writing of some letters, especially similar ones.

The answer to the third question: "What is the order of basic education students' practice of the educational competencies axis and the educational competencies who received preschool teaching?", from the arithmetic means, and standard deviations were extracted to arrange the axis of basic education students' practice of educational and administrative competencies who received pre-school teaching as follows:

### 1. Ranking of Administrative Competencies

Table 5. Arithmetic means and standard deviations for the administrative competencies dimension.

#	Domain	SMA	SD	Level	Order
1	Planning	4.08	0.791	High	1
2	Connection and Communication	4.06	0.834	High	2
3	Organization	3.94	0.865	High	3
4	Leadership	3.66	0.836	High	4
	<b>the total</b>	3.92	0.821	High	

The dimensions of administrative competencies were arranged in the following sequence using table (5): The first rank arrived at the planning axis with a high level of experience represented by an arithmetic mean (4.08) and a standard deviation (0.791). The second order arrived at the axis of connections and conversation with a high level of practice, as indicated by its arithmetic mean (4.06) and standard deviation (0.834). The organization axis came in third order with an arithmetic mean (3.94) and a standard deviation (0.865), and the leadership axis came in last order with an arithmetic mean (3.66) and a standard deviation (0.879), which represents a medium degree of practice.

### 2. Ranking of Educational Competencies

Table (6) Means and Standard Deviations for Ethical Leadership Dimensions

#	Domain	SMA	SD	Level	Order
1	Reading	4,095	0.836	High	1
2	Writing	3.67	0.833	High	3
3	Listening	3.87	0.865	High	2
	<b>The Total</b>				

The dimensions of educational competencies are listed in the following sequence according to table 6: The reading axis comes in first place with an arithmetic mean of 4.095 and a standard variation of 0.836, indicating a high level of practice. The listening axis, with an arithmetic mean of 3.87 and a standard variation, is in second place. (0.865). And the writing axis, which indicates a medium level of practice, came in last with an arithmetic mean (3.67) and a standard deviation (0.833).

## Conclusion

The study's findings concluded that students with basic education who enrolled in pre-school education for administrative competencies had high arithmetic averages (3.93), which are close to very high, and that they had high levels of educational competencies because their arithmetic averages reached 3.93. (3.85). This shows the confluence of the two skills and how these students' abilities were polished during the preschool years. Regarding the rankings of the skills within each axis, the research revealed that the administrative axis' ranks were as follows: (planning, connections, communication, organization, and leadership). It was discovered that each of these abilities was accompanied by a strong math average, demonstrating the significance of the preschool years for students. Reading, listening, and writing were ranked in that sequence on the second axis of educational skills, and all three of them scored highly and fell within the range of the arithmetic mean (4.09–3.67), demonstrating the significance of the preschool years.

'The study demonstrates that education has a positive effect on students not only from a scientific (academic) standpoint, but also in terms of the child's personal skills, which are crucial for developing the child's personality. Most international studies and trends in all nations concur on the significance of the pre-school education stage. Despite its significance, the research revealed that this stage is still optional in the Sultanate of Oman.

## Recommendations

- The Ministry of Education should take the full responsibility for early education, as this is a crucial time for forming a child's scientific and intellectual outlook on life.
- Carefully choosing the preschool education stage's course offerings to align them with Oman 20/40's vision and current educational trends worldwide.
- The selection of pre-school employees with bachelor's degrees in kindergarten studies.

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## Situating Scientific Literacy within the Context of a Pandemic

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**Abstract:** Society has increasingly looked upon science education to prepare the public for Industrial Revolution 4.0, as scientific reasoning and practices can hone 21st century skills, including scientific literacy. However, the COVID-19 pandemic has changed how science is taught and learned. Hence, this mixed methods study seeks to determine if there would be a significant increase in scientific literacy among undergraduate students after taking a six-week online course offered during the first year of the pandemic as part of their science education. It also aims to examine which aspects of the course offering students attributed, if any, their scientific literacy. Using a one-tailed paired sample t-test ( $\alpha = 0.05$ ) to compare the Global Scientific Literacy Questionnaire scores of 67 undergraduate students surveyed at the start and end of the online course, this study demonstrated a significant increase in their scientific literacy despite the constraints brought by the pandemic ( $p = 0.03$ ). Specifically, these students became better at systematic thinking and information management ( $p = 0.01$ ) as well as self-directed planning and monitoring ( $p = 0.02$ ). A focus group discussion with five students revealed that course design and the nature of remote learning could explain the gain in their scientific literacy.

**Keywords:** Scientific literacy, Science education, Industrial revolution 4.0, COVID-19 pandemic

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### Introduction

The digital revolution that characterizes the 21<sup>st</sup> century has ushered our society into Industrial Revolution (IR) 4.0 (Reddy, 2021). It has accelerated scientific progress more than ever by making most of the technological advancements of previous industrial revolutions: the use of steam power in the mechanization of manufacturing during the first industrial revolution, electrical energy for large-scale production during the second industrial revolution, and computerized information technology for automated production during the third industrial

revolution (Melinda & Sa'ud, 2022). Although science and technology have become accessible to many because of this digital revolution, pseudoscientific views and misinformation have also abounded (Reddy, 2021). These attempts to discredit science can be countered though by nurturing scientific literacy among the public wherein they, according to the Organisation for Economic Co-operation and Development (2019) in their Programme for International Student Assessment, demonstrate the “ability to engage with science-related issues, and with the ideas of science, as a reflective citizen” (p. 16).

Science education has therefore become more salient in fostering scientific literacy in this age of IR 4.0. It has been increasingly viewed in society as a strategic approach to equip students with 21<sup>st</sup> century skills that will allow them to navigate through the socio-economic and socio-cultural transformation involved in IR 4.0 (Dovgyi et al., 2020). Expectedly, institutions responsible for science education must respond to the demands and challenges brought by the technological breakthroughs of IR 4.0 to our society (Morales et al., 2022). They need to address four essential elements comprising Education 4.0 as a counterpart of IR 4.0: development of critical competencies in today's students, application of new learning methods, incorporation of current and emerging technologies in the teaching-learning process, and use of innovative infrastructure to enhance the educative experience (Miranda et al., 2021).

However, the COVID-19 pandemic has disrupted our daily lives, including how science is taught. Teaching in many parts of the world suddenly shifted to remote learning as campuses abruptly closed to mitigate the spread of COVID-19. This unprecedented shift has exacerbated the digital divide between developed and less developed countries, adversely affecting the attainment of educational outcomes, such as scientific literacy, due to disparate access among and within countries to inclusive, equitable, and quality education (United Nations, 2020).

Nonetheless, “the COVID-19 pandemic,” as Shi (2022) argues, “offers vivid examples of teachable aspects of the nature of science” (p. 311). For example, the public has witnessed the role of scientific progress and technological innovation in overcoming the pandemic as well as the importance of scientific culture and scientific spirit in making informed decisions and policies during such a global crisis (Han, 2020). These teachable aspects for scientific literacy take place despite the “infodemic of misleading information about the pandemic” (Schneegans & Nair-Bedouelle, 2021, p. 17) as the scientific community and the education sector, among others, have growingly recognized “the critical need for prompt, universal access to science” in a time of a public health crisis (Persic et al., 2021, p. 14).

Further research is warranted though to support views that science education within the context of a pandemic can bring about scientific literacy. Hence, this study aims to determine if there would be a significant increase in scientific literacy among undergraduate students after taking the mandated *Science, Technology, and Society* as a six-week online course offered during the first year of the COVID-19 pandemic. It also seeks to examine which aspects of their science education in a time of a pandemic would these students find helpful in making them scientifically literate. Findings from this study can contribute to efforts geared toward achieving



Sustainable Development Goals on quality education by providing valuable insights on how science education can best promote scientific literacy despite the challenges and constraints brought by adverse situations, including the recent pandemic.

## Theoretical Framework

Scientific literacy, as a social construct, has differed through the years to suit the ever-changing circumstances and needs of society (Choi et al., 2011). Its meaning has evolved from a public understanding of science to critical engagement with the social practices of science (Braund, 2021). However, the notion of scientific literacy as an individual characteristic to possess still prevails against radical views of it as a collective human praxis (Choi et al., 2011; Roth, 2003). This predominant concept though is deemed as no longer responsive to meet the demands and challenges of the 21<sup>st</sup> century (Mun et al., 2015). Hence, there are resounding calls to rethink current stances of scientific literacy to account for perspectives, competencies, and values orientation that are necessary to live in a global society (Choi et al., 2011; Mun et al., 2015).

In response to these calls, Choi et al. (2011) propose Global Scientific Literacy as a framework that can be more fitting in the 21<sup>st</sup> century wherein local issues have become worldwide concerns. This Global Scientific Literacy Framework consists of five dimensions that work together: scientific content knowledge, habits of mind, character and values, science as a human endeavor, and metacognition and self-direction. Scientific content knowledge refers to an integrated understanding of core ideas of science, which are foundational to applying scientific concepts to solve real-world problems (Mun et al., 2015). Habits of mind are characterized by the use of scientific reasoning and practices to explore natural phenomena and address science-related social, ethical, and moral issues (Choi et al., 2011; Mun et al., 2015). These scientific reasoning and practices include skills in critical thinking, problem solving, decision-making, information management, communication, and collaboration (Choi et al., 2011).

Character and values, on the other hand, pertain to a display of ecological worldview, moral and ethical sensitivity, appreciation of cultural diversity, socio-scientific accountability, an ethic of care, and compassion for others (Mun et al., 2015). They stand for belief systems and preferences that have become utmost necessary in the 21<sup>st</sup> century society (Choi et al., 2015). Science as a human endeavor involves having an awareness of science as tentative, subjective, and value-laden, an understanding of how science, technology, and society are interrelated, and adherence to the spirit of science, such as curiosity, intellectual honesty, creativity, skepticism, tolerance of ambiguity, and openness to new ideas (Mun et al., 2015). Lastly, metacognition and self-direction are key processes that bind these four dimensions together (Choi et al., 2011). These cognitive processes include self-directed planning to determine which strategies and resources are needed to complete a task, self-directed monitoring to track one's progress in view of identified strengths and limitations, and self-directed evaluating to reflect on one's past experiences and use these insights in tackling similar situations in the future (Choi et al., 2011; Mun et al., 2015).

## Method

A mixed methods research design was carried out in this study to make the most of the quantitative and qualitative approaches in understanding the development of scientific literacy among undergraduate students during a pandemic. Specifically, an explanatory sequential research design was used as findings from the focus group discussion (qualitative data) were tapped to make sense of the results from the survey (quantitative data). Qualitative data gathering and analysis in this instance followed quantitative data gathering and analysis to arrive at an explanation of the phenomenon under study (Edmonds & Kennedy, 2017).

## Setting and Participants

This mixed methods study was set at Ateneo de Manila University, an institution of Jesuit higher education in the capital of the Philippines. Its undergraduate curriculum includes *Science, Technology, and Society* as part of the students' science education and in fulfillment of the general education curriculum mandated by the country's Commission of Higher Education (CHED). To foster scientific literacy, the following are the learning outcomes of *Science, Technology, and Society* as stated in the syllabus:

- 1) Students should be able to evaluate the capabilities as well as limitations of Science and Technology through distinguishing what questions and methods are valid in the realm of science based on its nature and practice.
- 2) Students should be able to contextualize issues using perspectives from and beyond Science and Technology to dissect the interplay of various factors in analyzing the complexity of the human experience.
- 3) Students should be able to synthesize insights from various disciplines to propose solutions to contemporary issues with a view toward sustainable development and improving quality of life.
- 4) Students should demonstrate how individuals and an entire generation - guided by Ignatian Values - can participate in and contribute to the practice of Science and Technology, driving the transformation of society through their various professions and leadership.

During the first year of the COVID-19 pandemic, *Science, Technology, and Society* was delivered online for six weeks using Zoom for synchronous learning and Canvas Learning Management System for asynchronous learning. In general, this course consisted of four modules, namely 1) the Nature and Practice of Science and Technology; 2) Science, Technology, and Lifestyle; 3) Environment and Sustainable Development; 4) the Origin of Life and Universe.

After this study obtained ethics approval from an accredited institutional review board, undergraduate students enrolled in *Science, Technology, and Society* during the second semester of the academic year 2020 to 2021 in

Ateneo de Manila University were recruited by volunteer sampling to take part in this study. The second semester of academic year 2020 to 2021 was chosen as the period for data gathering instead of the first semester so that both teachers and students were accustomed to online learning by then. Students eligible as participants for this study completed the four modules either from 10 February 2021 to 7 April 2021 or from 12 April 2021 to 5 June 2021.

### Data Gathering

A pre-test survey was sent through the institutional emails of eligible study participants at the start of the course. An online survey was deployed in this study as it was the most appropriate mode of administration given the lockdown and restrictions imposed by the Philippine government as a response to the pandemic. This survey included demographic questions and 48 items from the Global Scientific Literacy Questionnaire (GSLQ) by Mun et al. (2015). The 5-point Likert scale items from the GSLQ were developed to measure four dimensions of the Global Scientific Literacy Framework: habits of mind (i.e., 5 items for communication and collaboration, while 8 items for systematic thinking and information management), character and values (i.e., 7 items for ecological worldview and compassion, while 2 items for socio-scientific accountability), science as a human endeavor (i.e., 3 items for characteristics of scientific knowledge, whereas 10 items for science and society as well as the spirit of science), and metacognition and self-direction (i.e., 10 items for planning and monitoring, whereas 3 items for evaluating). Scientific content knowledge was not included in the development of GLSQ by Mun et al. (2015) as they believed this dimension may require other measures. These scale items were tested validly based on exploratory and confirmatory factor analysis. The items in each dimension also showed good internal consistency as they displayed a Cronbach's alpha of 0.80 and above.

A post-test survey was then emailed at the end of the course to the study participants, who completed the pre-test questionnaire. This survey included the same questions and items from the pre-test questionnaire to facilitate comparison. Specifically, giving the same questions and items for the pre-test and post-test to the students allowed the researchers to determine if *Science, Technology, and Society* as a six-week online course offered within the context of a pandemic can bring about an increase in scientific literacy.

To make sense of the results gathered from the surveys, a focus group discussion was carried out after the grades were released for the second semester. A focus group discussion, as Stewart and Shamdasani (2015) point out, can add depth to the survey responses by making most of the group interaction to yield "a very rich body of data expressed in the respondents' own words and context" (p. 42). Around four to six students, as suggested by Krueger (2015), were needed as participants in the focus group discussion. Aside from offering a comfortable environment, this small focus group size is conducive for participants to detail insights and observations about their experience. In this study, participants in the focus group discussion were randomly sampled from the list of undergraduate students enrolled in *Science, Technology, and Society* during the second semester of the academic year 2020 to 2021. Those who consented were asked to take part in the focus group discussion via Zoom as the videoconferencing platform.

## Data Analysis

Mean and standard deviation were employed to describe the central tendency of the GSLQ scores on pre-test and post-test. To determine if there is a significant increase in scientific literacy among undergraduate students after taking *Science, Technology, and Society* as a six-week online course offered during the COVID-19 pandemic, a one-tailed paired sample t test of the GSLQ scores was performed at a 95% confidence interval and 0.05 level of significance using Microsoft Excel. To examine which aspects of the course these students find helpful in making them more scientifically literate at a time of a pandemic, a thematic analysis of the verbatim transcript of the focus group discussion was carried out to find out recurring meanings. Thematic analysis in this study involved 1) familiarizing with the data through reading and re-reading the transcript; 2) generating initial codes through in vivo coding; 3) coming up with candidate themes by searching for meaningful patterns among the codes; 4) reviewing and re-classifying the themes by checking them against the transcript; 5) reporting the findings based on the emerging themes that were drawn from the gathered data (Braun et al., 2018).

## Results

A total of 67 students coming from different sections completed both the pre-test and post-test surveys sent to them via email. These surveys yielded an approximately 10% response rate. The survey respondents were  $19.54 \pm 0.93$  years old. 62.69% (42 of them) were females, while 37.31% (25 of them) were males. Almost all were in their second year of undergraduate studies.

Table 1 shows the GSLQ scores of the survey respondents on pre-test and post-test. Out of the highest possible sum of 240, their total GSLQ scores on pre-test and post-test were  $205.33 \pm 17.15$  and  $208.54 \pm 20.76$ , respectively. One-tailed paired sample t test revealed there was a statistically significant increase in the total GSLQ scores of the survey respondents after taking *Science, Technology, and Society* over for six weeks during the first year of the COVID-19 pandemic ( $p = 0.03$ ). Among the constructs of the Global Scientific Literacy Framework, statistically significant higher scores were observed at the end vis-à-vis at the start of the course for systematic thinking and information management ( $p = 0.01$ ) as well as self-directed planning and monitoring ( $p = 0.02$ ). The rest of the constructs, however, posted no significant difference in scores before and after the six-week online classes in *Science, Technology, and Society*.

**Table 1. Pre-Test and Post-Test GSLQ Scores (n = 67)**

<i>Dimensions of Global Scientific Literacy Framework</i>	<i>Pre-Test Score</i>	<i>Post-Test Score</i>	<i>p value</i>
<b>Habits of Mind</b>			
Communication/Collaboration	$20.87 \pm 2.75$	$21.10 \pm 2.43$	0.21
Systematic Thinking/Information Management	$33.12 \pm 4.46$	$38.28 \pm 4.13$	0.01
<b>Character and Values</b>			
Ecological Worldview/Compassion	$29.30 \pm 4.26$	$29.75 \pm 4.98$	0.14

www.icres.net	May 18-21, 2023	Cappadocia, Turkiye	www.istes.org
Socio-Scientific Accountability	08.13 ± 1.95	08.34 ± 1.97	0.15
Science as a Human Endeavor			
Characteristics of Scientific Knowledge	13.51 ± 1.39	13.28 ± 1.45	0.13
Science and Society/Spirit of Science	46.54 ± 3.17	46.59 ± 4.26	0.47
Metacognition and Self-Direction			
Planning and Monitoring	41.70 ± 4.87	42.85 ± 5.23	0.02
Evaluating	12.16 ± 2.09	12.45 ± 2.21	0.15
Total	205.33 ± 17.15	208.54 ± 20.76	0.03

A total of five students took part in the focus group discussion. They were  $19.40 \pm 0.55$  years of age. 20% (1 student) described themselves as female, whereas 80% (4 students) identified themselves as male. 60% (3 students) and 40% (2 students) were in their second year and third year of undergraduate studies, respectively. 60% (3 students) were from the field of science and engineering, 20% (1 student) belonged to the field of humanities, and another 20% (1 student) came from the field of management.

When asked during the focus group discussion what are their understanding of scientific literacy, student A considered it as “beyond being knowledgeable about scientific facts.” For student B, scientific literacy is “not just about formulas.” He defined it as the “use of science in real, urgent issues.” Scientific literacy, as student C pointed out, also involves the application of scientific reasoning and practices to “connect the dots” to arrive at “a better grasp of real-world phenomena.” It entails, according to students B, D, and E, “triangulating credible sources” to distinguish the scientific truth from erroneous claims.

Whether they regard themselves as scientific literate based on their understanding of it, all of them believed so and they partly attributed their increase in scientific literacy to *Science, Technology, and Society*. Student A felt this course reinforced and built on the competencies they learned from previous science classes. Student B even brought up how “thankful” he is that his classes in *Science, Technology, and Society* “reminded [him] of what matters the most about science,” while student C found the course offering itself as “very insightful and interesting.”

This positive feedback about their experiences in *Science, Technology, and Society* can be due to the topics covered in class as they piqued the interest of the focus group discussion participants. Although students A and C found topics, such as the scientific method and the environmental impact of climate change, were already tackled in their previous subjects, the discussion of the module contents offered them “new perspectives.” Specifically, the application of “social frameworks” in understanding how science and technology are intertwined with society, as student C explained, gave them an “interdisciplinary view.” For student B, the approach to *Science, Technology, and Society* was “very different from how [he] learned in elementary.” It was not “bookish.” Furthermore, the assigned readings and complementary resources like the curated YouTube videos, according to students C, D, and E, were quite engaging. The learning materials made available to them also impressed students B and E as several of these resources are “contextualized to Philippine realities.”

Student B appreciated the compulsory use of the discussion board in their Canvas Learning Management System in fostering his scientific literacy as there were opportunities to exchange views with his classmates about science-related issues. Additionally, most of the focus group discussion participants, such as student A, identified the classes held online through Zoom as helpful in making them learn and become more scientifically literate since their teachers can explain further the concepts and synthesize the main points of the module. The way they were assessed for the course learning outcomes could have contributed as well to facilitating their scientific literacy. Instead of being given objective test items, which for students B, C, and D can be easily passed through rote memorization, they were “challenged to understand the lessons well,” “research on the topic,” and “organize their thoughts” so that they could better compose essays synthesizing their learning and insights about the module. There were also occasions to learn from their classmates and gather different perspectives as they must collaborate for their group requirements.

The focus group participants, however, felt that the six-week duration to go through the four modules in *Science, Technology, and Society* was rather short. For instance, the assigned readings, as student D pointed out, “was too much” given the limited time to complete the course. Students B and E deemed they could have learned further if there was a presentation of their module synthesis in which they could share with others their insights and engage the class in a meaningful discussion. Such activities were not taken up in their classes due to time constraints, among others.

## Discussion

The COVID-19 pandemic has upended the way we carry out our daily lives. How science is taught and learned is no exception as educational institutions across the world have resorted to online delivery of classes to minimize the disruption to learning in spite of the public health crisis. On one hand, this abrupt shift from in-person classes to remote learning has posed challenges to teachers and students alike as both have been caught off guard by the pandemic: teachers must swiftly translate their lessons to make them suitable for remote learning, while students must quickly adapt to the unfamiliar terrains of learning in an online environment. On the other hand, the pandemic has accelerated the adoption of online platforms for teaching as educational institutions harness the positive aspects of information technology in promoting scientific literacy, among others, despite the global crisis. There are, however, few studies that look at students’ acquisition of scientific literacy within the context of adverse situations, such as a pandemic. Hence, this study seeks to find out if there would be a significant increase in scientific literacy among undergraduate students after taking the government-mandated science education as a six-week online course offered during the first year of the COVID-19 pandemic. It also intends to understand which aspects of their science education during a time of pandemic would these students find helpful in facilitating their scientific literacy.

Comparing the total GSLQ scores on pre-test and post-test, this study showed there was a significant increase in scientific literacy among undergraduate students after going through a six-week online course offered during the

first year of the pandemic as part of their science education. Qualitative data from the focus group discussion supported these results as student participants felt they became more scientifically literate by the end of the course offering based on their understanding of scientific literacy as the use of scientific reasoning and practices not only to comprehend the world but to also solve urgent issues in society. This gain in scientific literacy could be particularly attributed to improvement in their systematic thinking and information management as well as in self-directed planning and monitoring.

Systematic thinking and information management are foundational to scientific inquiry (Krajcik & Sutherland, 2010). They represent higher levels of thinking, which allow individuals to see the whole without losing sight of its parts (Almamuri & Shaalan, 2021). They entail logically organizing gathered data and critically evaluating various resources to find relevant information, methodically analyzing data for patterns to explain observations and arrive at valid conclusions, and innovatively applying new or prior understanding to draw the best solutions to real-world problems (Mun et al., 2015).

In this study, students probably became better at systematic thinking and information management due to the course design. First, the topics covered in class were engaging for the students, affording them to see multiple perspectives with the use of social frameworks to examine science-related issues. Ensuring that the course content in an online setting would be engaging to students, as Tsang et al. (2021) point out, is crucial in motivating them to learn in adverse situations. Doing so can foster higher levels of thinking despite the constraints brought by the pandemic as students are given meaningful opportunities to break down, integrate, and synthesize concepts, discover nuances, and apply the knowledge they acquired in challenging ways (Schaber & Shanedling, 2012). Second, the incorporation of online discussion boards as part of the students' asynchronous learning helped them to externalize their thinking and exchange views with other students about science-related issues. Embedding student-student interaction using online discussion boards can facilitate student-content interaction as students, according to Ertmer et al. (2011), are offered meaningful opportunities to "interact with each other over course-related topics" through the "processes of articulating, reflecting on, and negotiating their understandings of course content" without the pressure of responding to the posts instantaneously (p. 158). Third, employing videoconferencing for synchronous learning provided the students with real-time support from their teachers as concepts in class can be clarified and main points from the module can be run through. This student-teacher interaction, which among others involves students asking questions and their teachers providing timely feedback, is vital in promoting higher levels of thinking and mediating learning outcomes as there are meaningful opportunities to connect new concepts with prior knowledge (Tsang et al., 2021). Lastly, knowledge construction instead of rote learning was the focus of the assessment as students must collaborate for their group requirements and they must individually demonstrate a deep understanding of science-related issues in view of course content. Student-student interaction in an online environment through giving collaborative learning tasks can facilitate higher levels of thinking by recognizing that knowledge takes place within a social context (Hussin et al., 2019), while student-content interaction through assigning reflective tasks can similarly foster higher levels of thinking by emphasizing the contribution of meaning-making in effective learning (Ertmer et al., 2011; Safitri et al., 2019).

Self-directed planning and monitoring are also transferable skills that are necessary for carrying out a scientific inquiry. They, as Mun et al. (2015) describe, “refer to an individual’s capability to use cognitive resources actively in order to regulate one’s own thinking and improve [the] capability to understand” (p. 1746). These transferrable skills help individuals to decide when they need further information, what data they need, and whether they understand the gathered information (Choi et al., 2011).

In this study, self-directed planning and monitoring improved among students after taking *Science, Technology, and Society* within six weeks during the first year of the pandemic probably because of the nature of remote learning, which demands greater responsibility among learners for their learning. Specifically, asynchronous learning warrants independence and self-regulation, while synchronous learning necessitates connectivity, interaction, and collaboration (Garrison, 2003). Such findings reflect how the students were bound to take control of their learning by being proactive and autonomous as teaching abruptly shifted to an online setting during the pandemic. Similar to the study of Maphalala et al. (2021), these students were challenged by the extraordinary circumstances to adopt learning strategies that would help them navigate through remote learning within the context of a pandemic.

The other dimensions of the Global Scientific Literacy Framework, however, were not further developed among the students in this study due to several reasons. First, the six weeks allotted for the online course offering may not be enough for the students to acquire the other dimensions of scientific literacy. Second, cognitive overload could have taken place as there were plenty of learning materials to go through over a short period. Third, the pandemic is not an ideal context to learn. Fourth, some students may have not adapted well to the abrupt shift from in-person classes to remote learning. Fifth, there could have been more collaborative tasks to promote social presence in an online setting.

## Conclusion

Scientific literacy has become imperative in this age of I.R. 4.0. The COVID-19 pandemic, however, has challenged the acquisition of scientific literacy among students as the delivery of science education has suddenly shifted from in-person classes to remote learning. Nevertheless, this mixed methods study showed that there could still be a gain in scientific literacy despite the constraints on science education by the pandemic. An improvement in systematic thinking and information management as well as self-directed planning and monitoring among the students can account for such an increase in scientific literacy. Students became better at systematic thinking and information management possibly because of the course design wherein elements of student-teacher interaction, student-student interaction, and student-content interaction were purposively included in the teaching-learning process that takes place in an online setting. The very nature of remote learning that requires students to be more responsible for their learning, on the other hand, can explain why there was an improvement in their self-directed planning and monitoring. The role of teachers as facilitators of



learning within the context of adverse situations, such as pandemics, is therefore crucial as they map out and implement course design and they offer instructional as well as psycho-emotional support to students, who must adjust to the unfamiliar terrain of remote learning. Findings from this study can offer valuable insights for science educators and higher education institutions on how to ensure quality education when using remote learning during pandemics and other adverse situations.

## Recommendations

Several recommendations for future research are listed below in view of the limitations that were encountered in this study. First, the constructs used for scientific literacy in this study were confined to the theoretical framework suggested by Choi et al. (2011) and Mun et al. (2015). Other studies may consider other theoretical frameworks in measuring and evaluating scientific literacy. Second, this study only offered observations and explanations on the acquisition of scientific literacy during the latter part of the first year of the pandemic. Additional studies may be needed to better understand the development of scientific literacy among students during the early months of the pandemic and throughout the remainder of this public health crisis. Third, the study participants volunteered to take part in this research and may not represent other students within and outside the examined university. Future studies may benefit from carrying out probability sampling and investigating multiple educational institutions. Fourth, this study only yielded a 10% response rate to the online surveys despite the researchers repeatedly sending out email notifications. It also garnered more female participants than males. Asking the teachers to remind their students about the surveys, giving incentives to the respondents, and assuring the students of the anonymity of their responses and the practical usefulness of these responses are some of the strategies that other studies may employ to increase the survey response rate. Lastly, the study participants came from classes handled by different teachers. Their learning experiences during the pandemic may therefore vary. Future studies may find it useful to use analysis of covariance to account for the difference in teachers.

## Acknowledgment

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# Reharmonizing Islam and Science of Creating a Scientific Civilization based on Religious Values: Case Study of Indonesian Fundamentals Pancasila

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**Abstract:** The deviated assumptions between religion, especially Islam, and science have been in vogue for a while. Many people today explicitly distort the foundation norms of Islam and what is taught in today's modern science and culture. To illustrate, Islamophobia is a common perception of Islam—portraying it as violent, terror-filled, and inhumane. Experts are beginning to realize that there is a big mistake to distinguish between religion and science. For instance, it turns out that many of today's scientific discoveries were written thousands of years ago in the Qur'an, the Muslim holy book. Al-Isra 7 calls upon humans to practice more kindness and mutual respect towards fellow humans, while Al-Baqarah 205 emphasizes the prohibition against destroying the earth, including plants and livestock. Indonesia is a country that has managed to unite multiculturalism and has become one of the countries with the largest Muslim population. The state does not distinguish between religion and science. The state harmonizes Islam and science through Pancasila as the *kalimatun sawa*. The data in this paper are sourced from reviews, literature relevant to the writing. The results of the review, as well as the relevant literature, are then analyzed and presented.

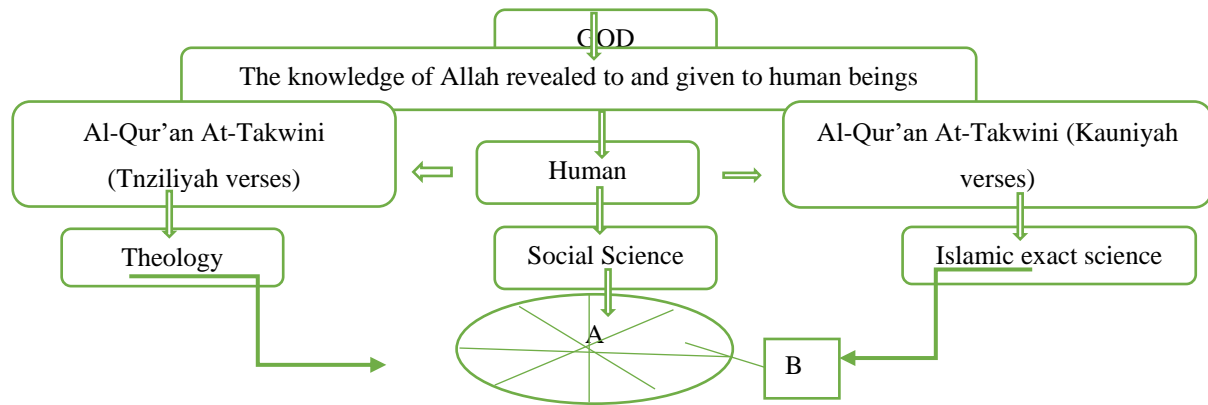
**Keywords:** Reharmonizing, Scientific Civilization, Religious Values, Pancasila

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## Introduction

Science and religion, especially Islam, are actually classic and sustainable issues, but along with changing the paradigm and developing knowledge in all fields, opportunities for the integration of science are wide open. This relationship shows how positively Islam views science (and matters related to scientific activities). In this regard, Islamic education can be internalized and understood in a complete and "kaffah" (whole and comprehensive, without a dichotomy between religious education and general education) (Murtopo, Ali. 2017).

A. M. Saefuddin and M. Zainuddin proposed creative thinking formulations to be integrated in a coherent manner with knowledge in Islam (M. Zainuddin, 2008). The combination in simple terms can be seen in the following scheme:



Information:

A = Integration of Islamic Sciences

B = Specialization of Science

The unification of science with religious values, in this case Islamic teachings, the insights of knowledge are no longer dichotomously separated in the division of religious and non-religious sciences, but will be differentiated (not separated) into knowledge that concerns qauliyah verses. (Written in the Qur'an and Hadith) and the sciences of ayat kauniyah (sciences about natural sciences). Review of Islam and science integration will be in touch with people's culture in religion practice. (Kuntowijoyo, 2011) stated that Islam is portrayed in the following table:

Display of Islam			
Basic: values of Islam	Myth	Ideology	Sciene
Way of thinking	Pre-logic	Non-logic	Logic
Form	Magic	Abstract/a priori	Concrete/empiric

M. Syafii Anwar, he states that Islam should be oriented to the empiricism and should become the problem solver for people, strengthen people through social practice and politics, and bargain with the state as well. (Munadi, M. 2016). To illustrate, Islamophobia is a common perception of Islam—portraying it as violent, terror-filled, and inhumane. The exact definition of Islamophobia continues to be discussed with academics such as Chris Allen saying that it lacks a clear definition. ( Allen, Chris 2010), (Burak Erdenir 2010) According to Erik Bleich, in his article "Defining and Researching Islamophobia", even when definitions are more specific, there is still significant variation in the precise formulations of Islamophobia. As with parallel concepts like homophobia or xenophobia, Islamophobia connotes a broader set of negative attitudes or emotions directed at individuals of groups because of perceived membership in a defined category. (Bleice, Erik. 2011) Mattias Gardell defines Islamophobia as "socially reproduced prejudices and aversion to Islam and Muslims, as well as

actions and practices that attack, exclude or discriminate against persons on the basis that they are or perceived to be Muslim and be associated with Islam."

For instance, it turns out that many of today's scientific discoveries were written thousands of years ago in the Qur'an, the Muslim holy book. Al-Isra 7 calls upon humans to practice more kindness and mutual respect towards fellow humans, while Al-Baqarah 205 emphasizes the prohibition against destroying the earth, including plants and livestock. From this verse, Quriash Shihab interprets this verse more in the general context, namely doing evil and good deeds. Whereas in Tafsir Jalalain it is stated more specifically that then We say (if you do good) by doing obedience (meaning you do good for yourself) because actually the reward of goodness is for yourself (and if you do evil) by causing damage (then the crime is for yourselves) in retaliation for your crime. (And when the time of punishment comes) for the (second) crime, We send them again (to darken your faces) to make you sad because you were killed and captured so that the effect of that sadness can be read from your countenances (and they enter into mosque) namely the Baitulmaqdis to destroy it (as your enemies enter it) and destroy it (for the first time and to destroy) to carry out destruction (against whatever they control) which they can defeat (with all-out destruction) with the destruction after -end. (Al Suyuthi, Jalaluddin. 2015). Tafsir QS. Al Baqarah (2): 205. By Muhammad Quraish Shihab: When they hold a power, they do not seek improvement. They even use it to damage and destroy crops and livestock. Allah does not like people like this, because He does not like corruption. (Shihab, M. Quraish. 2000). From the description of these 2 verses, Indonesia is a country that has succeeded in uniting multiculturalism with the largest Muslim population. A country that can harmonize religion and science, especially the Islamic religion contained in Pancasila as the basis of the Republic of Indonesia and is commonly known as *Kalimatunsawa*.

Reviews about how scientific al-Qur'an and sunnah are getting various from year to year. Whether it is individually or collectively, both locally or internationally. The review is individually because it is arranged by only one writer. For example, review of psychology by Ahmad Mubarak from Indonesia in 1999. While from abroad, there was the book of spirit science in al-Qur'an written by M. Utsman Najati. It was firstly published in 1985. In exact science, there was a book entitled al-Qur'an: Ilmu Kedokteran Jiwa dan Kesehatan Jiwa (al-Qur'an: Science of Spirit Medicine and Health) written by Dadang Hawari that published in 1998. Previously in 1976 Maurice Bucaille wrote Bible, al-Qur'an, and modern science or La Bible, Le Coran et La science in French. The newest one was by Agus Purwanto, a physician from ITS. He wrote about the Verses of the Universe: The Forgotten Sides of al-Qur'an (2012) and the Logic of the Verses of the Universe. Both reviews focused more on science specially on physics. While a various review in al-Qur'an was conducted by Nadiyah Thayyarah (2013). The title was smart book of science in al-Qur'an. There were a lot of matters discussed in the book such as the miracle of Al-qur'an and the relationship with various science whether in medical field, embriology, astronomy, as well as food. (Munadi, M. 2016). Islam and Science provides a clear and concise historical introduction to the intellectual developments that have shaped Islamic civilization, both religious and scientific. Hence, the research inquiries addressed in this study are:

1. Relation between Islam and science as well as the reason why they are disharmonized in many

countries?

2. Why reharmonizing between Islam and science is a must and how to do it?
3. Is Pancasila effective to reharmonize Islam and science?
4. What is the result if Islam and science reharmonized, could it lead to a harmony to intimate Indonesia as a country with Pancasila as the fundamentals to create scientific civilization based on religious values?

## Method

This study used literature review to achieve research objectives with the type of library research. Literature review is an objective, thorough summary and critical analysis of academic and non-academic literature relevant to the topic being studied (Hart, 1998; Cronin, et al., 2008). A literature review also includes a critical evaluation of the material. It is a process of reviewing the literature, as well as a form of writing. Reading combined with critical analysis can help to refine a topic and frame research questions. Conducting a literature review establishes the familiarity with and understanding of current research in a particular field before carrying out a new investigation. Research conducted with a focus on exploring sources related to the theme, such as books, journals, research reports, service reports, manuscript notes, and some others that are relevant to the research problem. (Ibrahim, 2015). The emphasis on library research is to find various theories, laws, propositions, principles, opinions, ideas and others that can be used to analysed and solve the problems studied. The main problem in this research is to find out whether Pancasila as the foundation of Indonesia can reharmonize Islam and science to create a scientific civilization based on religious values. Research shows that Pancasila can re-harmonize Islam and science because Indonesia has been proven to unite multiculturalism as well as one country.

## Results

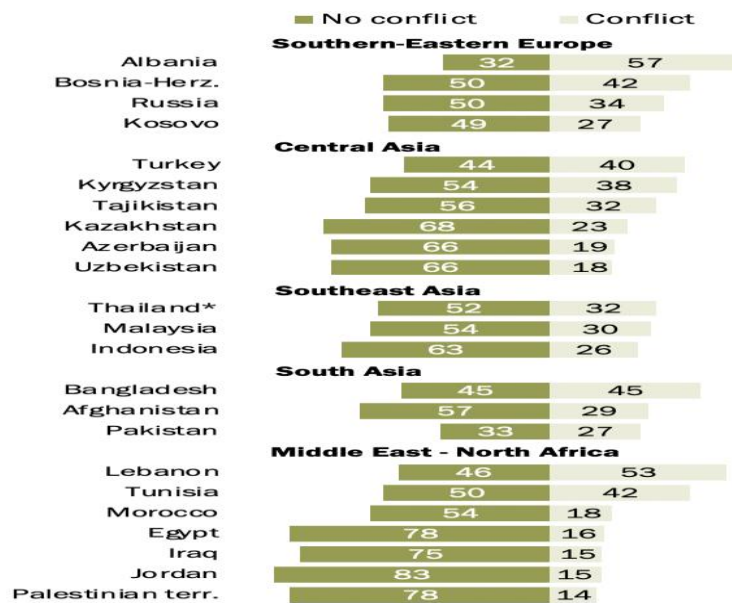
Over the centuries, the relationship between science and religion has ranged from conflict and hostility to harmony and collaboration, while various thinkers have argued that the two concepts are inherently at odds and entirely separate. There have also been reports of hate crimes targeting Muslims across Europe. These incidents have increased after terrorist attacks by extremist groups such as ISIL. (BBC News, 2015). Far-right and right-wing populist political parties and organizations have also been accused of fueling fear and hatred towards Muslims. (Reuters, 2017), (Nossiter, Adam, 2015), (Bender, Ruth. 2016), (Hume, Tim. 2017). Hate crimes such as arson and physical violence have been attempted or have occurred Norway, (Reuters, 2017) Poland, Sweden, France, Spain, Denmark, Germany and Great Britain. Politicians have also made anti-Muslim comments when discussing the European migrant crisis (Haddad, Yvonne et al., 2014).

Furthermore, experts are beginning to realize that there is a big mistake to distinguish between religion and science. Representative surveys of Muslims in countries around the world find variation in the share of Muslims

who see any conflict between science and religion, although this share is less than half in most countries surveyed. The 2018 Wellcome Global Monitor asked respondents if “science has ever disagreed with the teachings of your religion.” Across 51 countries that have large enough samples of Muslims that their views can be broken out separately and analyzed, a common response is that science has “never disagreed” with Islamic religious teachings.

**Is there a conflict between religion and science?**

*% of Muslims who say there is or is not generally a conflict between science and religion*



\*Interviews conducted with Muslims in five southern provinces only. Note: Based on Muslims. Respondents who did not give a response are not shown.

Source: Global Survey of Muslims 2011-2012. Q19. "The World's Muslims: Religion, Politics and Society"

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Similarly, a Pew Research Center survey conducted in 2011 and 2012 that examined the views of Muslims found that, in most regions, half or more said there was no conflict between religion and science, including 54% in Malaysia (Muslims in Singapore were not surveyed). Three-in-ten Malaysian Muslims said there is a conflict between science and religion; the share of Muslims around the world who took this position ranged from a high of 57% in Albania to a low of 14% in the Palestinian territories. (Pew Research Center, 2020).

For instance, it turns out that many of today's scientific discoveries were written thousands of years ago in the Qur'an, the Muslim holy book. Al-Isra 7 calls upon humans to practice more kindness and mutual respect towards fellow humans, while Al-Baqarah 205 emphasizes the prohibition against destroying the earth, including plants and livestock. Indonesia is a country that has managed to unite multiculturalism and has become one of the countries with the largest Muslim population. The state does not distinguish between religion and science. The state harmonizes Islam and science through Pancasila as the *kalimatun sawa*.

Islam is a religion embraced by many people in the world. (Intania, Naila, 2020) The Qur'an is the main and first



source for Muslims as a guide, a guide for those who study and practice it. And contains divine revelation which has no equal and no opponent in the natural life of the universe. The Qur'an as a guide of life which certainly does not only regulate human relations with Allah alone but the Qur'an also regulates relations among humans and the universe, one of the forms of the Qur'an's demands on the universe is protecting the environment. As explained in Al-Isra 7 & Al-Baqarah 205, in which the contents of the two letters are Allah stating that if the Children of Israel do good, then goodness is for themselves. However, the provisions contained in this verse are not specific to themselves, but generally apply to all mankind at all times. Therefore, if humans do good or do good, then the reward for that kindness will be felt, both in this world and in the hereafter. The good that they will receive in the world is that they will be a strong people defending themselves from the evil plans planned by their enemies. They will have the opportunity to multiply wealth as a means of life, and continue their descent as caliphs on earth. They will become a strong nation, which can embody a high culture to further excite their lives, and ensure the smooth running of their business and worship to Allah SWT. Meanwhile, eternal happiness is heaven full of pleasures that are provided and promised to them, as proof of Allah's pleasure for the good they have done. If they do evil by committing acts that are contrary to the revelations and events of their own nature, such as against the truth and norms in their own way of life, then the result of their actions will be Allah's wrath against them. Thus, they will become a divided nation because they are enslaved by lust, so that one group tries to concentrate the other group. An example is the story of the Aqsa Mosque which was torn down and a building named Jupiter Capitolina was erected on it. Then the Jewish kingdom was also destroyed so that the Jewish people had no kingdom anymore. They scatter to the protectors of the corners of the world. This event occurred in 132 AD. (NU Online)

Meanwhile, Al-Baqarah 205 provides an explanation in Tafsir Ibnu Katsir, Darud Thayyibah Linnasyari Wat Tauzi', Volume 8, p. 254 Have no desire to destroy the earth, while you live in it. And do not do bad to something that was created by Allah. It can be seen clearly that Allah does not like damage on earth. In this case, humans have a responsibility to preserve the environment. But the problem of environmental damage is no longer a foreign discussion. Environmental problems cannot be separated from religious issues with various types of damage to the earth in general rooted in the spiritual crisis and the existence of modern humans. This causes them to legally or illegally exploit nature to meet their needs without regard to nature, in order to gain personal welfare by doing things that harm other people. (Muhammad, Abdullah., 2022) The verse explains that Allah SWT. has spread the earth, made mountains and plants grow, then humans must be responsible for managing and utilizing natural resources based on the principle of sustainability to achieve prosperity so that they can meet the needs of mankind. (Shihab, M Quraish., 2000) Humans as a component of the population have a major role in utilizing, managing and controlling phenomena that occur in nature. Humans are responsible for the sustainability of the ecosystem because humans were created as caliphs. The environment is a gift given by Allah SWT. to all of His creatures to be put to good use. The environment must be maintained and preserved as a form of concern to manifest a sense of love and compassion for Allah SWT's creation. Islam teaches about environmental maintenance which must be implemented in human attitudes and behavior so as not to cause damage to the earth. (Intania, Naila et all., 2022).

### **Pancasila effective to reharmonize Islam and science**

Pancasila is the ideology of the nation that should be the spirit of every pulse of life of citizens and constitutional activity, because the Pancasila is seen as media acculturation in various partial thoughts on religion, education, cultural, political, social and even economic. As a result of making the philosophy of Pancasila as a nation, we can realize Indonesian nationalism. Pancasila is a revolutionary concept that advanced civilizations, especially for Indonesia, Pancasila as well as forming the character and identity of a great nation, modern, dignified and civilized. (Amir, Syafruddin. 2013) The name Pancasila comes from Sanskrit which consists of two words, namely 'panca' which means 5 and 'sil'a which means principle or principle. This means that there are 5 important guidelines for the Indonesian people in the life of the nation and state. The five precepts are Belief in One Almighty God, just and civilized Humanity, Indonesian Unity, Democracy led by wisdom in deliberations/representations, social justice for all Indonesian people.

Researcher will take one of the topics that can connect between Islam and science from Pancasila. That is how the relationship of Pancasila to prevent the extinction of natural ecosystems. An ecosystem is an ecological system formed by an inseparable reciprocal system between living things and the environment. Ecology is the study of the interrelationships between organisms and their environment. Reporting from the Encyclopaedia Britannica (2015), there are components that cause the formation of ecosystems, namely biotic and abiotic components. Living things and abiotic factors in an environment are a unit called an ecosystem. With Pancasila values we can prevent the extinction of natural ecosystems, the relationship is: 1. Believe in the one supreme GOD, belief in the Creator. This is the main foundation that should not be forgotten. This universe is the creation of the Creator, all religions recognize it and humans must protect and care for it. If nature is not cared for, it is the same as we do not believe in God's power over it. Destroying God's property is tantamount to not acknowledging the existence of God, and not recognizing God is definitely not Pancasila. 2. The second Justice and civilized humanity. The occurrence of the "karhutla" incident has clearly negated the human side, let alone being just and civilized. If there is only a group of people who have power over several thousand hectares of land, they can do anything on that land, they will also argue when a fire occurs, they are even euphoric as a group that cares about the environment, a company with the best CSR, that is where the sense of justice and humanity is in the precepts. both are disturbed. 3. The third precept, unity, is very clearly connected with the first and second. All of us are in one expanse of interconnected areas. Pain on one side will be a nuisance on all sides. Unity means having the meaning of needing each other, feeling each other, being bound in one inseparable series. If the actions we take cause ulcers to appear and damage relations with other parties, we have disrupted that unity. A river that originates in one province but flows downstream to another area, then it must be considered as one expanse, one landscape. 4. The fourth precept, the democracy led by understanding wisdom among honorable representatives from the parliament house, is an important point to say that all of this country's bloodshed must be treated as well as possible, wisely for prosperity, with enthusiasm.

Then the last one is to discuss the fifth principle of social justice for all Indonesian people. Justice is a principle that is very important and has a high position in Islam. The word "fair" is used in four ways, namely balance,

equality and non-discrimination, granting rights to those who are entitled, and delegation of forms based on level and feasibility. Divine justice means that every being takes the form and perfection of its form according to what is appropriate and possible for it. (Mutahhari, Murtadha. 2009) Justice is classified into three types, namely justice in the form of legislation (al-' is al-qanuniyyah), social justice (al-' is al-ijtima'iyah), and international justice (al- -,is al-dauiyyah). (Yasid, Abu, 2004) Justice in Islam depends on the justice that has been determined by Allah himself. Because it is impossible for humans to know that justice is true and correct. Here too faith precedes understanding, because it has been determined that everything determined by Allah SWT must be fair. Whatever its nature, justice in Islam is formulated by adhering to divine law or the will of Allah SWT which was formulated by the scholars to be used as law in living together as citizens. Justice is a collectivistic ideal that views justice as a harmonious relationship with various social organisms. Every citizen must carry out his duties according to his position and nature. (Almubarak, Fauzi. 2018)

## Discussion

Islam and science provide a clear and concise historical introduction to the intellectual developments that have shaped Islamic civilization, both religious and scientific. The reason for reharmonization between Islam and science is a must. The approach used by the Qur'an is in educating and teaching humanity to achieve balance in life. Harmony means living in peace even though we discriminate against each other or eliminate signs of position in society or between individuals so that social relations still look harmonious and good. Indonesia as a pluralistic country consisting of different tribes, customs and religions, people's lives can be harmonious and peaceful. For this reason, this harmonious life must be maintained and can even be spread to other countries as a role model and we must protect it. For the Indonesian people, Pancasila is the sentence of sawa' which unites the diversity of ethnicity, race, culture and religion. Even though at the beginning of independence Indonesia felt long about state ideology, the founding fathers found common ground in terminology called Pancasila. I believe this model of social relations is being sought in this world," said Vice President (Vice President) K.H. Ma'ruf Amin in an interview with Nusantara TV via video conference from the Vice President's official residence, Jalan Diponegoro No.2, Central Jakarta, Monday (11/9/2020).

## Conclusion

This paper has argued that Indonesia is a country that is successful in uniting multiculturalism at the same time as one of the countries with the most Muslim population. The state does not differentiate between religion and science, let alone separate them. In Indonesia, the state actually harmonizes Islam and science in the Pancasila as the *kalimatun sawa*, the meeting point between spiritual needs and the encyclopedias reality in the purpose of creating a scientific civilization based on religious values. Reflecting on scientific evidence and a country as a role model for the success of the harmonization of religion and science, the world, therefore, should not distinguish between these two interrelated things. Indonesia follows the ways of the Prophet. Therefore, even though the majority of Indonesia's population are Muslims, they still provide opportunities for other religions to live together in harmony and harmony.

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## Dataset of Chinese Language Beginning Learners Reading Speech and Text-to-Speech

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**Abstract:** Three categories of audio recordings, a web service platform, and commercial software were involved in this analysis process. The three categories of audio recordings included eight filtered student recordings, an audio recording provided by a Mandarin instructor from University Malaysia Sabah, and an audio recording generated by Text-to-Speech MP3, available at <https://ttsmp3.com/>. All ten recordings will be uploaded into the NCH WavePad Sound Editor to build a spectrum image. This will allow us to compare and identify differences in tone reading, emotion reading, etc. You can download the NCH WavePad Sound Editor from <https://www.nch.com.au/WavePad/index.html>. This information is beneficial for all Mandarin language beginners and their teachers, as it can be used for comparison purposes. With this knowledge, they can further undertake a pilot study. This study provides a foundation for investigating differences in human and machine reading from multiple perspectives. Furthermore, this dataset can be used to analyze reading speed. It serves as a crucial starting point for spectrum, voice wave, and reader behavior research.

**Keywords:** NCH Wave Pad Sound Editor, teaching, learning, foreign language, spectrum

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### Introduction

The data collection process can be divided into three distinct phases: the preparation period, the data collection period, and the data validation period. The planning stage begins in early January 2020, with a team meeting to confirm the research plan and timeline. Team members will recommend six proficient Mandarin instructors who will provide three Mandarin sentences from the University of Malaysia Sabah Mandarin Class textbook. These sentences will be compiled in a Google Drive document. The selected Mandarin instructors will have approximately five months to determine the appropriate sentences.

The team will inform Level 1 Mandarin students at the University of Malaysia Sabah about the study and encourage their participation. They will discuss the research and ensure the students are prepared for the recording process. After May 2020, the team will reconvene to select the ten most relevant sentences for reading speech. A research assistant will prepare for data collection and invite interested individuals to join a WhatsApp group.

The data collection period commences in June 2020 and concludes in July 2020. The research assistant will brief the participants before they begin recording their readings. Participants will be required to carefully read the Participant Consent Form, sign it, and submit it to the research assistant. Furthermore, the research assistant will distribute honorariums to each participant prior to data collection. Participants will then record themselves reading the ten Mandarin sentences listed in section C of the participant authorization form and send the audio file to the research assistant via email or WhatsApp.

During the data validation phase, if there are any errors in the recordings, the participant will be requested to resubmit them.

In total, 16 audio recordings in MP3, MP4, M4A, and MPEG file formats were obtained voluntarily from 14 participating students who used their smartphones to record their readings. These were then sent to the researcher via email or WhatsApp. The NCH WavePad Sound Editor, available at <https://www.nch.com.au/WavePad/index.html>, was used to capture 10 spectrum images in PDF format. The software was downloaded onto a Windows 10 personal computer. Six experienced Mandarin language teachers at the University of Malaysia Sabah each proposed three classic, culture-based Mandarin sentences. These were added to a Word document containing ten Mandarin sentences and stored in a Google Drive document. Finally, ten of the eighteen sentences were selected for reading speech. All sentences were chosen from the University Malaysia Sabah Mandarin Class textbook.

### **Participant Selection Criteria**

Students from the Mandarin Level 2 class volunteered for this research. The criteria for participation were as follows:

1. Participants must have joined the research from Mandarin Level 1.
2. Participants must be able to read and understand the provided sentences.
3. Participants must not have any disabilities that would prevent them from performing the tones and rhythms of the language.

### **Reading Criteria:**

Recordings were obtained from students, a Mandarin language lecturer, and Text-to-Speech MP3 recordings at <https://ttsmp3.com/>. All recordings had to meet these criteria:

1. The recording must be done in a quiet room.
2. The recording must be audibly clear, pronunciation must be correct, and the speed and rhythm of speech must be natural.

**All recordings had to meet these criteria:** I. The recording must be done in a quiet room. II. The recording must be audibly clear, the pronunciation must be correct, and the speed and rhythm of speech must be natural.



### **Selection of Sentences for Reading**

1. The sentences are in classic Mandarin and may be in dialogue form.
2. The sentences used were suggested by Mandarin language teachers who chose them based on their reflection of one or more of the following: a. Describing Mandarin culture b. Reflecting the Mandarin lifestyle c. Common sentences often used in the Mandarin language.

Before pre-recording, the researchers explained the meaning of each sentence to each participant and also provided translations in Malay for each sentence. Every participant was thoroughly briefed before the recording took place.

### **Limitation**

The study's subjects were limited to students of the University of Malaysia Sabah. Additionally, the recordings were limited to sentences appearing in the Mandarin language textbook of the Mandarin language class.

### **The research took place at:**

- Institution: University Malaysia Sabah
- City/Town/Region: Kota Kinabalu, Sabah
- Country: Malaysia
- Latitude: 6° 02' 7.20" N
- Longitude: 116° 07' 4.20" E

### **Methodology**

#### **Tools Used**

Every participant, including native Mandarin language speakers, used a smartphone app or recorder to create the recording. The Text-to-Speech feature from the Text-to-Speech MP3 at <https://ttsmp3.com/> provided a free text-to-speech recording via a web service.

### **Method**

The NCH WavePad Sound Editor, which can be downloaded from <https://www.nch.com.au/WavePad/index.html>, was primarily used to analyze and observe the spectrum of the recording. All participants were encouraged to record their readings using smartphone audio recording applications. Each participant, including a native Mandarin instructor, utilized a smartphone application to generate the recording. The Text-to-Speech MP3 provided a free text-to-speech recording through a web service. The NCH WavePad Sound Editor was mainly used to analyze and monitor the recording's spectrum.

## Analysis

The NCH WavePad Sound Editor was used to perform a spectrum comparison of the recordings. To simplify the comparison, the spectrums of the recordings were segmented into similar-length, fixed-size sections.

## Materials

Several essential materials were required to complete the investigation. These included a Google Drive spreadsheet, a Mandarin textbook (Liu, 2010), a Respondent Consent Form (Lau, 2022b), Spectra (Lau, 2022b), and Audio Recordings (Lau, 2022a). The research team recommended six proficient Mandarin instructors to contribute three Mandarin sentences from the University Malaysia Sabah Mandarin Class textbook (Liu, 2010). These sentences were compiled into a Google Drive document sheet. The selected Mandarin instructors were given approximately five months to finalize the appropriate sentences.

For audio recording collection, the research assistant briefed the participants before they started recording. Participants were required to carefully read the Participant Consent Form, sign it, and return it to the research assistant.

## Results

This article references three types of data (Lau, 2022a, 2022b) that are available on Mendeley Data (Mendeley Data, 2022) via a specified URL. The initial contents of the "Audio SGA0028-2019" folder (Lau, 2022a) include 16 audio recordings. The "Spectrums and Respondent Consent Form" PDF file (Lau, 2022b) contains "Spectrums" on pages 1 to 3, and a "Respondent Consent Form" (Lau, 2022b) on pages 4 and 5.

The "Audio SGA0028-2019" folder (Lau, 2022a) contains 16 MP4-formatted audio files. They are labelled as Audio A, Audio A+1, Audio B, Audio B+1, Audio C, Audio D, Audio E, Audio F, Audio H, Audio I, Audio J, Audio K, Audio L, Audio M, and Audio N. Additionally, there is a file titled "Spectrum and Respondent Consent Form" (Lau, 2022b). This file contains 10 voice wave displays. These include eight sound waves from student audio readings, one sound wave from a native Mandarin speaker, and one sound wave from the Text-to-Speech MP3 (2022). These sound waves are represented in spectrum form on pages 1 to 3. The respondent consent form is presented on pages 4 and 5.

Table 1. Details of 16 audio files

Audio Nama	Read by	Item Type	Size	Length(time)	Note
Audio A	Male	MP3	5.89MB	00:02:34	Respondent A provided two recordings
Audio A+1	Male	MP4	1.17MB	00:01:15	
Audio B	Male	MP4	1.82MB	00:01:57	Respondent B provided two recordings
Audio B+1	Male	MP4	1.58MB	00:01:42	

Audio C	Female	MP3	1.34MB	00:01:46	
Audio D	Female	MP4	1.29MB	00:02:40	
Audio E	Female	MP4	1.63MB	00:01:45	
Audio F	Female	MPEG	3.32MB	00:01:27	
Audio G	Male	MP3	4.83MB	00:02:06	
Audio H	Male	M4A	836KB	00:01:39	
Audio I	Female	MP4	1.12MB	00:01:12	
Audio J	Male	MP4	659KB	00:01:20	
Audio K	Female	M4A	839KB	00:01:43	
Audio L	Female	M4A	854KB	00:01:41	
Audio M	Female	MPEG	1.10MB	00:01:12	
Audio N	Female	MP3	4MB	00:01:44	

Table 1 provides information about the sixteen audio files. The table lists the 16 audio file names, the gender of the person who read each file, and whether they were saved in MP3, MP4, M4A, or MPEG format. It also includes information about their size, duration, and notation. The majority of the recordings are between 1MB and 2MB in size, and between 1 and 2 minutes in duration.

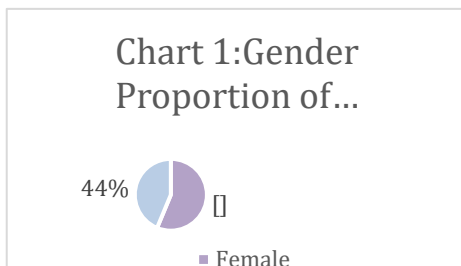


Chart 1. Gender proportion of recordings readers

Chart 1 presents the gender distribution of the readers who participated in the recordings, represented as percentages of the sixteen recordings obtained from University Malaysia Sabah, seven were performed by male students and nine by female students.

Recordings F %

MP3	25
MP4	43,75
M4A	18,75
MPEG	12,5

Chart 2. Percentage of file types for audio recordings

Chart 2 illustrates the distribution of file types for audio recordings, expressed as percentages. Files are saved in either MP3, MP4, M4A, or MPEG formats. Specifically, 4 files were saved in MP3 format, 7 in MP4, 3 in M4A, and 2 in MPEG.

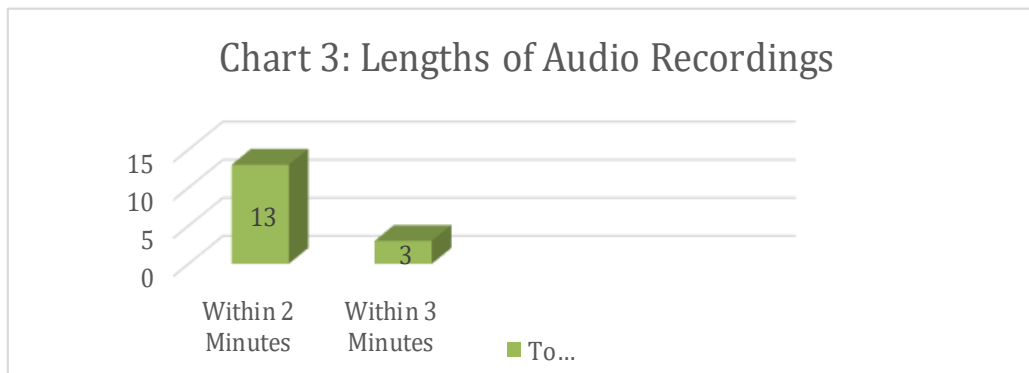


Chart 3. Lengths of Audio Recordings

Chart 3 depicts the total count of audio recordings that are two to three minutes long.

The "Spectrums" (Lau, 2022b) section contains 10 spectrum photos. These include spectra from Subjects 1, 2, 3, 4, 5, 6, 7, and 8. There's also a spectrum from the Text-to-Speech MP3 (2022) reading and one from the Mandarin instructor's reading. All these reading speech recordings were converted into spectrum files using the NCH WavePad Sound Editor, which can be downloaded at <http://www.nch.com.au/WavePad>.

Table 2: Categories of Spectrums

Spectrums	Machine reading	Human reading	Explanation
Subject 1		v	
Subject 2		v	
Subject 3		v	
Subject 4		v	
Subject 5		v	
Subject 6		v	
Subject 7		v	
Subject 8		v	
Subject 9		v	
TTSMP3 Reading	v		TTSMP3 refers to Text-to-Speech MP3
Reading of Mandarin Language Lecturer		v	

**Table 2** presents the categories of spectrums (Lau, 2022b). Subjects 1 through 8 were randomly selected from the 16 student-submitted recordings and then converted into spectrums for the comparative study. The category "TTSMP3(2022)" refers to the spectrums converted from the Text-to-Speech MP3 web service (Free Text-To-Speech for US English language and MP3 Download | ttsMP3.com, 2022). The "Reading of Mandarin Language Lecturer" category, on the other hand, refers to the spectrums converted from the recording made by the Mandarin instructor at the University Malaysia Sabah.

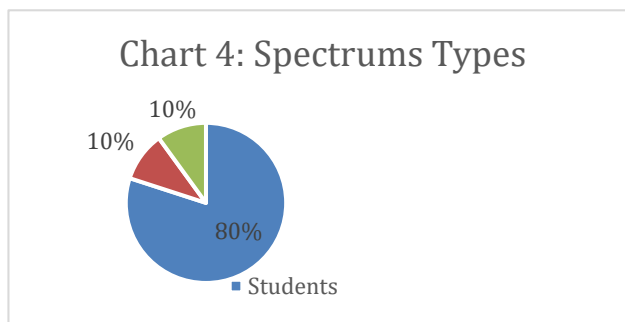


Chart 4. Spectrums Type

Chart 4 represents the types of spectrums as a pie chart. Of these, 80% are derived from student audio recordings, 10% from machine readings, and 10% from a Mandarin instructor's readings. The researcher purchased all spectrums from the NCH WavePad Sound Editor online, thereby gaining access to all functionalities of the web service. Each analysis was conducted in accordance with the website's, web services', and software's open rules and standards (NCH Software legal terms, 2022). The "Respondent Consent Form" (Lau, 2022b) provided pertinent instructions.

Table 3: Components of the Respondent Consent Form and their duties

Part	Components	Purposes	Duties	Action was taken by
A	Name	Check the credentials of respondents.	Ensure that the actual name is written.	Research Assistant
	Gender		Ensure that the correct gender is written.	Research Assistant
	Age		Ensure that they are between 18 and 22 years old.	Research Assistant
	Course Code		Ensure that the correct Mandarin course code is written.	Research Assistant
	Religion		Ensure that the respective religion is written.	Research Assistant
	Which language are you studying as a foreign language?		Ensure that "Mandarin" is written	Research Assistant
	to what extent?		Ensure Level 2 is documented	Research Assistant
	From University Malaysia Sabah Main campus/ Sandakan Campus or Labuan Campus:	Area restrictions of the respondent.	Ensure that one of these campuses is indicated.	Research Assistant

	How to pay you? By way of BOOST? GRAB PAY? TNGO: (Please supply your telephone number or account number.)	Honorarium payments.	Ensure that the payment received details are recorded.	Research Assistant
B	Please record yourself reading the 10 sentences stated below in <b>Part C</b> .	Describe the requirements of the recording.	Ensure that the respondents comprehend the recording's terms and conditions.	Mandarin language lecturer
	Please ensure you receive your honorarium payment prior to beginning the recording.	Describe the requirements of the recording.	Ensure that the respondents comprehend the recording's terms and conditions.	Mandarin language lecturer
	All of these recordings will be used as research data to determine the volume/volume of tones/frequency/spectrum of reading speech, etc.	Describe the requirements of the recording.	Ensure that the respondents comprehend the recording's terms and conditions.	Mandarin language lecturer
	As a respondent, your participation in the study signifies that you consent to the use of your data for analysis, sharing, and research purposes and that the researchers will keep it secure.	Describe the requirements of the recording.	Ensure that the respondents comprehend the recording's terms and conditions.	Mandarin language lecturer
	Please use a recorder to create a recording, and please make the recording clear, read it out loud (and before you read it, please read the translation words first), and record what you read properly, correctly, and neatly. After that, please WhatsApp or email your recording to yokelian@ums.edu.my. Thank you for your assistance; the file name should be Mandarin +your name.	Describe the requirements of the recording.	Ensure that the respondents comprehend the recording's terms and conditions.	Mandarin language lecturer

C	<p>宋华一九八二年十月二十七日出生，属狗。</p> <p>sòng huá yī jiǔ bā èr nián shí yuè èr shí qī rì chū shēng , shǔ gǒu .</p> <p>Song Hua's birthday is October 27th, 1982, and his zodiac sign is the dog.</p>	<p>Pinyin assists respondents in reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>Ensure that the content is read out loud and correctly.</p>	Respondent
	<p>A: 我很好。你和爸爸身体怎么样?</p> <p>wǒ hěn hǎo 。 nǐ hé bà bà shēn tǐ zěn me yàng ?</p> <p>B: 我的身体很好，你爸爸也很好。</p> <p>wǒ de shēn tǐ hěn hǎo , nǐ bà bà yě hěn hǎo .</p> <p>A: I'm fine, how about your father?</p> <p>B: Your father and I are both in good health.</p>	<p>Pinyin assists respondents in reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>Ensure that the content is read out loud and correctly.</p>	Respondent
	<p>一斤香蕉多少钱?</p> <p>yī jīn xiāng jiāo duō shǎo qián ?</p> <p>How much does a 500g banana cost?</p>	<p>Pinyin assists respondents in reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>Ensure that the content is read out loud and correctly.</p>	Respondent
	<p>我买两瓶红葡萄酒。</p> <p>wǒ mǎi liǎng píng hóng pú táo jiǔ .</p> <p>I purchase two bottles of red wine.</p>	<p>Pinyin assists respondents in reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>Ensure that the content is read out loud and correctly.</p>	Respondent



	<p>喝点儿啤酒。</p> <p>hē diǎnr pí jiǔ。</p> <p>Consume a small amount of beer.</p>	<p>Pinyin assists respondents in reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>Ensure that the content is read out loud and correctly.</p>	<p>Respondent</p>
	<p>可以吸烟吗?</p> <p>kě yǐ xī yān ma?</p> <p>Permission to smoke?</p>	<p>Pinyin assists respondents in reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>Ensure that the content is read out loud and correctly.</p>	<p>Respondent</p>
	<p>我们吃寿面。</p> <p>wǒ men chī shòu miàn .</p> <p>We eat longevity noodles.</p>	<p>Pinyin assists respondents in reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>Ensure that the content is read out loud and correctly.</p>	<p>Respondent</p>
	<p>我想租一套房子。</p> <p>wǒ xiǎng zū yī tào fáng zǐ 。</p> <p>I wish to lease a home.</p>	<p>Pinyin assists respondents in reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>Ensure that the content is read out loud and correctly.</p>	<p>Respondent</p>
	<p>你愿意吃中药还是愿意吃西药?</p>	<p>B: Pinyin assists respondents in</p>	<p>Ensure that the content is read</p>	<p>Respondent</p>

	<p>我愿意吃中药。</p> <p>nǐ yuàn yì chī zhōng yào hái shì yuàn yì chī xī yào ?</p> <p>B: wǒ yuàn yì chī zhōng yào .</p> <p>A: Do you favour traditional Chinese medicine or Western medicine?</p> <p>B: I prefer Chinese medicine.</p>	<p>reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>out loud and correctly.</p>	
	<p>今年是马年, 你属什么?</p> <p>jīn nián shì mǎ nián , nǐ shǔ shí me ?</p> <p>This is the year of the horse; what is your zodiac sign?</p>	<p>Pinyin assists respondents in reading the text, while English translations aid respondents in comprehending the text's content.</p>	<p>Ensure that the content is read out loud and correctly.</p>	<p>Respondent</p>
D	<p>I agree to join the research, and I permit for the researchers to use all the given data for analysis for research grant SGA 0028-2019 purpose.</p>	<p>Respondents must check the "v" box.</p>	<p>Make sure respondents check the "v" box.</p>	<p>Research Assistant</p>
	<p>Signature</p>	<p>The respondent must sign the form.</p>	<p>Verify that responders have signed the form.</p>	<p>Research Assistant</p>
	<p>Identity Card Number</p>	<p>Respondents must enter their identification card number.</p>	<p>Ensure that respondents gave the right number for their identification card.</p>	<p>Research Assistant</p>

Table 3 consists of four components. Part A requests the respondent's information to verify that the respondent matches the intended participant. Respondents are asked to provide their E-wallet number, linked to their mobile phone number. They will be informed about their compensation prior to the recording session. Part B outlines the recording criteria. The recording must meet these specified standards, or a retake will be necessary. Part C

comprises 10 sentences from a Mandarin textbook (Liu, 2010). Each sentence is accompanied by its Pinyin and English translation to ensure that each respondent comprehends the meaning and pronunciation of each Mandarin term. The final section, Part D, requires respondents to sign their names, record their identification numbers, and check a box to indicate their agreement with the terms and conditions governing the researchers' use of their data.

## Discussion

This research involves three parties. University Malaysia Sabah provides an appropriate platform, locations, and resources for conducting language research, cooperating with the research team and suggesting a proficient Mandarin instructor for the project. The University also assists in the development of each section of the consent form, rules, and conditions related to the audio recording criteria, and verifies the accuracy of all data. The research assistant aids in the payment of honorariums to all respondents, maintains contact with respondents, and examines all acquired data.

The architecture of this study integrates an online machine reading web service, online software, and human reading. The research team selected Text-to-Speech MP3 (2022) to construct machine speech reading audio from text-to-MP3 format due to its user-friendly nature.

Text-to-Speech MP3 (2022) is a free web service accessible to all users. Upon enabling cookies from the homepage, users can access all features of the website for free. This web service has a character limit of 3,000, and the device's speakers must be activated. The researchers selected Chinese Mandarin, the fourteenth option in the drop-down menu, as their target language. They then inserted the ten Mandarin sentences from section C of the "Respondent Consent Form" (Lau, 2022b) into the empty column, clicked 'read', and downloaded the MP3 file of the speech reading. The machine-reading audio recording was thus generated.

To complete the Mandarin-Level-2 learners' speech-reading audio recordings, the research team engaged a research assistant to gather the human speech-reading audio recordings. As the potential respondent was unfamiliar with the recording equipment, they were notified about the research seven months in advance. A member of the research team who also served as a Mandarin instructor at University Malaysia Sabah performed the instructor's speech reading.

After collecting all audio recordings, the research team converted the files to spectrums using the NCH WavePad Sound Editor (2022). As this software wasn't free, the research team paid for it using provided research funds. Ten identically-sized spectrums (Lau, 2022b) were laid out for visual analysis. The analysis focused on reading tone, reading mood, loudness level, sensitivity to key words, and the relationship between word-by-word reading and reading tone speed (Yoke et al., 2021).

## Conclusion

Text-to-Speech MP3 (2022) offers a human-like reading format, recording syllable-by-syllable and word-by-word. In the process of translating text to speech, the system combines syllables and words into sentences and then vocalizes them. One of its limitations is the inability of text-to-speech technology to convey human emotions such as happiness, grief, and frustration during the reading process. The data (Lau, 2022a, 2022b) provide an overview of the progression of technology and the extent to which it can substitute humans in education. These data are valuable for a variety of quantitative and qualitative research approaches.

This information can be beneficial to all beginners of the Mandarin language and their teachers. Both instructors and beginner-level Mandarin language learners could utilize the data (Lau, 2022a, 2022b) for comparative purposes. The reading characteristics or style of Malaysian Mandarin may be of interest to researchers. With this understanding, they can conduct a pilot study. The data (Lau, 2022a, 2022b) provide several angles to examine human and machine reading from various perspectives. This dataset (Lau, 2022a, 2022b) can also be used to analyze reading speed, and it illustrates how some students read in a highly formal manner while others do not. It serves as a critical starting point for spectrum, voice wave, and reader behavioral studies. The audio recordings (Lau, 2022a, 2022b) are easy to access and analyze. They can be accessed anywhere and analyzed using any relevant software. Given the typical difficulty of obtaining audio recording type data from respondents, this ready-to-use data is particularly valuable.

Those wishing to learn culture-based Mandarin sentences from the perspective of a native Malaysian Chinese speaker could use the selected sentences from a Mandarin textbook (Liu, 2010) — which are believed to convey cultural traits — as a guide. Mandarin instructors can use it as a data gathering model, while Mandarin learners can use it as a means of self-improvement.

The audio recordings are ideal data for analyzing the differences between human and machine readings. Converting audio recordings into spectrums allows for a clear and vivid visual comparison of the spectrums generated by the three groups of respondents. This provides a straightforward analysis to meet the objectives of the research.

The findings contribute to the achievement of the three goals of the original study. Firstly, they determine the effectiveness of Text-to-Speech in reading Mandarin, the limitations of Text-to-Speech, and the differences between machine and human readings. Secondly, the study suggests that while Text-To-Speech technology is sufficiently advanced at present, there are still challenges to be addressed in certain areas such as conveying human nuances, incorporating more elements of human nature, and expressing human emotions in future reading processes. Lastly, the study can broaden the research scope regarding innovative language teaching and learning technologies.

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## Volunteering in Non-Governmental Organization and Their Roles towards Community Development During COVID-19 Pandemic

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**Abstract:** The concept of empowering the culture of volunteering was very broad, considering that this dimension focuses on development community as a whole. The needs of education among the community itself was a challenged. The term volunteering is a term global which is getting more and more attention because of its ability in stimulate community participation to get involved with charity work which brings benefits to the public. The Movement Control Order (MCO) enforced in Malaysia for three phases from 18 March 2020 to 31 August 2020 following the COVID-19 outbreak has had a big impact to Malaysians. To help government efforts, volunteers from various voluntary organizations went to the field to help the community affected by this situation. This concept paper focuses on the roles among the volunteers from non-governmental organizations (NGOs) during the past COVID-19 occurred. It will also explore the mental health issues faced by a community facing by NGO volunteers in Malaysia when conducting aid missions, help support communities, develop roles and plans to improve their readiness in the field towards the community development in Malaysia. At the same time, the need of an educational knowledge towards volunteering also will be explore. The scope of volunteering during this pandemic is very broad. Volunteers can choose to be on the 'front line', volunteers can also choose to be in the 'middle line' and for groups at risk such as the elderly or those with other constraints, volunteers are seen to still be able to engage in this voluntary work by being in the 'back line', which is work that can be carried out in a safe location or at home. As a conclusion, a volunteer especially the NGO's involved, can evoke feelings of love among the community. This feeling of love is not only to be fostered among the family members only, but it needs to go beyond the boundaries before a harmonious society can be formed. All the efforts shown by the NGO's as a volunteer during Pandemic COVID-19, has proved that their roles are very important to the community development in Malaysia.

**Keywords:** Volunteering, Community, Community development, COVID-19 Pandemic, Non-Government organization. NGO

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## Introduction

The definition of volunteering includes the following four key components which are sincerity, education, empowerment and engagement (Hamzah & Suandi, 1994). Volunteering is a sort of prosocial activity where individuals actively and voluntarily look for opportunities to help those in need (Omoto et al., 2020) and serve others who are not their next of kin (Lai et al., 2013). It is a characteristic that has existed in most individuals since the emergence of human civilization and communities, and it is viewed as a concept of service and sharing, a process of education or a learning experience, and the active participation of citizens in community issues and matters (Maharam Mamat et al., 2018). Volunteering is the act of serving the community by providing time, energy, skills, and resources to benefit the needy without expecting monetary or non-monetary rewards in return (Wan Zakaria & Jaafar, 2021; Akintola, 2011). Ali Salman et al., (2015) insisted that volunteering should be instilled in every level of society to produce a community that is aware of the issues around them and helps shape a strong and developed nation.

Three different types of volunteering have been proposed by Fischer et al., (1991) which are formal volunteering for unpaid work for organizations, informal volunteering for unpaid service in one's community, and personal volunteering for aiding relatives. Formal volunteering typically takes the form of formal enlistment in an organised group or institution with a clearly defined social structure, role, and function (Surjit Singh et al., 2005). It typically happens when a person performs unpaid, voluntary work in a non-profit group or volunteer programme under the direction or supervision of a non-profit organisation (Wan Zakaria & Jaafar, 2021). Meanwhile, volunteering that is done informally takes place outside of established organisations or charity causes (Surjit Singh et al., 2005). Unpaid babysitting, assisting a neighbour with home tasks, and donating one's clothes to a local charity are a few examples of it that are more spontaneous and aren't organised by any official non-profit groups (Wan Zakaria & Jaafar, 2021). Additionally, there is corporate volunteering as well as mobile volunteering (Seelig & Lough, 2015).

Since volunteering is an activity, program, or service that is planned and executed sincerely and voluntarily, it exposes someone to many experiences that are related to one's career, boosts self-worth, reduces negative behaviours, strengthens social ties, increases positive life practices, and increases emotional resilience (Maharam Mamat et al., 2018). Although volunteering enables one to experience a distinct sense of well-being and purpose, volunteers may have different motivations for doing so and anticipate other benefits for the work they perform (Hamzah et al., 2016), such as reward, interest, obligation (Ismail et al., 2014), and satisfaction (Zid et al., 2021; Gage III & Thapa, 2012; Pauline, 2011; Bang & Ross 2009). According to Lee et al., (2014) and Chua et al., (2021), positive attitudes towards volunteering will enhance the likelihood of working as a

volunteer even in the long term. Individual resources such as education level, good income, a secure job, a lot of free time, and good health also play an important role in volunteering (Musick & Wilson, 2008).

Volunteers are crucial for communities as they positively contribute to community development through numerous activities (Ferreira et al., 2012). According to Coursey et al., (2011), the choice of a volunteer activity is largely influenced by its compatibility with the individual's motivational palette, which is influenced by the sharing of values within social networks and extrinsic rewards, particularly personal development and long-term intentions of career advancement. People participate in volunteer work for a variety of reasons, including altruism, social contact, personal interest, emotional needs (Yeung, 2004), altruistic, ideological, egoistic, material or reward motives, status, social relationships, leisure, time (Fischer and Schaffer, 1993), values, understanding, enhancement, career, social, protection, social justice function, equality promotion, socialization, a sense of community, and official requirements to serve (Clary et al., 1998; Ferreira et al., 2012; Jiranek et al., 2013).

Studies have shown that voluntary work performed out of altruistic motives lasts longer than commitments resulting from egoistic reasons, and a variety of factors such as organisational support, volunteer satisfaction, social trust, self-esteem, self-efficacy, and well-being make volunteering more likely to be satisfying and sustainable (Stukas et al., 2014; 2016). As a result, it is critical to encourage volunteering for the positive development of a society by changing informal norms and attitudes that influence how people perceive and act on governing institutions and inspiring direct participation. It is a mutual relationship in which volunteers benefit local communities and volunteers benefit personally and professionally. All major components of social interaction connectedness, reliance, and mutuality among individuals, communities, and larger mediums; integration; and the sentiment of belonging to a group benefit from volunteering and have a positive impact on the personal level through knowledge, education, and skill acquisition (Foley et al., 2012).

Trust between volunteers and communities can have a significant impact on social capital (Wollbaeck & Selle, 2002). Volunteering also has the potential to help the social and emotional development of individuals in such areas as communication skills, problem solving, collaboration, and the development of career opportunities, as well as foster awareness (Abdul Rahman et al., 2020), enhance personal skill development, a sense of civic responsibility, career choice, and employability (Hall et al., 2009; Musick & Wilson 2008), and enhance human capital, which includes knowledge, skills, abilities, leadership opportunities, and work experience (Statham & Rhoton, 1986).

In addition, volunteering can lead to small shifts in gendered power relations for some women, manifested in increased confidence, social networks, and independence (Peach, 2011). Meanwhile, the young volunteers can be moulded into active leaders and useful citizens, develop positive social behaviours that can help reduce negative risk-taking, and prepare for employment and the transition to responsible adulthood (Hamzah et al., 2016).



## Volunteering in Malaysia

Various efforts should be made to empower non-governmental organisations (NGOs) to influence civil society development processes. According to Kamal and Lukman (2017), volunteer retention and recruitment continue to pose a challenge to an organization. Therefore, appropriate voluntary activities must be developed according to the interests and needs of individuals. For example, the ASEAN Youth Volunteer Programme (AYVP) is a dedicated youth volunteerism platform that creates opportunities for knowledge-driven volunteerism, supports the exchange of learning experiences, develops capacity, enhances cross-cultural understanding, and forges a sense of regional identity while making a sustainable difference to communities across ASEAN, including China, Japan, and the Republic of Korea.

Meanwhile, Muslim Volunteer Malaysia and Islamic Relief Malaysia are independent international humanitarian aid organisations that serve as fundraisers and project implementers at the local and international level. On the other hand, Mercy Malaysia is an international non-profit organisation focusing on providing medical relief, sustainable health-related development, and risk reduction activities for vulnerable communities in both crisis and non-crisis situations.

All of these organisations clearly have different visions and missions that meet the differences in people's interests. Thus, the utilisation of new technologies, especially mobile platforms, through messaging services, social media, and various apps definitely can enhance volunteering and its effects on developing an ecosystem to support volunteering (Seelig & Lough, 2015). People's awareness can be increased through campaigns, volunteer ads, and supportive environments for participation, engagement, and volunteering. Since NGOs act as a bridge linking government support and community needs (Abdul Rahman et al., 2020), further collaboration and cooperation should be made to cultivate the culture of volunteering in society. Research on volunteering is also vital in helping NGOs, corporate organizations, communities, and the government develop better programmes in the future.

Numerous studies on volunteering have been conducted in Malaysia, including those that examining the factors that influence and motivate people to volunteer (Turiman et al., 2011; Maharam Mamat et al., 2018; Ismail et al., 2014), the challenges in voluntary work (Mohamad Kamaludin et al., 2013), empowering youth volunteerism and motivating factors (Sahri et al., 2013), altruism as motivational factors toward volunteerism among youth (Zaliha & Arshad, 2012), psychosocial factors that influence the volunteers to offer their services to the community (Surjit et al., 2005), the relationship between motivation and participation in volunteer work (Abdullah Sahimi et al., 2018), the relationship and correlation between the management and retention practices of volunteers (Bukhari et al., 2018), factors that motivates the retirees in volunteering (Surjit Singh et al., 2005), the benefits, needs, and reasons for volunteering among youth (Hamzah et al., 2016), and volunteers satisfaction and intention to continue volunteering Zid et al., (2021).

## Methodology

To fulfil the purpose of the study, which is to see which aspects of education can be improved through the volunteering of non-governmental organisations (NGO) facing the COVID-19 pandemic in Malaysia, the methodology of this concept paper is based on library research. Selection of appropriate secondary materials: emphasis is placed on searching electronically through internet facilities for articles and reference materials online that meet the needs of the study. Through this method, every piece of material, such as journal articles, books, proceedings, and related official reports, related to the education issues of community development and the COVID-19 pandemic is collected to increase knowledge and improve understanding of the issue studied. The resources obtained through this method are very helpful in strengthening the information that is needed. After this secondary data is obtained and collected, the study continues by classifying themes based on content analysis techniques. The division of themes is determined by the suitability of the debate for the education issues that arise as a result of NGO volunteer tasks in the face of the COVID-19 pandemic, particularly in Malaysia. In the analysis of the content carried out, there are four themes discussed: introducing a lay counsellor, educating the community by raising public awareness about mental health care, raising awareness of family wellbeing issues, and practising strategic communication.

## Discussion

The COVID-19 pandemic has had a huge impact on community development (Abiddin et al., 2022). This meta-analysis study will focus on the implications from the point of view of mental health issues, which is one of the branches of healthy community development. How do volunteers play their part to help the communities involved? As we can see, throughout the period of MCO implementation, various problems have occurred that affect the well-being of the community. The limitations due to these restrictions are certain and have created an atmosphere that induces stress, anxiety, and depression towards society in this country more widely across at-risk groups than under normal circumstances. Based on the Talian Kasih Report published by the Ministry of Development Women, Family, and Community (KPWKM), case records for the period of 18 March 2020 to 31 March 2020, which is during Phase I of the MCO, recorded 336 complaints on physical, mental, emotional, and sexual abuse and exploitation and neglect involving the categories of children, domestic violence, people with disabilities, and the elderly; and to get counselling services, which represents 47.3 percent of the 710 complaints after being dismissed with a complaint on welfare assistance applications and inquiries from 1,535 complaints, which represent a total of If society or the government fails to manage this stressful situation, it will weaken the immune system and interfere with the ability of the individual's body to overcome infection and disease, in addition to inviting the problems that have been mentioned before. Therefore, efforts to contain the spread of this epidemic at the micro level may also be slightly affected. As a result, the NGO has been tasked with dealing with these issues. There are NGOs that have taken some initiatives by creating an educational service for the community about the benefits of *lay counsellors*. Secondly, volunteers educate by raising public awareness about mental health care. Third, by educating the community about the importance of family well-being issues

during the COVID-19 pandemic. Finally, when dealing with the community, use strategic communication.

### ***Lay Counsellors***

For NGO groups, this initiative is very important in educating and producing more members of the public who can provide services by volunteering. With the right form and method of counselling assistance at the right level, the community can compensate for the current lack of counsellors. Thus, a total of 5,500 volunteers have been born through the Lay Program Counsellors implemented by KPWKM since 2015 and are targeted to reach 10,000 people in 2019. They need to be fully utilized, for example, by being absorbed as Sahabat Psychological Support Team (sPST) volunteers or other platforms. A database that is constantly updated and integrated with the system or other support programmes should also be established to avoid wasting the existence of lay counsellors in this country. The NGO's organisation is also advised to develop appropriate extension programmes to improve the knowledge and competence of this volunteer continuously, so they can be categorised as highly skilled volunteers. This was part of the NGO's volunteer role during and after the COVID-19 pandemic.

### ***Educate Community by Raising Public Awareness About Mental Health Care***

Most importantly, post-COVID-19 needs to be well managed to ensure that it does not interfere with a person's daily functioning. Individuals directly involved with COVID-19, such as victims, quarantined individuals, and health workers, are those who are most affected by this crisis, in addition to leaving a psychological impact on the general public. As a result, all volunteers and non-governmental organisations have taken proactive measures to avoid the worst-case scenario. Through various mediums, education that is concerned with mental health awareness has been given to the whole community all the time. From the time COVID-19 happened until the MCO ended, all the NGO's and volunteers made an effort to increase mental health awareness among the community through campaigns, talks, and group counselling, as well as a spiritual approach, in order to have a coping strategy (*coping skill*) for facing pressure.

### ***Awareness of Family Wellbeing Issues***

The COVID-19 pandemic is a global issue that is threatening family well-being and litigation. The COVID-19 outbreak is seen as a contributing factor to the stress in family institutions since the world has just identified the transmission of a killer virus and is still struggling with various related uncertainties. During the MCO period, all educational institutions involving all levels, including primary, secondary, and higher education institutions, have been closed. Children in nursery services are no exception. This situation has put pressure on parents because they have to be responsible in the aspect of children's education as well as ensure that aspects of home management run smoothly. Stress and emotions in parents' negativity also lead to abusive and potentially abusive parenting styles for children. Furthermore, the Ministry of Women, Family, and Community Development reports that there have been 1,929 complaints about cases of domestic violence that occurred

during the MCO period beginning March 2020. Domestic violence is most commonly reported when the perpetrator injures or physically harms the victim, which is then followed by intentional violence or attempts to put the victim in fear of physical injury, and the perpetrator commits psychological and emotional abuse against the victim. Realizing this, volunteers and NGOs try to increase a high level of understanding of the practise of philanthropy among the community, which is very important when the country is hit by the COVID-19 pandemic. This is because it can ensure that individuals who are less fortunate can be helped from an economic perspective. During this MCO period, many parties other than the government contribute funds to help individuals in need. This is evident when MyCARE Johor successfully raises RM6,300 from the general public, where with this fund MyCARE Johor was able to donate basic necessities for the target group in the south of the country. Besides, there are also individuals who voluntarily sew protective clothing (personal protective equipment, or PPE) to be distributed to all hospitals in Malaysia. Government bodies are also like PETRONAS, through which the PETRONAS Foundation has donated medical equipment and supplies worth RM20 million to help hospitals and healthcare frontline workers.

### *Practicing Strategic Communication*

In a civilised society, voluntary activities reflect humanity. It is a pure bond that binds a person together with other individuals and fosters a sense of common purpose. Voluntary activities are an important basis in the effort to create a more inclusive society. a strong culture of volunteerism forming confident individuals, empowered communities, and a safe and friendly place to live; better service; local and national governments that are more responsive; and an economy that is more lively. Volunteering is one of the ways to strengthen relationships with others and get closer to the community. Volunteers can improve their interpersonal skills while also expanding their social networks and contacts. Volunteers use interpersonal skills to delve into the feelings or expressions of the community. When society is comfortable with volunteers, there will be trust in one another to tell the truth. Being friends with this group of people makes it easier for them to feel comfortable sharing problems. When para-volunteers began to serve the community as if they were friends looking out for one another, the community was more willing to accept the advice given as well as the various stories that could be unravelled and solved. In this way, it becomes an alternative and a facilitator to educate the community, and the objective of developing a more open society will be realized. The benefits obtained by volunteers when using an effective strategy are to create trust with the community and volunteers. Communication strategy is very important because the selection, setting, and use of effective strategies will benefit both parties. It will make the role of volunteers easier because the community's trust will make it easier for them to collaborate.

### **Conclusion**

The spirit of volunteerism must be inculcated in every Malaysian citizen from the very beginning. This is because all parties will play an important role in the country's development as a potential leader and in determining its future national leadership. Everyone's involvement in volunteer activities brings various positive

benefits to society. The more active communities and volunteers who participate in activities such as this volunteerism, the more benefits the country will receive. The benefits of volunteering for the development of a society are a form of empowerment that can develop the people and the country overall.

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## Language Behaviors Signifying Lecturers' Social Identity in The Business English Teaching Context

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**Abstract:** The present study aims to investigate the socio- and applied linguistic functions and frequency of lecturers' language behaviors (code-switching (CS), code-mixing (CM), and translanguaging) in terms of showing lecturers' social identity in the Georgian educational discourse, namely, in teaching Business English (English for Specific Purposes - ESP) at the university level. An examination of Georgian discursive peculiarities is a novel addition to this field of research, as there are very few studies focusing on Georgian lecturers' language behaviors in English for Specific Purposes (ESP). Both quantitative (online questionnaires (70 students) and qualitative (8 lecturers' recorded lectures) research methods are used to illustrate the functions of using code-switching, code-mixing, and translanguaging in English for Specific Purposes (ESP) (lecturers' recorded lessons (80 hours). Surprisingly, in contrast to previous studies' findings, we found that the Georgian and English languages are equally used for informal and formal purposes. Both languages are used to express solidarity in classroom conversations. The given study is a unique example in which both English and Georgian are used as marked/unmarked ("We-code", "They-code") choices, as previous studies only considered L1 (first language) as "we-code" and a foreign language (English) was regarded solely as "they code." Within 80 hours of recordings (ESP), 549 cases of code-switching, 103 cases of code-mixing, and 177 cases of translanguaging, planned use of L1 (Georgian) were detected in teaching vocabulary. Consequently, using translanguaging can be beneficial to business English lecturers seeking to improve and fossilize students' Georgian business terminology. The business English lecturers consider the English language to be an inseparable part of their identity, however, they still incorporate the mother tongue in their lectures for encouraging the enhancement of the Business terminology in the Georgian language.

**Keywords:** ESP, Code-switching, Code-mixing, Translanguaging, Social identity

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## Introduction

This research studies Business English lecturers and their students across two Georgian state universities.

Business English (B2-C1 level) is taught as a compulsory course at Ivane Javakishvili Tbilisi State University and as an optional course (B1-B2 levels) at Ilia State University. The study combines both quantitative and qualitative research methods. The article will suggest a combination of psycholinguistic, sociolinguistic, and structural perspectives to provide a deeper explanation of language behaviors captured in the recorded lectures.

Moreover, this paper illustrates the co-existence of the competitive terms: translanguaging, code-switching, and code-mixing. The original use of translanguaging as a language behavior has two core aims: 1. For students to gain a deeper comprehension of the content; 2. For students to acquire both languages simultaneously since these languages represent inseparable parts of bilingual speakers' repertoire. There is no such notion as language, but 'lect', and idiolect is a subject of interest in translanguaging studies.

As for code-switching (code-mixing) behavior, it refers to the switching of languages depending on the purpose and environment of the communication within one conversation. Some unconscious switches, those which are not associated with comprehension and acquiring knowledge, can be found in the educational discourse.

The research questions are the following:

1. What are the sociolinguistic functions of using code-switching, code-mixing, and translanguaging in English for Specific Purposes (ESP) context (based on the data collected in two state universities in Tbilisi)?
2. What is the structural representation of code-switching, code-mixing, and translanguaging in English for Specific Purposes (ESP) context (based on the data collected in two state universities in Tbilisi)?
3. What are the attitudes Georgian lecturers and students have toward lecturers using L1 (Georgian) in business English classrooms?

The structure of the paper follows the three WH-questions: what (the terminological clarification of the words: translanguaging, code-switching, code-mixing, diglossia, borrowings, how (theoretical framework: a description of quantitative and qualitative methods used in the study), and where (discourse, in our case, teaching ESP – Business English).

### Code-switching and its related vocabulary

The term 'code' has been widely observed. In sociolinguistics, 'code' is employed in both a general (i.e., system of signs) and specific (i.e., dialect and register, etc.) sense. Code refers to the language and a variety of languages that are transmitted by different groups in social situations (Swann, 2004). Swann suggests a broad understanding of code (the language and a variety of a language). A language variety, also called a 'lect', is a specific form of a language or language cluster, which may include languages, dialects, registers, styles, or other

forms of language, as well as a standard variety.

Based on the definition of the term code (general/specific), the definition of code-switching is determined. According to Myers-Scotton, code-switching is the use of two or more languages in the same conversation usually within the same conversational turn or even within the same sentence of that turn (Myers-Scotton 1997:47). Mayers-Scotton suggests the general understanding of the word code, which refers to language (i.e., Georgian, English, etc.).

There are other terms used in the scientific literature concerning code-switching; these are code-mixing, translanguaging, diglossia, and bilingualism. This article will discuss the terminological distinction between the above-given terminologies.

Table 1. Terminological definition of code-switching related words

Code-mixing	Wardhaugh (1986:103) suggests that code-mixing occurs when conversants use both languages together to the extent that they change from one language to the other during a single utterance. It means that the conversant just changes some of the elements in their utterance. Code mixing takes place without a change of topic and can involve various levels of language, e.g., morphology and lexical items.
Translanguaging	Translanguaging is the use of the full linguistic repertoire “without regard for watchful adherence to the socially and politically defined boundaries of named languages”. - Oftentimes, it is assumed that bilinguals have one dominant language, and thus there is a hierarchical relationship between their known languages (García et al 2017).
Borrowing	It has been claimed that from synchronic examination [i.e., without comparative or etymological evidence] no loans are discoverable or describable (see Fries and Pike, 1949, see also Haugen, 1950a, Weinreich 1953) presumably because they are perfectly assimilated to the recipient language patterns (Poplack and Sankoff, 1984).
Diglossia	A state of “being bilingual”. A situation, in which a community uses two different languages or varieties of a language for different situations (high variety and low variety).

The distinctions between code-switching and borrowing are vivid since borrowed words do not have an equivalent in the recipient language and become perfectly assimilated into it. On the contrary, code-switching and code-mixing may represent better versions of the existing units or fill the lexical gap in the recipient language. Importantly, they never become fully assimilated to the receiver (language).

Code-switching and code-mixing are also easily distinguished since one represents the switch on the intersentential (between sentences) level and the other intrasentential (within the sentence) which may involve

morphology and lexical items.

Diglossia is a situation in which two languages or two varieties of one language have their status (high, low). On the one hand, there is a standard language, which is used in education and literature, for official documents, etc. On the other hand, there is a low variety of language, which is only used in oral discourse and used as a standard language. The perfect example of diglossia is Arabic languages, standard Arabic and Arabic dialects, which are never used interchangeably. Communities living in such diglossic situations are bilingual.

There is considerable confusion surrounding translanguaging, as it can be an all-encompassing term for diverse multimodal and multilingual practices, which have traditionally been described as code-switching, code-mixing, code-meshing, and crossing.

There are two views of teaching languages in the classroom. The conventional view represents the process when two languages are generally taught as two isolated systems. The focus has tended to be historically on the structure of those languages, i.e., vocabulary, grammatical structure, and so on. But most people, who live in bilingual and multilingual parts of the world, engage in practices where they borrow words from one language that pop them into the language that they are using.

Table 2. Conventional versus Contemporary Views

Code-switching and translanguaging	
Conventional view:	Contemporary view:
<ul style="list-style-type: none"> <li>• Two languages are taught as separate entities (Lambert, 1991).</li> <li>• Focus on form (structure – lexis, syntax, 4 skills)</li> <li>• Code-switching and code-mixing are regarded as illegitimate practices.</li> <li>• Code-switching is the alternating use of chunks (clauses, sentences, paragraphs) of two or more languages.</li> <li>• Code mixing, usually inserting/including one or two words here &amp; there from a second language into the predominant use of one language.</li> </ul>	<ul style="list-style-type: none"> <li>• two languages, part of the student’s repertoire (bilinguality/multilinguality) (Agnihotri, 2007),</li> <li>• Focus on (social) process – ‘languaging’ (Swain, 2006), ‘translanguaging’ (Garcia, 2009).</li> <li>• Increasing awareness of what bilingual learners do to make meaning.</li> <li>• Reappraisal of the role of translation and Interpreting.</li> </ul>

Translanguaging is using language as a unitary meaning-making system of the speakers. It is characterized by bilingual speakers. Languages are not perceived separately in translanguaging, rather they are seen from speakers' perspective as a language repertoire, from which they select features that are appropriate to

communicate. In Pedagogy, translanguaging is used as an approach to make the context better understandable with the help of using bilingual speakers' (students') repertoire.

The concepts of translanguaging and code-switching using bilingual classrooms are often confused. However, they can be distinguished in terms of language interference and individuals involved in language practice.

There are several distinctive features between these two terms: Garcia and Wei (as cited in Molina & Samuelson, 2016) think that code-switching is seen as the process of changing two languages, whereas translanguaging is about "the speakers' construction that creates the complete language repertoire" (Molina & Samuelson, 2016: 3).

Table 3. Terminological Distinctions between Code-switching and Translanguaging

Translanguaging	<ul style="list-style-type: none"> <li>• An existing controllable cognition (bilinguals know what they are saying while producing words in both languages)</li> <li>• analyses "how bi/multilingual individuals are involved in their linguistic practice" (Hornberger and Link, 2012: 267)</li> <li>• focuses on learning both languages at the same time without separating (Lewis, Jones, and Baker, 2012)</li> </ul>
Code-switching	<ul style="list-style-type: none"> <li>• "Changing languages within a single conversation"(Baker &amp; Jones, 58) (bilingual individuals shift between two or more languages, which depend on the purpose and environment of the communication)</li> <li>• Has been considered a linguistically incompetent ability</li> <li>• searches for "language interference and transfer" (Hornberger and Link, 2012: 267)</li> <li>• According to Lewis, Jones, and Baker (2012), code-switching practices the notion of separate languages.</li> </ul>

Thus, code-switching is seen as the process of changing two languages (1. using at least a clause in a sentence in one language and switching over to a new one, then developing a second clause, a subordinate clause in the second language; 2. one sentence in one language and then, alternating with one sentence in the second language; 3. speaking for five minutes in one language or writing a paragraph in one language and switching over and writing or speaking in the other language) for deliberate purposes, whereas translanguaging is about perceiving languages as unitary meaning-making systems, bilingual repertoire.

Translanguaging has been studied in bilingual and multilingual societies (Garcia, 2009; Wei, 2011). It must be said that the term translanguaging was originally intended to be a descriptive label for a specific language practice. It was Baker's (2001) English translation of Williams's (Williams, 1994) Welsh term 'trawsieithu', to describe pedagogical practices that Williams observed in Welsh revitalization programs, where the teacher would try and teach in Welsh and the pupils would respond largely in English. William suggested that they help

to minimize the learners' and the teacher's linguistic resources in the process of problem-solving and knowledge construction.

Wei (2017) elaborated on two related concepts translanguaging space and translanguaging instinct to bridge the artificial and ideological divides between the so-called socio-cultural and the cognitive approaches to translanguaging practices. Current studies use the notion of translanguaging since both sociocultural and cognitive (acquiring language through bilingual communication) aspects of using L1 versus target language in the Business English classes. In terms of code-switching and code-mixing behaviors, we are interested in the sociolinguistic and psycholinguistic aspects of using L1 in the same context.

## Method

Both qualitative and quantitative studies were used to better illustrate the core aim of the given paper. On the one hand, we analyzed Business English lectures recorded via the Zoom platform. On the other hand, two questionnaire forms were filled out by eight lecturers (teaching Business English) and their students (taking Business English courses) from two state universities (Ivane Javakhishvili Tbilisi State University and Ilia State University). The participants are randomly chosen for both, quantitative and qualitative studies, the questionnaires were sent to as many students and lecturers as possible via platforms ([argus.iliauni.edu.ge](http://argus.iliauni.edu.ge); [LMS.tsu.ge](http://LMS.tsu.ge)) which are used in the above-mentioned universities. We asked 11 lecturers to record their Business English lectures, however only 8 complied with our request.

The quantitative data was collected with the help of Google forms from 70 students (taking Business English course) and from eight teachers who recorded the Business English lectures (80 hours overall, 10 hours, 5 lessons each). As for the qualitative data, 80 Zoom lectures were transcribed with the help of online software ([otter.ai](http://otter.ai)). The lecturers' moments of switching from the target language (English) to L1 (Georgian) were analyzed by using conversational analytics (CA) (Auer, 1988), interactional sociolinguistic (IS) (Bailey, 2015), and contextualization cues (Gumperz, 2002) methods. According to the CA approach, language choice and turn-taking define the teachers' attitudes toward each language. A change in register and implicature (IS) signifies the language identity. Lecturers' language choice is also determined by their identity ("we-code and "they-code"); Employing the structural analysis in our research qualitative data is also illustrated quantitatively.

## Results and Discussion

Translanguaging cannot fully have the same usage in multilingual classrooms (knowing more languages than a native one) as it has among bilingual speakers (people naturally have an inborn ability to speak two languages). This research focuses on cases in which the monolingual approach is a dominant teaching method for Business English. Thus, some elements of translanguaging are included together with code-switching and code-mixing behaviors.

Business English is the most popular field of interest in teaching English for specific purposes (ESP) due to several reasons. First, business administration has become one of the most demanded professions in Georgia. Across Georgia's higher education institutions, from 6000 to 7000 (21-22%) of BA students study at the faculty of Business Administration based on the statistical data of 2018-2022. Second, English, in addition to being a lingua franca, obtained a function of code used in business communications worldwide; therefore, a specific English terminology bank is formed, and equivalent terms may not be found in other languages. Thus, the paper is focused on Business English (ESP), rather than English as a foreign language (EFL).

### Qualitative research

Eight participant Business English lecturers were categorized in the following way: their demographical data, their attitude towards the English language, and functions of using L1 in their Business English classes. The demographic values are illustrated in the table below.

Table 4. Demographical Data of the Research Participants

Business English lecturers	Age	Gender	Place of birth	The highest level of Education they have	Their mother tongue	The language they use with their family members
Teacher 1	41-45	F	Georgia	MA	Georgian	English
Teacher 2	41-45	F	Georgia, Tbilisi	Ph.D.	Georgian	Georgian
Teacher 3	36-40	F	Georgia, Tbilisi	MA	Georgian	Georgian
Teacher 4	31-35	F	Georgia, Tbilisi	MA	Georgian	Georgian
Teacher 5	31-35	F	Georgia, Chiatura	MA	Georgian	Georgian
Teacher 6	56-60	F	Georgia, Sokhumi	Ph.D.	Georgian	Georgian
Teacher 7	36-40	M	Georgia, Tbilisi	MA	Georgian	Russian
Teacher 8	21-30	F	Georgia, Tbilisi	MA	Georgian	Georgian

The table shows that most of the lecturers (4 out of 8) surveyed are from 31 to 40 years old and were born in Tbilisi, Georgia. Only one lecturer is male. Most of them (6 out of 8) have MA degrees. Most individuals speak Georgian with their family members but two use either English or Russian.

Based on our survey two lecturers work at Ilia State University, while six work at Ivane Javakhishvili Tbilisi State University. Six out of eight lecturers believed having a good command of English is very important and seven out of eight lecturers considered the English language as an important part of their identities. All eight

participants claimed that they use and prefer to use either only English or a combination of English and Georgian languages. None of them prefer nor use only Georgian in their Business English classes.

Based on the recorded Business English lectures (80 hours), we managed to identify the functions of using lecturers' code-switching and code-mixing language behaviors and to single out the translanguaging moments. The paper aimed to structurally analyze and categorize the parts of speeches found in lecturers' code-switching and code-mixing examples.

Within the 80 hours of recordings (ESP), 549 cases of code-switching, 103 cases of code-mixing, and 177 cases of translanguaging were used by the Business English lecturers. These three language behaviors are analyzed separately. All five translanguaging behaviors found in the recordings had comprehensive functions, lecturers used them namely for Business English vocabulary clarification purposes code-switching and code-mixing language behaviors had almost similar functions:

- to give instructions
- to explain difficult concepts
- to explain grammar explicitly
- to check for comprehension
- to introduce unfamiliar materials/topics in Business
- to explain the differences between the students' L1 (Georgian) and English
- to draw students' attention to the correct pronunciation of sounds in English
- to maintain classroom discipline and the structure of the lesson
- to provide praise/feedback/personal remarks about students' performance
- to encourage student's participation in classroom activities
- to build/strengthen interpersonal relationships between the teacher and students
- to reduce students' anxiety in learning Business English
- to increase students' motivation and confidence in learning Business English

Table 5. The Structural Stratification of the Given Language Behaviors

Structural forms:	English for Specific Purposes (Business English)
Paragraph	Code-switching (16); Translanguaging (21)
Phrase	Code-switching (14) Translanguaging (2)
Collocation	Code-switching (3); Translanguaging (4)
Idioms	Code-switching (0); Translanguaging (0)
Participle	Code-mixing (1)
Noun	Code-mixing (12); Translanguaging (2)
Adjective	Code-mixing (4); Translanguaging (1)
Numeral	Code-mixing (2)

Adverb	Code-mixing (17)
Verb	Code-mixing (31)
Particle	Code-mixing (25)
Interjection	Code-mixing (4)
Conjunction	Code-mixing (2)

Structurally, there were dominant parts of speech found in the recordings. Code-mixing and translanguaging behaviours are categorized to show the quantity of each part of speech in the lecturers' language repertoire.

In terms of code-switching and translanguaging, L1 is used mostly in the form of a paragraph, while code-switching is mostly presented as a verb.

Sentences were classified according to their content.

Table 6. Classification of Sentences found in the Business English Teaching Context

Types of sentences:	English for Specific Purposes
Declarative Sentence	Overall: 243 Code-switching (154); Translanguaging (90)
Interrogative Sentence	Overall: 127 Code-switching (113); Translanguaging (14)
Exclamation Sentence	Overall: 111 Code-switching (92); Translanguaging (19)
Interrogative-exclamatory Sentence	Overall: 103 Code-switching (85); Translanguaging (18)
Imperative Sentence	Code-switching (31)
Negative Sentence	Overall: 44 Code-switching (38); Translanguaging (6)

Declarative sentences are the most, while the negative sentence type is the least used.

Some examples are discussed in this section of the paper: code-witching, code-mixing, and translanguaging.

Notes:
// - Pause 0.5 seconds and more
= - a direct link between sentences
[ ] – speeches coincide
, - hesitation
? - rising tone
. - falling tone
— - Georgian sentences are underlined
( ) - English Translation



**Example 1/01:28 (code-switching)**

Topic: Reading (Problem Solving); Grammar (Past modals)

Function: (1) (2) to solve the problem created in the process of lecturing: interrogative

S: მიჭედავდა და ხმა კარგად არ მესმის./mitchedavda da khma kargad ar mesmis. (It was stuck and I barely hear the voice.)

T: (1) არ ისმის ახლა ჩემი ხმა?/ar ismis akhla chemi khma? (?) (Can you hear my voice, now?)

S: ახლა კი, არ ვიცი რატომ ჭედავს./akhla ki, ar vitsi ratom tchedavs. (now yes, I don't know why it is unstable)

T: (2) უი, რატომ?/ui, ratom? (?) (oh, why?)

This example shows the pitfalls of online learning. e.g., interruptions caused by weak internet connection. As can be seen from the example, both sides use the Georgian language, consciously or unconsciously, in order to quickly eliminate the mentioned problem. The choice of the Georgian language by the lecturer is determined by the students' language choice.

**Example 2/1:38:37 (code-mixing)**

Topic: Writing (Minutes)

Function: Greetings/Farewells

T: Okay, I guess you have no questions, would you like to, I don't know, say something before we say goodbye?

Ss: (silence)

T: okay, then guys, have a nice day. Have a nice weekend and see you next week.

Ss: Thank you, Okay, goodbye.

T: Okay, bye,

S: goodbye,

T: ნახვამდის/nakhvamdis (goodbye).

The example shows a change in register, namely the English language is used either formally (would you like to, goodbye) or informally (guys, bye, okay). The Georgian is used formally (ნახვამდის/nakhvamdis (goodbye)). The function of the example is seeing off in the form of interjection.

**Example 3/1:22:33 (Translanguaging) (Code-switching) (Code-mixing)**

Topic: Vocabulary (Law)

Function: Code-switching - (1) (2) (6) (7) to check for comprehension, to ask, to inquire so that the students answer by themselves.

Code-mixing (3) to ask, to inquire so that the students answer by themselves.

Translanguaging - (4) (5) (8) to explain difficult concepts

T: Okay (.) (1) ახლა, რამე სიტყვები რაც თქვენ გახსოვთ აქედან?/akhla, rame sityvebi rac Tqven gakhsovT aqedan? (now any vocabulary items you remembered from the task?)

S1: Excruciating

T: (2) რა არის ეგ?/ra aris eg? (what does that mean?)

S1: მტანჯველი/mtanjveli (gives a Georgian definition of the word)

T: yeah! = (3) კიდევ?/kidev? (what else?)

S2: trepidation?

T: (4) რაღაც ისეთი/raghats iseti (something like) = trepidation. So, you, you feel trepidation (.) (5) რაღაც/raghats (something) excitement-სავითარი ხო?/excitement-saviTari kho? კიდევ?/kidev? (like excitement, isn't it? what else?)

S2: incredulously,

T: Yeah, (6) კარგი სიტყვა არის. კიდევ რა, ვის რა აქვს?/kargi sityva aris. Kidev ra, vis ra aqvs? (it is a nice word, what else, what else do you have?)

S3: vigor

T: vigor! = (7) რა არის გ (student's name) vigor? /ra aris G = vigor? (G (student's name) what is vigor?)

S3: ძალა!/Dzala! (power!)

T: (8) ენერჯია ხო? სხვათაშორის vigor არ არის მარტო ენერჯია, ეს არის ფიზიკური ძალაც და აი, ჯანმრთელი რომ ხარ./energia kho? Skhvatashoris vigor ar aris marto energia, es aris fizikuri dzalats da ai, janmrтели rom khar. (Energy, right? Vigor is not only energy, but also physical power and, like being healthy.) = You are vigorous and full of energy.

This example incorporates all language behaviors. Translanguaging is used to clarify the meanings of the unknown terms; With the help of using translanguaging, lecturer tries to teach his or her students the business terms, both in Georgian and English. Code switching is used to check for comprehension (რა არის ეგ? /ra aris eg? (What does that mean?)). Code mixing is used by the lecturer to make his or her students talk. The example can be analyzed with the help of CA (lecturer encourages his or her students to use Georgian).

## Quantitative research

Participants: 70 BA Students, taking a Business English course, from Ivane Javakhishvili Tbilisi State University and Ilia State University.

Quantitative research aims to answer the following research questions: 1. What is the correlation between Business English students' sex and their identity; 2. How Business English students' English language competence is correlated with their identity; 3. How functions of using L1 (Georgian) by lecturers are determined by students' identity, sex, and English language competence.

- 86% of Business English students believe that the English language is part of their identity. Only 14% of students surveyed believe that the English language is not part of their identity and consider it only as means of communication.

- (No difference in Gender - Fisher's Exact Test = .543, Pearson Chi-Square =.733).

- In terms of Identity, there is no difference in results between students born in Tbilisi and the regional

parts of Georgia. (Fisher's Exact Test = .484, Pearson Chi-Square = .695).

Business English Students want their lecturer not to use the Georgian Language, but to reinforce using the English language for expressing the following functions:

- to explain the differences between the students' L1 (Georgian) and English
- to encourage student's participation in classroom activities
- to build/strengthen interpersonal relationships between the lecturer and students
- to reduce students' anxiety in learning Business English
- to increase students' motivation and confidence in learning Business English

Please use 10-point font size. Please margin the text to the justified. Manuscripts should be 1.5 times spaced. Footnotes and endnotes are not accepted. All relevant information should be included in main text. Do not indent paragraphs; leave a 1.5 times space of one line between consecutive paragraphs. Do not underline words for emphasis. Use italics instead. Both numbered lists and bulleted lists can be used if necessary. Before submitting your manuscript, please ensure that every in-text citation has a corresponding reference in the reference list. Conversely, ensure that every entry in the reference list has a corresponding in-text citation.

## Conclusion

Based on both, quantitative and qualitative research methods, we came to the following conclusions:

In the Georgian educational discourse, within 80 hours of recordings (English for Specific Purposes (ESP), 549 examples of code-switching, 103 examples of code-mixing, and 177 examples of translanguaging were found.

The language behavior examples are classified according to the structural forms and sentence types. Overall, the most spread ones are a paragraph and declarative sentence type.

The lecturers' frequently-expressed functions of code-switching and code-mixing behaviors are (1) to explain the differences between the students' L1 (Georgian) and English; (2) to encourage student's participation in classroom activities, and (3) translanguaging – to explain the specific Business term.

All participants (8 lecturers) claimed that they use and prefer to use either only English or a combination of English and Georgian languages. None of them prefer or/and use only Georgian in their Business English classes.

Even though the Georgian lecturers have a conventional view of teaching a foreign language, English wasn't the only language used in their Business English classes. The use of the first language (L1- Georgian in our case) was also detected in their recorded lectures.

Although there is a considerable amount of L1 (Georgian) used by the lecturers in the Business English classes, still English was the dominant language of instruction used by the lecturers to show their positive attitude towards using it.

The majority of Business English students (86%) believe that the English language is part of their identity. Only a few (14%) of them consider it only as means of communication. Regarding attitude, there is no difference in Gender (Fisher's Exact Test = .543, Pearson Chi-Square = .733).

Considering students' identity there is no difference in results between students born in Tbilisi and the regional parts of Georgia. (Fisher's Exact Test = .484, Pearson Chi-Square = .695).

Students' attitudes toward lecturers using L1 (Georgian) are far more negative than the lecturers themselves in the Business English classes. Although there is a considerable amount of L1 (Georgian) used by the lecturers in the Business English classes, English was still the dominant language of instruction used by the lecturers to show their positive attitude towards using it.

In brief, using translanguaging in the Business English teaching context can have a positive outcome and result in reinforcing not only the business terminology in English but also its equivalents in Georgian. The English language being part of the lecturers' social identity can help them contribute to the betterment of the business field in the Georgian language.

## Recommendations

The future perspective of this study is observing students' language behaviors found in the recordings. As for the applied linguistics, the productivity of using L1 by the lecturers and their students would also play a role in the development of the business English teaching methodology.

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## Identifying Factors That Influence Medical Tourists' Perceptions of Satisfaction and Their Intention to Revisit Malaysia's Hospitals

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**Abstract:** Cognitive model of the antecedents and consequences of satisfaction decisions in Malaysia medical tourism context cannot be ignored by applying the concept to become a new scope of a marketing strategy to increase and integrate medical tourist revisit interest to Malaysia. Objectives include (a) investigating the factors that influence medical tourists' perception on satisfaction in their intention to revisit Malaysia's hospitals; (b) determining the relationship between perceived value, perceived authenticity, and destination image in relation to the perception of satisfaction; (c) investigating if employee attitude has an indirect effect on perceived satisfaction towards revisit intention; (d) proposing the moderation role of perceived satisfaction in the relationship between the extended factors (perceived authenticity, perceived value, and destination image) of continuity and medical tourist revisit intention; and (e) to validate the extended determinants of the medical tourists' revisit intention model in the context of Malaysia. All suggested paths based on previous related studies This study adopted a quantitative research method, data will be collected through a survey questionnaire. SEM – PLS will be used to analyze the collected data. The study sample will be selected based on a probability sampling that focuses on medical tourist's that have visited Malaysia medical hospitals. The study is expected to pave opportunity to expand previous studies by exploring the moderating role of satisfaction in the relationship between employees' attitude, perceived authenticity, perceived value, and destination image towards medical tourist intention to revisit.

**Keywords:** Medical tourism, Revisit intention, Value, Authenticity, Satisfaction, Attitude, Destination image

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## Introduction

The healthcare providers in Malaysia excelled in cardiology, oncology, fertility, orthopaedics, and cosmetic surgery with patients mostly from Indonesia, China, and Indochina (Vietnam, Cambodia, Myanmar). Meanwhile, Malaysia's medical tourism revenue is estimated at RM800 million in 2020, compared to RM1.7 billion revenue posted in 2019 (Mohd Daud Mohd Arif of Malaysia Healthcare Travel Council). However, due to the interruption of Covid-19 pandemic, Malaysia aims to generate RM650 million in revenue from the medical tourism industry in 2021, assuming the country opens its borders for international travellers by the fourth quarter of the year, according to Malaysia Healthcare Travel Council (MHTC). Forecast on the international tourist arrivals in Malaysia from 2010 to 2025 (in millions) report projected that international tourist arrivals in Malaysia will hit again reach 27.23 million by 2025 as achieved in the year 2014 with 27.44million (Degenhard, 2021). However, the forecast has been adjusted due to the expected impact of COVID-19 (Degenhard, 2021). In addition, Transparency Market Research (2017) forecasted that medical tourism in Malaysia would grow at a compound annual growth rate of 30.1% per annum from 2016 to 2024 and that revenue would increase to US \$3.5Million (RM14) billion by 2024. These estimates have now been revised downwards because of the COVID-19 pandemic (Narayanan & Wah, 2021). With the uncertainty, medical tourism sectors must establish strategies and employ new strategies application in current business models (Lipiäinen, 2014), which would lead to an increase in medical tourists' visiting and revisit Malaysia Medical hospital as their option of medical tourism destination. Previously, studies have focused on promoting the visit intentions of medical tourists to the destination, but those that focus on the moderating effect of satisfaction in the relationship between cognitive model of the antecedents and consequences of satisfaction decisions and medical tourist intention to revisit in the context of Malaysia are limited.

## Problem Statement

Thus, this study aims to investigate the factors that may lead to high revenue attaining and provide consistent medical tourist increase to Malaysia medical tourism industry. This study explore how medical tourists revisit intention will enact the existing medical tourism research variables. The study will allow to determine if adaption of Cognitive model of the antecedents and consequences of satisfaction decisions and extended factors assume to support the medical tourism capability to increase medical tourists' revisit intention to destination. Theory of cognitive model of the antecedents and consequences of satisfaction decisions base in this current

study is aligned with satisfaction behavioural intention by Oliver's (1980) factors, which has been widely adapted (Harasis, Qureshi, & Rasli, 2018; Piehler, Wirtz, & Daiser, 2016; Solomon Oluyinka et al., 2022; Chen, Chen, & Lee, 2013; Huang & Hsu, 2009). The explored the creation of an enhanced model for continuance with respect to information system (IS) through the concepts of expectation- confirmation models.

The theory is considered relevant because it includes disconfirmation, satisfaction, expectation attitude, and behavioural intention in this current study. Meanwhile, previous studies have revealed that perceived value, satisfaction, and destination image and employees' attitude, as well as perceived authenticity, are common determinants towards revisit intention (Cham, 2016; Cham *et al.*, 2021; Manaf *et al.*, 2015; Maryam Fard *et al.*, 2021; Mohammad Jamal *et al.*, 2020; Rahman, 2019; Rahman & Zailani, 2016; Sultana *et al.*, 2014, Khan *et al.*, 2020; Lim *et al.*, 2017; Ismail *et al.*, 2018; Irimiás & Volo, 2018; Mihaela, 2015; Shivany, 2013). And studies affirmed that there is a relationship between destination image and perceived satisfaction towards tourist decisions on destinations (Mohaidin *et al.*, 2017; Mun *et al.*, 2015; Shafiee *et al.*, 2016).

These literature findings provide justification for further research into the moderating role of satisfaction in the relationship between perceived authenticity, perceived value, and destination image towards the revisit intention of medical tourists. Disconfirmation is one aspect of the Cognitive model of the antecedents and consequences of satisfaction decisions that was not considered since none of the previous studies utilized it. It could also be interchanged with perceived authenticity (Choi, Ramaprasad & So, 2021). Nevertheless, conceptualized framework for this study is demonstrated in Figure 1.

### **Revisit Intention**

A medical tourist **revisit intention** represents a dependent variable in this study Because revisit intention is regarded as an extension of satisfaction. When tourists derive pleasant feelings from a tourism destination, they will probably be satisfied with that place, leading to an increased intention to revisit (Ayodele Abubakar et al., (2017); Khasawneh & Alfandi, 2019; Stylos *et al.*, 2016). In addition, Zhang *et al.*, (2014), revealed that revisit intention signifies customer loyalty and further explained that in the service industry, more than five per cent of the upsurge in retention of customers will yield 85 per cent additional profit based on their satisfaction level.

### **Perceived authenticity**

**Perceived authenticity**, in general, is an indistinct concept that is term as interpreted diversely in different fields (Yu Chiang Lin & Yun Chiao Liu 2019). authenticity was firstly introduced by Dean McConnell, giving meaning to authenticity as a means of identifying what the customers want. The authenticity of Malaysia medical healthcare must meet the conditions of “integrity” and/or “authenticity” and be of “outstanding universal value. Nonetheless, authenticity and integrity are useful guiding concepts in striving for a systematic approach to preservation in diverse contexts (Domínguez-Quintero et al., 2018).



### Perceived value

**Perceived value** is understood as a customer perception based on cognitive behavior such as an individual's feelings in respect to what customer expects or gains from services or purchase of products (Dodds, 1991; Hsu *et al.*, 2010; Songshan Huang & Hsu, 2008; Klijs *et al.*, 2016; Nilashi *et al.*, 2019; Ormond & Sulianti, 2017; Rahman, 2019; Shima *et al.*, 2016; Shivany, 2013). In this study, perceived value refers to as overall assessment by medical tourist on the perceived medical services either monetary or non-monetary value received, and its quality of available facilities at the destination. Medical tourism and medical healthcare services in Malaysia, medical tourist is expected to received value for both tangible and intangible measure such as monetary and or non-monetary aspect.

### Destination image

**Destination image** in the mind of the visitors plays a vital role in their travel purchase decisions, and subsequently it stimulates their revisiting intentions (Cham, 2021; Cham *et al.*, 2021; Crooks *et al.*, 2011; Ganguli & Ebrahim, 2017; Lim *et al.*, 2017; Mohaidin *et al.*, 2017; Nilashi *et al.*, 2019; Rahman, 2019). Some studies agreed that the main elements considered by visitors in a destination are natural and scenic resources, accessibility, cultural resources, security, nightlife and entertainment, and quality/price ratio (Bigné *et al.*, 2001; Chen & Tsai, 2007; Chi & Qu, 2008; Shafiee *et al.*, 2016). Heydari *et al.*, (2021); Milman & Pizam (1995); Mohammad Jamal *et al.*, (2016) explained that destination image has three consisting components, namely: the product, for instance, the quality of the attraction; the second is the behaviour and attitude of the destination hosts, and; thirdly, the environment such as weather, scenery, and facilities. In the case of Malaysia medical tourism destination image, the positive destination image in the mind of medical tourist is important to achieve the confidence that could lead to medical tourist revisit to the Malaysia healthcare

### Employee attitude

Examining the impact of **employee attitude** on customer's decision within an unprecedented competitive environment is crucial for sensitizing employees to recognize their essential role in customer satisfaction within an instance of improving or providing adequate relevant information, communication, commitment and interaction that could influence medical tourist revisit intention (Rodrigues., *et al.*, 2017; Heydari Fard *et al.*, 2021; Agyeiwaah & Dayour, 2021; Huang & Hsu, 2009; Agyeiwaah & Dayour, 2021). While examining the role of employee attitude in relationship to medical tourist revisit intention, the study underpin Oliver's 1980 cognitive model of the antecedents and consequences of satisfaction decisions to explain customer attitudinal loyalty through employee attitude fully but more so helps to understand the significant role of employees' attitudes. This is pertinent for managers to make effective changes to the service climate to improve employee performance and customer satisfaction.

**Perceived satisfaction**

Extensive research has been conducted to examine tourist satisfaction and tourist intention to revisit destination (Mohaidin *et al.*, 2017; Rahman, 2019). The question is how does this **perceived satisfaction** is important to this study? Perceived satisfaction is generally reflecting the individual’s “medical tourist” overall judgement or perception of performance on product or services in relation to expectation (Sunny and John, 2014; Albert Caruana *et al.*, 2012). However, with an extensive research study conducted from the previous studies on perceived satisfaction (Bruno Miguel Sousa, 2019; Cham *et al.*, 2016; Cham, 2021; Manaf *et al.*, 2015; Chi & Qu, 2008). Exploring moderating effect of perceived satisfaction between antecedent factors particularly in terms of medical tourist revisit intention need more limelight. In the case of Malaysia, perceived satisfaction by medical tourist is important to the medical tourism healthcare not just for the purpose of making profit but, also, for the purpose of aspiration by the Malaysian government to make the sector most service value chain, this assertion gave more reason to project and campaign positively for medical tourist intention interest to revisit the destination.

In all indications from the literature evidence, the medical tourism research studies that explore and analyse the above explained factors on medical tourist revisit intention are uncommon, and convincingly, study that explore perceived satisfaction as moderator variable to moderate between explained variables and medical tourist revisit intention is considered new. The value expected from a medical destination is paramount. Therefore, the conceptual model of this study is proposed (as seen in **Figure 1**). The proposed model will test perceived satisfaction and medical tourist revisit intention concurrently. The model will test the moderating effect of perceived satisfaction indirect relationships between independent variable and medical tourist revisit intention.

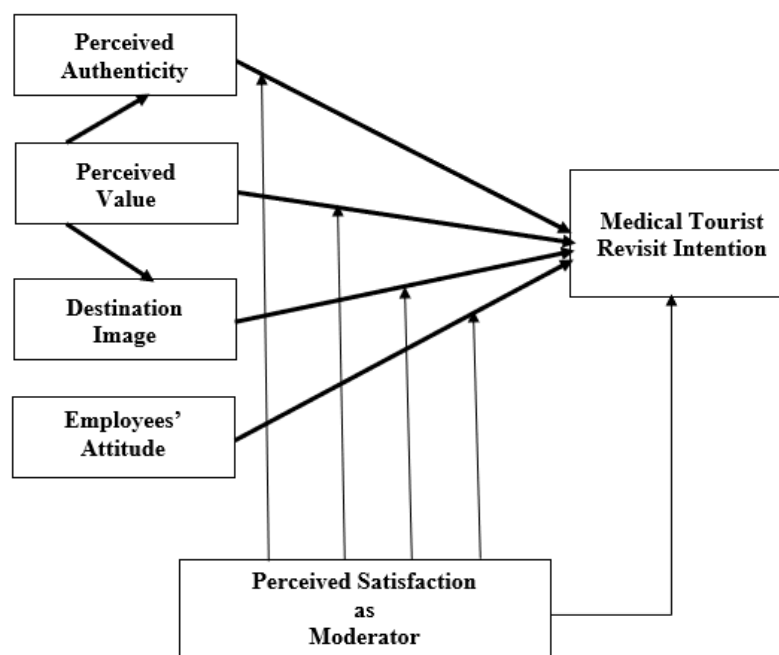


Figure 1. Proposed Conceptual Model

The relationship between perceived satisfaction and the other four independent factors towards revisit intention. In addition, satisfaction perception suggested considered as a moderator towards explain medical tourist revisit intentions to hospitals in Malaysia demonstrated in **Figure 1**, the conceptual framework of this study. Nonetheless, related studies to each construct and their attributes shall be discussed while developing the hypotheses related the constructs. In a nutshell, we developed constructs for this proposed study based on the Cognitive model of the antecedents and consequences of satisfaction decisions (Oliver, 1980) and Heydari Fard *et al.*, (2021) determinants of medical tourists' "revisit intention."

## Method

The nature and method scope of this study, in general, is to adopt a quantitative research method aimed at applying hypotheses as a means of testing. Aforementioned that this study will adapt the Cognitive model of the antecedents and consequences of satisfaction decisions (Oliver 1980) and determinants of medical tourist's revisit intention model (Heydari Fard *et al.*, 2021). The cognitive model explains the expectancy is a precursor of attitude. expectancy and disconfirmation as precursors to satisfaction, and attitude will influence behavioural intention and confirmation (Oliver, 1980; Liao *et al.*, 2009). Perceived value influences perceived satisfaction towards revisit intention (Heydari Fard *et al.*, 2021). The current models suggested perceived authenticity, perceived value, destination image and employee attitude and perceived satisfaction as moderator. These variables have been validated in the field of IS and social sciences to investigate behavioural intention. Meanwhile, this current study is limited to investigating the relationship between perceived authenticity, perceived value, destination image and employee attitude while perceived satisfaction will moderate the variables mentioned in relation to medical tourist revisit intention.

Prospective literature was referred to from several sources such as government agencies and associations, professional data, publications on tourism management, information social science studies, related methodology and analytical techniques, and frameworks considered from two decades of publications. However, fewer old references are cited.

Study is important since the reviewed related literature shows that tourist satisfaction, perceived value, attitude, and destination image play a vital role in medical tourists' intentions and decisions. The study is expected to validate an established medical tourism and hospitality research framework, contributing to medical tourism marketing operationalization based on existing research literature underpinning continuity concepts and selected variables that support the objectives of this study. The study will contribute ideas and support to the government's economic policy through the study outcome and suggestions. Economic competition is imminent as the world is preparing to exit the COVID-19 pandemic turmoil. Therefore, this study will significantly contribute to the government creating policies that promote medical tourism destinations in Malaysia. In return, revenue will be generated while more job opportunities will be created.

### **Participants / Study Location**

The location for this current study is limited to Malaysia and medical tourists whose purpose of visit includes medical treatment, medical consultation, beauty therapy, and specialist hospitals in Malaysia. The selected locations are Johor Bahru and Kuala Lumpur, because these parts of Malaysia have main port entries for tourists and the medical centres are easily accessible (Thoo, Khairuddin, Tat, Sulaiman, Lai, & Mas' od, 2020; Chandran *et al.*, 2017; Vashu *et al.*, 2018; Alkelani & Habil, 2018). However, using medical tourists from the mentioned locations could be one of the limitations of this current study's generality and more location may be suggested for this study. Nonetheless, the chosen participants and locations are intended to support the study's objectives.

### **Questionnaire Development**

The research questionnaire is designed to address the research objectives. The study objectives include investigating the factors that influence medical tourists' perception on satisfaction in their intention to revisit Malaysia's hospitals; (b) determining the relationship between perceived value, perceived authenticity, and destination image in relation to the perception of satisfaction; (c) investigating if employee attitude has an indirect effect on perceived satisfaction towards revisit intention; (d) proposing the moderation role of perceived satisfaction in the relationship between the extended factors (perceived authenticity, perceived value, and destination image) of continuity and medical tourist revisit intention; and (e) to validate the extended determinants of the medical tourists' revisit intention model in the context of Malaysia.

In addition, the research questionnaire was adopted and adapt from past literature study such as demographic respondents' profile with eight-item questions, were adopted and adapted from Kim *et al.*, (2012); Medical tourist revisit intention with five-item questions were adapted from Li & Liu (2014) and Limayem & Cheung (2008); perceived authenticity with five-item questions were adapted from (Das & Mukherjee, 2016; Heydari Fard *et al.*, 2021; Botterill *et al.*, 2013; Cook, 2010). Also, perceived value with five-item questions, were adopted and adapted from Cham *et al.*, (2021) and Manaf *et al.*, (2015); destination image with five-item questions adapted from Cham *et al.*, (2021); employee's attitude with five-item questions adapted from (Rodrigues., *et al.*, 2017; Heydari Fard *et al.*, 2021; Huang & Hsu, 2009; Agyeiwaah, & Dayour, 2021) and perceived satisfaction with the five-item questions adopted and adapted from Cham (2021) and Manaf *et al.*, (2015). The modified survey questionnaire suggested by this study will be used to collect relevant data from medical tourists in Malaysia. The study considered a survey questionnaire as the research instrument for an easier and faster way of collecting data. The items were organized, and precision will be checked by expert.

### **Expected Results in General**

The expected result from the study is theoretically and practically important. It is critical for stakeholders to understand that an integrated of ccognitive model of the antecedents and consequences of satisfaction decisions

might potentially raise the intention of medical tourist to revisit and boost the economy's revenue forecast. In particular, the knowledge and expected results from this proposed study will contribute to the medical tourism sector, strengthening their marketing operational while integrating the extended continuity factors towards medical tourists' revisit intention.

Moreover, the study is important since the reviewed related literature shows that tourist perceived satisfaction, perceived value, employee attitude, and destination image play a vital role in medical tourists' revisit intentions and decisions making as well as perceived authenticity. For academia, the study is expected to validate an established medical tourism and hospitality research framework, contributing to medical tourism marketing operationalization based on existing research literature underpinning continuity concepts and selected variables that support the objectives of this study. The significance of the study to the government will contribute ideas and support economic policy. Economic competition is imminent as the world is preparing to exit the COVID-19 pandemic turmoil. Therefore, this study will significantly contribute to the government creating policies that promote medical tourism destinations in Malaysia. In return, revenue will be generated while more job opportunities will be created.

#### **Expected results Base on Hypothesis**

The expected results based on literature, recommendations, and arguments from Heydari Fard (2021); study hypothesized that; *perceived authenticity may influence intention of the medical tourist to revisit (H1)*. Based on literature, recommendations, and arguments from Moon *et al.*, (2013) and Pandža Bajs (2015) *that perceived value has a significant effect on medical tourist revisit intention (H2)*. Based on literature, recommendations, and arguments from Cham, (2016); Mohaidin *et al.*, (2017); Mohammad Jamal Khan *et al.*, (2016); Shafiee *et al.*, (2016) *that medical tourist revisit intention may be influenced by destination image (H3)*. Based on literature, recommendations, and arguments from Mankame (2021); Lee and Choi (2020); Mohaidin *et al.*, (2017); Thiumsak & Ruangkanjanases (2016) *that the employee's attitude may have a direct impact on medical tourist revisit intention (H4)*. Based on literature, recommendations, and arguments from Hernandez-Fernandez and Collin (2019); Mohammad Jamal Khan *et al.*, (2016); Shafiee *et al.*, (2016); Assaker & Hallak (2013) *that there is a significant relationship between perceived value and perceived authentication that influence medical tourist revisit intention (H5) also, thus hypothesized that: there is a significant relationship between perceived value and destination image that influence medical tourist revisit intention (H6)*.

In addition to hypothesis one (1) to hypothesis six (6). Moderating effect is expected to be applied. Integrating perceived satisfaction as a moderator in the relationship, among other suggested variables. Based on literature, recommendations, and arguments from Thiumsak & Ruangkanjanases, (2016); Mohaidin *et al.*, (2017); Heydari Fard *et al.*, (2021); Moon *et al.*, (2013); Yin *et al.*, (2014); Lee *et al.*, (2014); Lu *et al.*, (2015); Gholipour Soleimani & Einolahzadeh, (2018); Park *et al.*, (2019) the expected results thus *hypothesized that; perceived satisfaction will influence medical tourist intention to revisit (H7)* and thus, it is *hypothesized that perceived satisfaction is a moderator between perceived authenticity, perceived value, destination image, and employees'*

attitude toward medical tourists' intention to revisit Malaysia hospitals (H7a-d).

Conclusively, Figure 2 demonstrated the hypothetical conceptual framework for the perceived satisfaction moderation model based on the cognitive model of satisfaction decision (Oliver, 1980) and determinants of the medical tourists' revisit model (Heydari Fard *et al.*, 2021) reviewed.

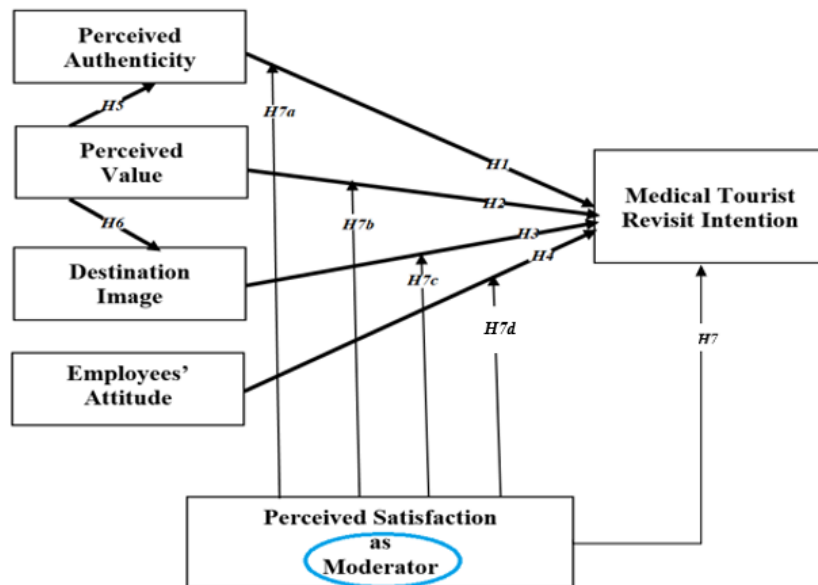


Figure 2. Framework

## Discussion

The study adopts quantitative research method using survey questionnaire as a tool. The survey questionnaire is divided into seven (7) sections—Section 1. Questions into the demographic respondents' profile with eight-item questions, which are adopted and adapted from Kim *et al.*, (2012). Section 2. Probe into Medical tourist revisit intention with five-item questions adapted from Li & Liu (2014) and Limayem & Cheung (2008). Section 3 Questions related to perceived authenticity with five-item questions adapted from (Das & Mukherjee, 2016; Heydari Fard *et al.*,2021; Botterill *et al.*,2013; Cook, 2010). Section 4. Questions into a perceived value with five-item questions, which are adopted and adapted from Cham *et al.*, (2021) and Manaf *et al.*, (2015). Section 5. Questions relating to destination image with five-item questions adapted from Cham *et al.*, (2021). Section 6. Questions related to employee's attitude with five-item questions adapted from (Rodrigues., *et al.*, 2017; Heydari Fard *et al.*, 2021; Huang & Hsu, 2009; Agyeiwaah, & Dayour, 2021). Section 7. Questions about perceived satisfaction with the five-item questions adopted and adapted from Cham (2021) and Manaf *et al.*, (2015). These questions will be based on a 5-point Likert scale according to research conducted by Bosque Salmones *et al.*, (2009), with a scale showing "Option 5" as "Strongly Agree" and "1" Strongly Disagree." The respondents will be asked to indicate their answers by checking an answer box containing the scale as mentioned above after questions are made in a statement form.

## Conclusion

Research ethics is imperative in any research study. Saunders *et al.*, (2012) stated that any research produced should follow ethical protocols. Academicians have concluded that several ethical principles need to be followed when research is conducted, such as informed consent, voluntary participation, privacy, and confidentiality (Bergbom & Kinnunen, 2014; Tearney *et al.*, 1996; Tien & Berg, 2003). This study will take ethical consideration within this approach very seriously, and the anonymity of the participants will be strictly preserved, while the participants will be voluntary. Informed consent will be attached to the questionnaire for the respondents to understand the research's purpose and scope. The participants will be given an option to withdraw from the study. The respondents' names from which the data are collected will not be revealed to preserve the participants' privacy. As the questionnaires are shared with the respondents through smart devices such as iPad, Android Tablet and other smartphone, the data collected will be stored in the google data deposit tools.

## Recommendations

Both the Faculty of Management, library staff and the faculty library of University Technology Malaysia, are well-regarded. Also, the researchers of this study would like to acknowledge the National Library Board of Singapore.

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Both the library staff and the faculty library of University Technology Malaysia are well-regarded. Also, the researchers of this study would like to acknowledge the National Library Board of Singapore.

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## Undergraduate Students' Digital Literacy Skills in The Digital World of Sustainable Development

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**Abstract:** The world of globalization and the high development speed has raised high demands on equitable quality education and lifelong learning to all, which is also known as the objectives of Sustainable Development Goal 4 (SDG 4). Thanks to the rapid expansion of digital technology, educational quality and equity are gradually achieved. In addition, information technology (IT) plays vital roles of electronic instructors, guiders, tools and materials in supporting individuals' lifelong learning. Therefore, it is tremendously crucial that young generations should prepare themselves not only academic competencies but also a variety of skills including digital skills (e-skills) in a digital society that is densely linked and moves at a quick pace. This research emphasizes the significance of being digitally-enabled in the sustainable development world. It aims to find out how undergraduate students view themselves in terms of several facets of digital literacy, such as the capacity to handle digital issues, the processing of data and information, the production of online contents, the usage of communication tools and the ability to create online contents. The findings give an analysis of university students' current digital literacy and their application, whose outcomes can be used to enhance learning, teaching and administrative activities in education in general; and to attain SDG4 in particular.

**Keywords:** undergraduate students, e-skills, digital literacy skills, sustainable development, higher education, digital tools, digital learning

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### Introduction

At the heart of UNESCO's mission is "Education transforms life" for the sustainable development world. While "transform" implies various aspects of education, it also markedly refers to digital transformation in Industry 4.0. Genuinely, in the UNESCO's Sustainable Development Goal 4 (SDG 4) targetting "lifelong learning", SDG4.4.2 emphasizes boosting "the percentage of youth/adults who have achieved at least a minimum level of

proficiency in digital literacy skills". In a world characterized by the omnipresent innovation of technologies and digital transformation, digital literacy and skills have become crucial in generating and sustaining economic growth. Hence, on the policy agenda of most countries including Viet Nam, education focusing on skills, especially Internet access and technology usage, are of great compulsion.

When it comes to the current situation in Vietnam, under the rapid pace of economic growth and the reallocation of jobs away from agriculture in recent years, Vietnam is facing new challenges. As the size of its workforce is turning to be expanding and demanding, her youth population is shrinking and lacks of necessary skills to meet the firms' increasing requirements. Therefore, there is urging need for a more productive and skilled workforce for its further economic modernization in the coming decade and beyond. Despite the impressive literacy and numeracy achievements among Vietnamese workers, many Vietnamese firms report a shortage of workers with adequate skills as a significant obstacle to their activity. The statistics of the Vietnamese Ministry of Information and Communications shows that the number of job openings in the software and IT industry increases by about 30,000 every year. By 2020, the recruitment demand of enterprises would be 1 million IT personnel. With such a fertile IT job market, Vietnam, however, is predicted to be in shortage of some 400,000 IT workers and each year. Although experts claimed that digital technology must be used more often in education to train students on essential digital skills and competencies to adapt to the digital revolution (Herman, 2019), only about 27% of IT workers can meet the requirements, the rest need additional training for a minimum of three months. According to the Ministry of Education and Training, 37.5% of universities and colleges in Vietnam offer ICT majors, and there are about 50,000 IT graduates (over 400,000 IT vacancies) each year. With the high pressures on the demand in quantity and quality of labors, it is questioning whether education in ICT has been in its right track, and whether educators know "what is happening to their students?".

The concept of digital literacy encompasses skills and capabilities that enable learners to accomplish commissions, solve complex challenges, try out new things, and ease and enrich life under technology support (Hatlevik and Christophersen, 2013; Kim, Hong, and Song, 2019). To young adults, digital literacy is vital because all of our daily activities ranging from study, work, and entertainment to communication greatly depend on technology. Apparently, digital literacy is not just about scrolling a website up and down, or posting some pictures and writing comments on social media, it is more about acquiring knowledge of technology, what it can help to solve real-life purposes, and how to use it smartly; therefore, apply and build a strong career out of their lives. However, most young adults are partly aware of what digital literacy skills actually are and how digitally literate they really are. As Rogers (2000) asserted that students' attitudes are primary elements in the successful integration of new technology in education, an insight into their self-assessment on literacy in the concepts and the uses of technology should be well delved into by not only students themselves but also teachers and academicians. While there have been hundreds of studies on digital competence, an empirical study on students' digital literacy in the Vietnamese Southern context is still scarce and needs more investigation. This study aims at identifying university students' self-evaluation of their digital literacy due to two primary reasons. Firstly, undergraduates are those who will be soon new employees in international workplaces and potential global citizens. It is expected that they are well literate in technologies to meet the needs of their career requirements in

the 21<sup>st</sup> century. Secondly, university students are those who have completed their compulsory 12-year education and are reaching their degrees in some professions. They are, to some extent, expected to acquire the necessary digital skills that have been trained. This study, on the one hand, is able for students to evaluate their e-skill acquisition before any further education and career decisions. On the other hand, the study outcome is taken as proof of the current national curriculum in digital literacy education. It is significant for teachers and educators who directly work with students to know what and how to update and adjust for more efficient education in the future.

## Research Questions

1. What is the general digital literacy skill level of Vietnamese undergraduate students according to Digital Literacy Global Framework (DLGF)?
2. What is the strongest digital literacy skill in the overall Vietnamese sample?
3. What is the weakest digital literacy skill in the overall Vietnamese sample?

## Research objective

- To examine the general level of digital literacy skills according to their self-assessment.
- To identify the strongest literacy skill from the Vietnamese students' self-evaluation.
- To identify the weakest literacy skill from the Vietnamese students' self-evaluation.

## Significance of the study

This study is significant because there has not been a lot of research conducted to identify the current issue of young people's digital literacy progress in the Mekong Delta, Vietnam. As Vietnam has become an active member of UNESCO in the "Sustainable Development" campaign, the pursuit of accomplishing the campaign targets, including education-oriented targets, is of great concern more than ever. Regarding education plans, terminologies like life-long learning, skills, digital, literacy, equity and equality, and sustainable development are key as well as goals. Self-assessment is able to boost an upward cycle of learning (Ross, 2006), the findings, hence, can help teachers, administrators and researchers draw a general picture of the digital literacy skill level of young citizens before any practical actions are carried out. Pertinent to their self-assessment is proven to improve performance through the element of self-efficacy, (Bandura, 1997), self-confidence and effort (Ross, 2006).

## Theoretical background

### Digital literacy skills (ICT skills/ e-skills)

Digital literacy has been defined in various ways since the term was first introduced in the 1990s by Gilster

(1997). Eshet-Alkalai (2004) generalized digital literacy into three dimensions: technical, cognitive and sociological skills, which are used to deal with problems within the environment of a digital society. In 2005, Martin (2006) suggested a more complete definition of digital literacy: individual realization, attitude and usage capacity of digital tools in order to access, manage, integrate, analyze, and synthesize digital information sources. Hatlevik and Christophersen (2013) described *digital competence* as the acquisition and processing of digital information and the ability to produce digital information. It was not until recent years that Law et al. (2018) initiated a more concrete definition of the term digital literacy. According to these scientists, it refers to the use of digital technology, communication tools, gadgets, and networks to access, manage, integrate, evaluate, and create information safely and appropriately for a knowledge society. Clearly, digital literacy is a broad concept embracing different aspects, and its continuous progress ranges from the acquisition of instrumental skills to that of productive and strategic competence and cognitive skills (Calvani, Fini, Ranieri, & Picci, 2012). Digital literacy is identified and analyzed in different concepts, such as internet skills (van Deursen & van Dijk, 2011; Hargittai, 2010), digital literacy (Eshet-Alkalai & Yoram, 2012), digital readiness (Arthur-Nyarko & Moses, 2019), and digital skills (Reedy, Boitshwarelo, Barnes, & Billany, 2015). In this paper, digital literacy or e-skill literacy includes the abilities of (1) generating new digital knowledge, and (2) using various forms of digital media in order to communicate, create and reflect the concepts within daily life situations in the digitally-rich world.

### **Digital literacy framework**

Digital competence is even regarded as a key determinant for understanding and interpreting digital learning resources and online learning services (Lopez-Meneses, Sirignano, Vazquez-Cano, & Ramírez-Hurtado, 2020). Hence, plenty of attention is paid to the panorama of digital competence, including employing a digital competence scale (Tzafilkou, K., Perifanou, M. & Economides, 2022), digital competence models (Amaro, Oliveira, & Veloso, 2017; Tournon, ' Deborah Martin, Enrique Navarro, SilviaPradas, & VictoriaInigo, ~ 2018), digital competence building blocks (Janssen et al., 2013) and applying comprehensive frameworks (Vukčević et al., 2021). Some of the frameworks to assess digital competence include the European Computer Driving License (Leahy and Dolan, 2010), the iCritical Thinking framework of the International ICT Literacy Panel (Verizon et al., 2002), and the Digital Competence Assessment Framework (Calvani et al., 2008). On the other hand, some research has also attempted to evaluate digital competence using qualitative (Çebi, A., & Reisoglu, ~ ' I. (2020) as well as mixed method approaches (Burgos-Videla et al., 2021). In this study, an empirical study was carried out to assess the digital competencies of university graduates based on the Vietnamese Digital Literacy Global Framework (Do et al., 2021) and the Digital Literacy Global Framework (DLGF) (Law et al., 2018). The current version of the DLGF was modified from Digital Competence Assessment Framework 2.0 (DIGCOMP 2.0) (Vuorikari et al., 2016).

*Digital Literacy Global Framework (DLGF) (Law et al., 2018)*

DLGF (shown in Table 1) is developed based on Digcomp 2.0 (Vuorikari et al., 2016), which originated from

DigComp 1.0 by Evangelinos and Holley (2015). The DigComp 2.0 framework suggests a pattern for evaluating the core competencies necessary for all citizens who adapt and actively participate in the digital world. The DigComp 2.0 framework accomplishes the concept of digital literacy both in scope (extension) and content (intensity). It includes 5 areas of competencies: (1) Information and data literacy; (2) Communication and collaboration; (3) Digital content; (4) Safety; and (5) Problem-solving. According to the scholars, the first three areas cover competencies that are applied within specific interactions and uses, whereas the two remainings incline to more specialized activity performed through digital technologies.

Compared to Digcomp 2.0, the updated model is more specific in measuring the digital literacy skills of global citizens because there are two more competence areas added (as can be seen in Table 1), which are Devices and software operations (ranked first) and Career-related competences (ranked last). These two newborn competencies are fundamental to fully scrutinize the field of digital literacy in teaching and learning, as well as best measure its proficiency level. Likewise, underlying is career-related competence when there are incongruities between what is taught and what is applied, what the teachers provide and what the entrepreneurs expect.

DLGF was created from the DLGF project aiming to generalize “a methodology that can serve as the foundation for thematic Indicator 4.4.2 and the development of digital literacy frameworks, curricula, and assessments across different countries and regions” (Law et al., 2018). Therefore, the instrument of the present study is highly based on DLGF. The design of the questionnaire is primarily constructed from the description of each competence area.

Table 1. Description of competences and competence areas in the DLGF

Competence area and competences	Description
0. Devices and software operations	To identify and use hardware tools and technologies. To identify data, information and digital content needed to operate somewhere tools and technologies
0.1. Physical operations of digital devices	To identify and use the functions and features of the hardware tools in technologies
0.2. Software operations in digital devices	To know and understand the data information and/or digital content that are needed to operate software tools and technologies.
1. Information and data literacy	To articulate information needs, to locate and retrieve the digital data, information and content. To judge the relevance of source and its content. To store, manage, and organize digital data, information and content
1.1. Browsing, searching and filtering data, information and digital content	To articulate information needs, to search for data, information and content in digital environments, to access them and to navigate between them. To create and update personal search strategies.

1.2. Evaluating data, information and digital content	To analyse, compare and critically evaluate the credibility and reliability of sources of data, information and digital content. To analyse, interpret and critically evaluate the data, information and digital content.
1.3. Managing data, information and digital content	To organise, store and retrieve data, information and content in digital environments. To organise and process them in a structured environment.
2. Communication and collaboration	To interact, communicate and collaborate through digital technologies while being aware of cultural and generational diversity. To participate in society through public and private digital services and participatory citizenship. To manage one's digital identity and reputation.
2.1. Interacting through digital technologies	To interact through a variety of digital technologies and to understand appropriate digital communication means for a given context.
2.2. Sharing through digital technologies	To share data, information and digital content with others through appropriate digital technologies. To act as an intermediary, to know about referencing and attribution practices.
2.3. Engaging in citizenship through digital technologies	To participate in society through the use of public and private digital services. To seek opportunities for self-empowerment and for participatory citizenship through appropriate digital technologies
2.4. Collaborating through digital technologies	To use digital tools and technologies for collaborative processes and for co-construction and co-creation of resources and knowledge.
2.5. Netiquette	To be aware of behavioural norms and know-how while using digital technologies and interacting in digital environments. To adapt communication strategies to the specific audience and to be aware of cultural and generational diversity in digital environments.
2.6. Managing digital identity	To create and manage one or multiple digital identities, to be able to protect one's own reputation, to deal with the data that one produces through several digital tools, environments and services.
3. Digital content creation	To create and edit digital content. To improve and integrate information and content into an existing body of knowledge while understanding how copyright and licenses are to be applied. To know how to give understandable instructions for a computer system.
3.1. Developing digital content	To create and edit digital content in different formats, to express oneself through digital means.
3.2. Integrating and re-elaborating digital content	To modify, refine, improve and integrate information and content into an existing body of knowledge to create new, original and relevant content and knowledge.
3.3. Copyright and licenses	To understand how copyright and licences apply to data, information and digital content.
3.4. Programming	To plan and develop a sequence of understandable instructions for a



	computing system to solve a given problem or perform a specific task.
4. Safety	To protect devices, content, personal data and privacy in digital environments. To protect physical and psychological health, and to be aware of digital technologies for social well-being and social inclusion. To be aware of the environmental impact of digital technologies and their use.
4.1. Protecting devices	To protect devices and digital content, and to understand risks and threats in digital environments. To know about safety and security measures and to have due regard to reliability and privacy.
4.2. Protecting personal data and privacy	To protect personal data and privacy in digital environments. To understand how to use and share personally identifiable information while being able to protect oneself and others from damages. To understand that digital services use a "Privacy policy to inform how personal data is used.
4.3. Protecting health and wellbeing	To be able to avoid health-risks and threats to physical and psychological well-being while using digital technologies. To be able to protect oneself and others from possible dangers in digital environments (eg. cyber bullying). To be aware of digital technologies for social well-being and social inclusion.
4.4. Protecting the environment	To be aware of the environmental impact of digital technologies and their use.
5. Problem solving	To identify needs and problems and to resolve conceptual problems and problem situations in digital environments. To use digital tools to innovate processes and products. To keep up to date with the digital evolution.
5.1. Solving technical problems	To identify technical problems when operating devices and using digital environments, and to solve them (from trouble-shooting to solving more complex problems).
5.2. Identifying needs and technical responses	To assess needs and to identify, evaluate, select and use digital tools and possible technological responses to solve them. To adjust and customise digital environments to personal needs (e.g. accessibility)
5.3. Creatively using digital technologies	To use digital tools and technologies to create knowledge and to innovate processes and products. To engage individually and collectively in cognitive processing to understand and resolve conceptual problems and problem situations in digital environments.
5.4. Identifying digital competence gaps	To understand where one's own digital competence needs to be improved or updated. To be able to support others with their digital competence development. To seek opportunities for self-development and to keep up-to-date with the digital evolution.
5.5. Computational thinking	To process a computable problem into sequential and logical steps as a

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	solution for human and computer systems.
6. Career-related competences**	To operate specialised digital technologies and to understand, analyse and evaluate specialised data, information and digital content for a particular field.
6.1 Operating specialised digital technologies for a particular field**	To identify and use specialised digital tools and technologies for a particular field.
6.2 Interpreting and manipulating data, information and digital content for a particular field**	To understand, analyse and evaluate specialised data, information and digital content for a particular field within a digital environment.

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### Self-assessment

Boud (2009) states that judgment is simply a daily activity at work and in life about where one is, the effectiveness of what one has done, and what one should do in the future. For Boud (2010a), assessment is sustainable when it comes to not only to high education requirements and outcomes, but also to what is primary for lifelong learning.

Research has shown that assessment has a tremendous impact on student learning and development (see e.g. Price et al. 2011), while inappropriate or poor thoughts can diminish the beneficial effects of good teaching practices if these are not captured in assessment approaches (Boud 1995).

Regarding self-assessment, it involves one's own making critical judgments about their achievements and learning outcomes (Boud & Falchikov, 1989). According to the Oxford Dictionary (2022), self-assessment is the process of judging one's own progress, achievements, etc. During the process, an individual reviews what was performed to identify elements that can be improved or exploited to achieve certain predefined. It is inevitably important for students to form the capacity for 'informed judgment' either individually or collectively before any further steps are considered to be taken. Self-assessment is appropriate for adolescents because they are more realistic in their approach to self-assessment of their performance, which, therefore, reflects a higher level of reliability (ibid, in Ross 2006:3).

When it comes to digital literacy skill self-assessment, it is a subjective evaluation of one's own digital competence, skills, relevant decisions made and progress towards some particular purposes. Students' self-awareness of the essence of e-skills and their level of e-skill competence enables them to self-regulate their own learning progress. Moreover, this investigation helps teachers and educators timely assist their children with appropriate policies, curriculum and teaching methodologies. The validity of self-assessment is guaranteed as the authors meant to inform from the beginning in the open letter that the questionnaire is served for the students' own self-regulation and research purposes only. It was also stated that the results would not be used

for testing or grading their performances. The mean and mean range (see Table 2) were utilized to identify the students' level of digital competence skills and sub-skills.

Table 2. Categorization of responses for Digital Literacy self-assessment

Means	Descriptive Equivalent	Interpretation
4.51 – 5.00	Very High	Digital Literacy is always manifested.
3.51 – 4.50	High	High Digital Literacy is often manifested.
2.51 – 3.50	Moderate	Moderate Digital Literacy is sometimes manifested.
1.51 – 2.50	Low	Low Digital Literacy is seldom manifested.
1.0 – 1.50	Very low	Very Low Digital Literacy is never manifested

### Previous studies

In the year later since DigComp Framework 2.0 was introduced, Al Khateeb (2017) designed a standardized questionnaire on the basis of the framework to investigate in-service English language teachers' digital competence. The outcomes of the current research revealed that the majority of teachers are not adequately digitally competent according to the level and standards required to enable them to be good digital teachers of the twenty-first century. Further digital-related competencies should be promoted to teachers as part of continuous professional development (CPD). Such competencies also need to be incorporated into different teacher education programmes. S Vishnu et al. (2022) also applied the Digital Competence Framework 2.0 of EU Science Hub (DIGCOMP) in their study assessing students' digital competence in a Turkey agriculture university. Their study's result was satisfactory as the students performed at an acceptable level of competence in most aspects of e-skill competence.

In consideration of DL in the Asian context, numerous studies have been conducted. [Son, Park, and Park \(2017\)](#) compared the DL of undergraduates learning English for academic purposes (EAP) and EFL in two universities in Canada and Japan. The study reported that all EAP participants taking part in the study were aware of digital technologies and were familiar with using them. In addition, most EAP students indicated that their level of DL was good or very good, while most EFL participants self-assessed their DL level as acceptable or good. [Cote and Milliner \(2017\)](#) surveyed first-year college students preparing for their study abroad program to find out students' specific DL levels. The results indicated that almost all students in the sample thought they had limited DL and lacked the necessary experience and skills. [Kim, Ahn, and Kim \(2019\)](#) conducted research to assess Korean primary and secondary school students' DL and found that students' DL had progressed. [Dashtestani and Hojatpanah \(2020\)](#) researched the DL levels of Iranian students. The questionnaire results depicted that students' DL is low, and they do not apply a broad range of computer applications and software. The study also indicates that the low DL level results from the Ministry of Education's ill-defined plans as regards improving students' levels of DL. [Mega \(2020\)](#) contributed to the digital literacy research field by *defining the Indonesian students' perception of digital literacy competencies as learning sources. In her study*

*using the descriptive qualitative method, digital literacy areas based on Paul Gilster's theory (1997) such as internet searching, hypertext navigation, content evaluation, and knowledge assembly were under study. The outcome was disappointing when only one over nine students considered him/herself digitally literate.* Zulkarnain et al. (2021) also adopted DigComp Framework 2.0 as the basis and the questionnaire from previous studies to carry out their research. The samples were 389 students studying multiple academic programs in UiTM, Kelantan Branch in Malaysia. The quantitative study concluded that Malaysian students have a "High level" of digital competence. However, respondents were not very competent in two areas out of five main areas of problem solving and digital content creation.

In Vietnam, a large-scale study was carried out by Nguyent et al. (2020) whose participants were up to 1661 English as a foreign language (EFL) learners at Vietnamese universities. According to the study, it is indicated that digital tools have a positive effect on their studies and students are aware of the essence of technologies towards their language learning. However, students' technology skill levels normally range from a low level to an average level, and they do not frequently apply technologies when learning English. Surprisingly, while seniors' attitudes toward using ICT tools are the most positive, their skills are the lowest among the year groups. Bearing that the sample of the study was served for language learning and primarily from Ha Noi (the capital city from the North), Ho Chi Minh (the most bustling and developed city), and Kien Giang (a province from the South) without clarification of students' DL levels of the three regions. This study, aiming to focus on students from the Mekong Delta will provide a more detailed picture of the current phenomenon. Besides that, identifying students' DL readiness for future careers, rather than learning a subject, is considered more vital for senior students.

## **Methodology**

### **Participants**

In order to generalize the picture, the study investigates 482 participants who are from 4 distinct universities in the Mekong Delta. They are all senior students because the study aims to investigate their self-evaluation in digital literacy before their graduation and employment. Moreover, students whose majors are technology or computer science related are excluded from the study due to the assumption that those undergraduates can gain an acceptable level of general digital literacy skills. In their curriculum, they have definitely learned basic information technology courses; therefore, their digital literacy should be explored in other studies which require other specialized research instruments.

### **Instruments**

The instrument used for this study was a questionnaire which was designed under careful review from various sources. This questionnaire was constructed following the UNESCO Digital Literacy Global Framework (Law et al. 2018) and a previous questionnaire by Zhao et al. (2021). Zhao et al. designed their study mainly based on

the research instrument by Martínez et al. (2010) and DGLF 2.0 model, which comprises five main competence areas. This research is, rather only adapted from Zhao et al, extended two other competence areas, which were devices and software operations, and career-related competence (introduced in the updated DLGF). The questionnaire was created in Vietnamese with English translation via Google form. Definitions of digital terms were included in the questionnaire to help students clearly understand the question items. The questionnaire is written in both English and Vietnamese. It comprises two main sections: (I) sociodemographic characteristics of students and, (II) a self-assessment on digital literacy, which includes 50 question items categorized into six subscales, in line with the defined areas in the DLGF. These competence areas are as follows: (2.1) devices and software operations, (2.2) information and data literacy, (2.3.) digital content creation, (2.4) communication and collaboration, (2.5) safety, and problem-solving, and (2.6) career-related competence. The development of digital literacy was assessed on a five-point scale (5 – I'm confident I can do, 4 – I'm somewhat confident I can do, 3 – I'm confident I know, 2 – I'm somewhat confident I know/can do, and 1- I don't know/cannot do), whereby a higher score indicates more developed digital competences of a student. The reliability of the assessment scale on the student sample was 0.84 expressed by Cronbach's alpha.

### **Research procedure**

For the guarantee of reliability and validity, the designed questionnaire went through two reviewing stages. The validation of the instrument was first reviewed by a panel of Information Technology lecturers who analyzed the content validity and an exploratory factor analysis was applied to complete the construct validity. It is to ensure that technical terms were precisely used and the meanings were not changed after the translation. The characteristics and external validity of the questionnaire were examined in discussion with experienced researchers in the fields of research methods, education and linguistics. After that, the questionnaire was revised in line with the recommendations of the experts. In the second stage, the questionnaire was piloted in a group of 30 participants. The Cronbach's Alpha coefficient reached a value of 0.987, representing a very high level of reliability.

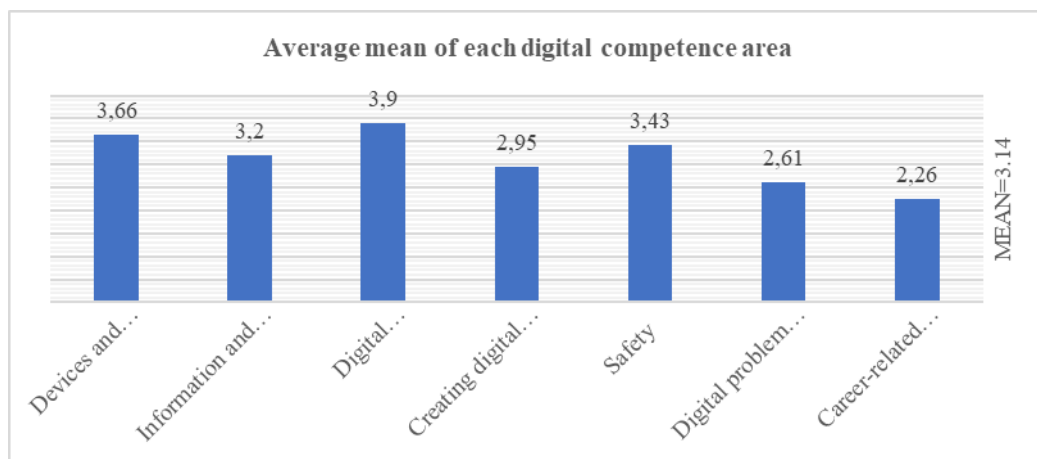
Consent emails were sent to the Deans of the four departments of the four universities in the Mekong Delta. After having got permission, I received the email addresses of lecturers who could help forward the email (including the student consent form and the questionnaires) to their students. The purposes of the study were explained in the email, which clearly stated that the outcomes of the questionnaire would be secured, only used for research purposes, and not for grading or evaluation. The number of participants is not narrowed in the English language Department only because the question items were already translated into Vietnamese. Students were able to share the link with their friends and anyone was welcome to answer the online questionnaire voluntarily.

After one month of the data collection process, 482 responses were digitally collected. The data were processed by using the IBM SPSS Statistics 20 statistical software in order to measure arithmetic mean and percentages. The results were then compared with the Categorization of responses for Digital Literacy self-assessment (Table

1).

## Findings

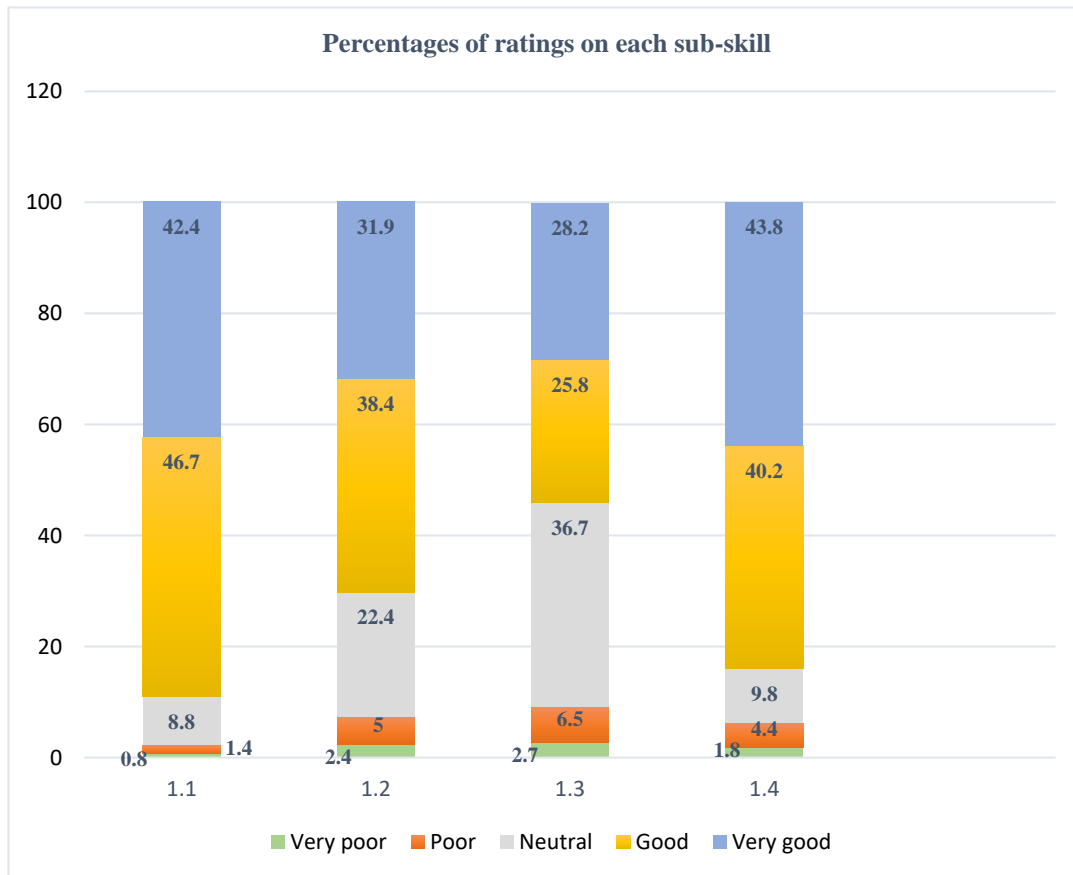
The present study was designed aiming to assess a sample of Vietnamese students in terms of their level of digital competence skills from their own perspectives. In this section, undergraduate students' self-evaluation of their digital competence skills (50 items) will be presented according to the following competency areas: information and data literacy (6 items); communication and collaboration (13 items); digital content creation (6 items); safety (7 items) and problem-solving (7 items). As mentioned above, to avoid bias, participants responded on a Likert-type scale of 1 to 5.



Graph 1. The comparison of average means of the seven digital competence areas

Graph 1 indicates the average values of the 7 digital literacy skills of undergraduates from four universities in the Mekong Delta. Overall, the participants from the four institutions placed themselves at a moderately high level with the total average mean=3.14. It is noticeable that digital communication and collaboration skill has the highest rating, with the mean being up to 3.9 and even higher than devices and software operation skills, with mean=3.66 only. However, students shown apparently much less confidence in productive digital skills such as creating digital content, digital problem solving and career-related competence skills (with the mean being no more than 3.0). Among the three aforementioned skills, career-oriented competence skill is the weakest, whose mean is only 2.26 and lower than the average.

In order to go deeper into the analysis of the results, the average scores of subskills in each competence area are presented in the following tables. Graph 2 provides information on the students' self-assessment of the first competence area. In comparison with other ones, the device and software operation competence area is the most extraordinary field with a mean ranging from 3.7 to 4.3. Among the four sub-skills, the highest score is seen in students' abilities to operate digital devices and basic softwares on a daily basis, reaching up to mean=4.3. The number of respondents who rate negatively in the four sub-skills is low, with no more than 10% each.

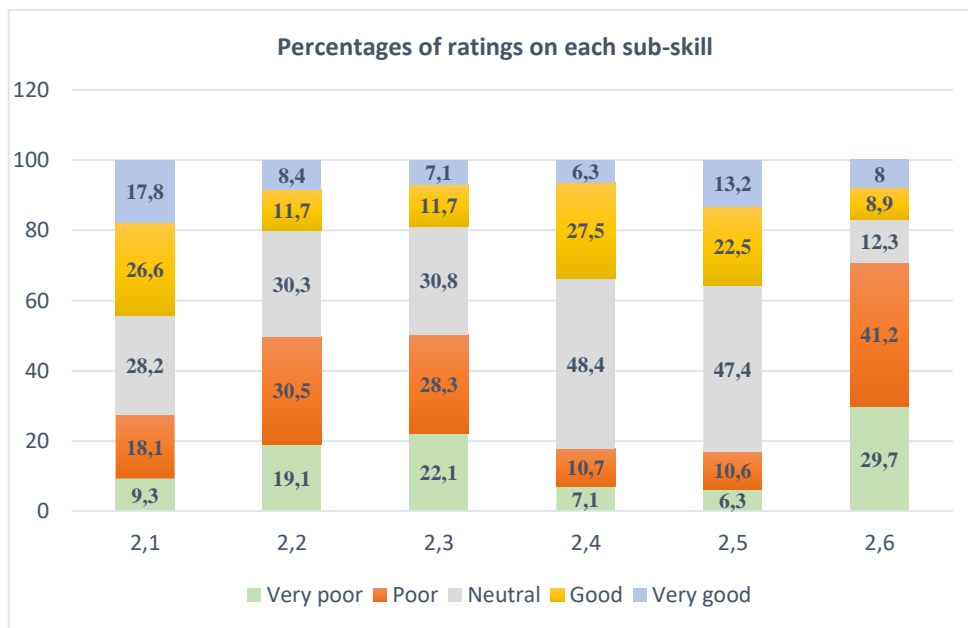


1. Device and software operation	Mean
1.1. I know how digital devices physically operate.	4.3
1.2. I am able to operate digital devices for my daily purposes.	3.9
1.3. I know how basic softwares and applications operate	3.7
1.4. I am able to operate basic softwares for my daily purposes.	4.2

Graph 2. University students' self-evaluation of digital competence on Device and software operation

As can be seen in Graph 3, students gain an acceptable ability in information and data literacy, with all of its sub-skills's mean values higher than 2.5. This shows that the individuals from the four institutions are able to use ICT tools to search, organize, evaluate... information, and apply different methods and tools to manage and store information (mean=3.4 each).

Another positive outcome is seen in students' ability to critically analyze and comment on data sources and digital content well (mean=3.3). Whereas, nearly half of the students feel uncertain about their abilities to analyze and comment critically, verify the information, and apply different methods and tools to manage and store information. It does not mention that up to 41.2% of students rated themselves "weak" in the ability to use their own strategies to organize and retrieve information and data.

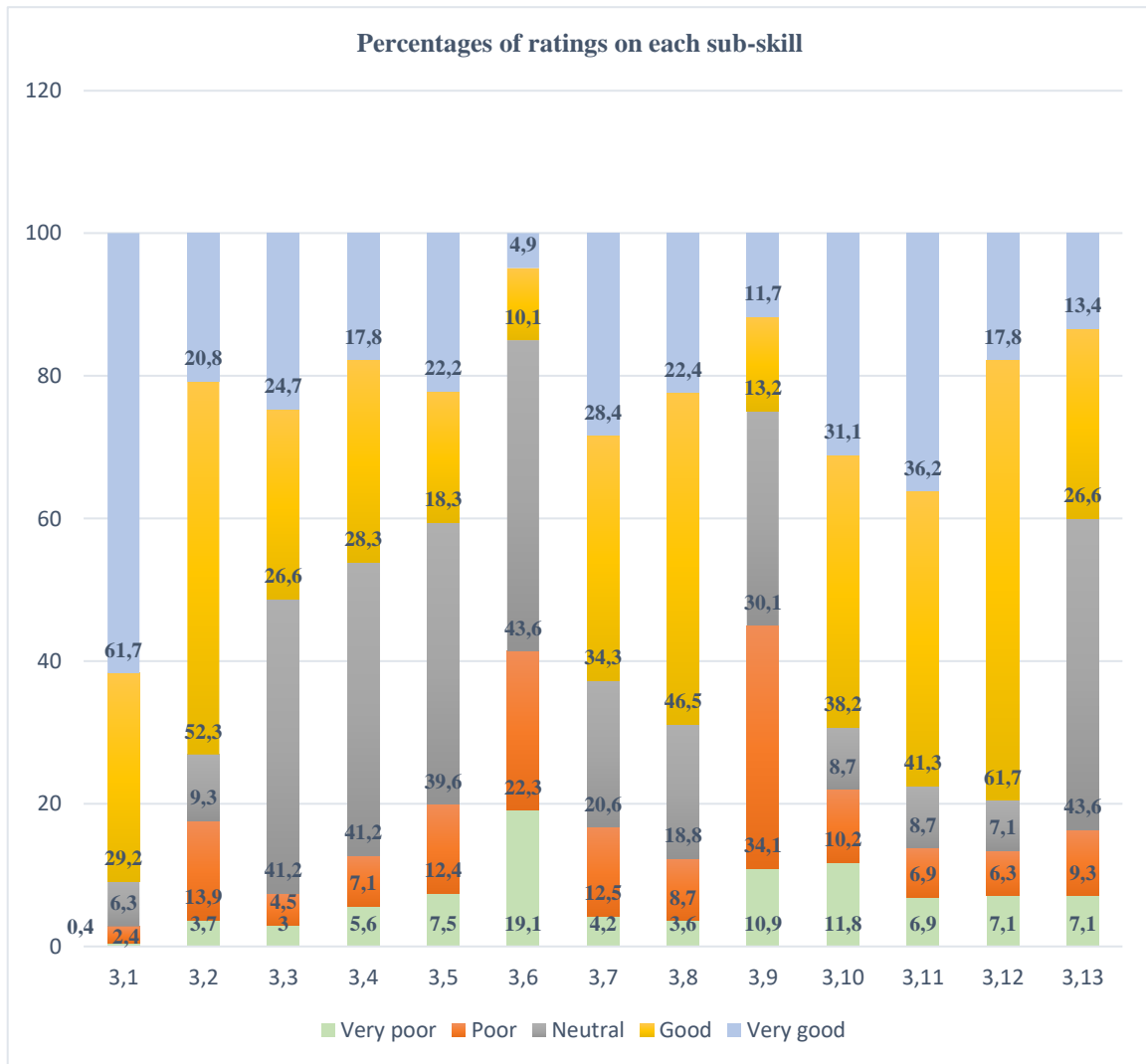


2. Information and Data Literacy	Mean
2.1. I use ICT tools to search, locate, select, organize, evaluate, process, store, transform, disseminate, cite and communicate information.	3.4
2.2. I use specialized search engines and meta-search engines with various mechanisms (Identify keywords, synonyms and related terms, search in more than one language...).	2.7
2.3. I understand different sources of information and can build search strategies correctly based on them.	2.6
2.4. I analyse and comment critically on information, data sources and digital content, verify the validity and timeliness of the information located.	3.3
2.5. I apply different methods and tools to manage and store information, data and digital content for easy retrieval.	3.4
2.6. I have my own strategy to organize and retrieve information and data.	2.3

Graph 3. University students' self-evaluation of digital competence on Information and Data Literacy

Students unveil their strengths in communication and collaboration competence, with up to 90% being able to communicate and interact through various digital devices and applications (mean=4.7) (see Graph 4,). This is also the highest digital sub-skill among the 44 under the survey. Besides, students are also literate in sharing knowledge and multimedia content via social networks and online communities (up to 73%). However, half of the students do not pay their specific attention to interacting with partners in their familiar educational or professional fields. A similar number of students also do not feel engaged in online citizen participation. In the discussion of teamwork, around 40% of students seem reluctant to apply digital technologies to getting together or solving groupwork tasks. In relation to ethnicity and security issues, nearly 70% of young respondents are aware of virtual world rules and remind families and friends of basic ethnic behaviors although about 50% of them report that they are not sure how they can actually protect their own digital reputation.





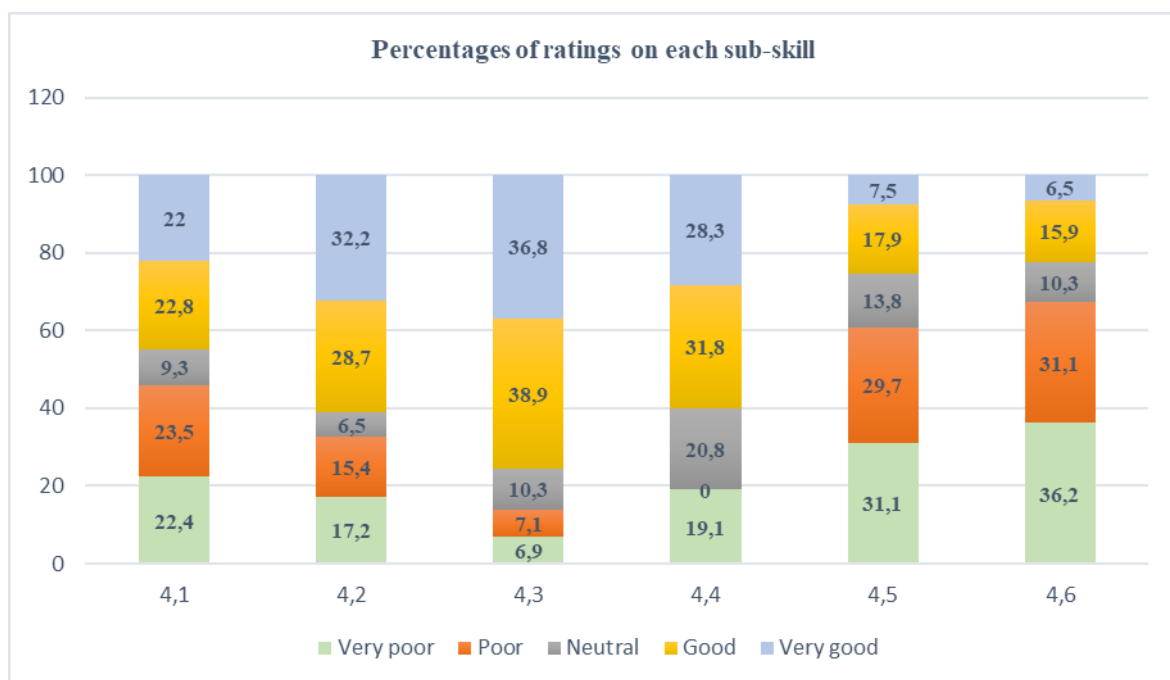
**3. Communication and Collaboration**

**Mean**

3.1. I communicate and interact through a variety of digital devices and applications (SMS, email, cloud, QQ, WeChat, video conferencing).	4.7
3.2. I participate in social networks, collaborative platforms and online communities where I share knowledge, multimedia content and information.	3.9
3.3. I collaborate through the Internet with other people in my educational or professional field that form my personal learning network (PLN).	3.8
3.4. I engage with society through online participation (social, political, cultural, administrative action) and am aware of the potential of technology for citizen participation.	3.6
3.5. I use digital technologies and media for teamwork.	3.4
3.6. I use technology and collaboration tools to plan, execute and share monitoring of activities and projects.	2.6
3.7. I participate in learning activities such as MOOCs through collaborative environments.	3.7

3.8. I am familiar with the rules of conduct online or in the virtual world, such as being friendly, respecting people’s privacy and being careful with my language.	3.8
3.9. I stay up to date with ethics regarding internet use.	2.8
3.10. I take care to remind my family and friends of the basic rules of behaviour on the Internet.	3.7
3.11. I know how to create and manage a public, personal and professional profile on social media.	3.9
3.12. I am able to manage several digital identities depending on the objective or context.	3.9
3.13. I pay attention to what I post online and I know how to protect my digital reputation and/or that of others.	3.4

Graph 4. University students’ self-evaluation of digital competence on Communication and Collaboration



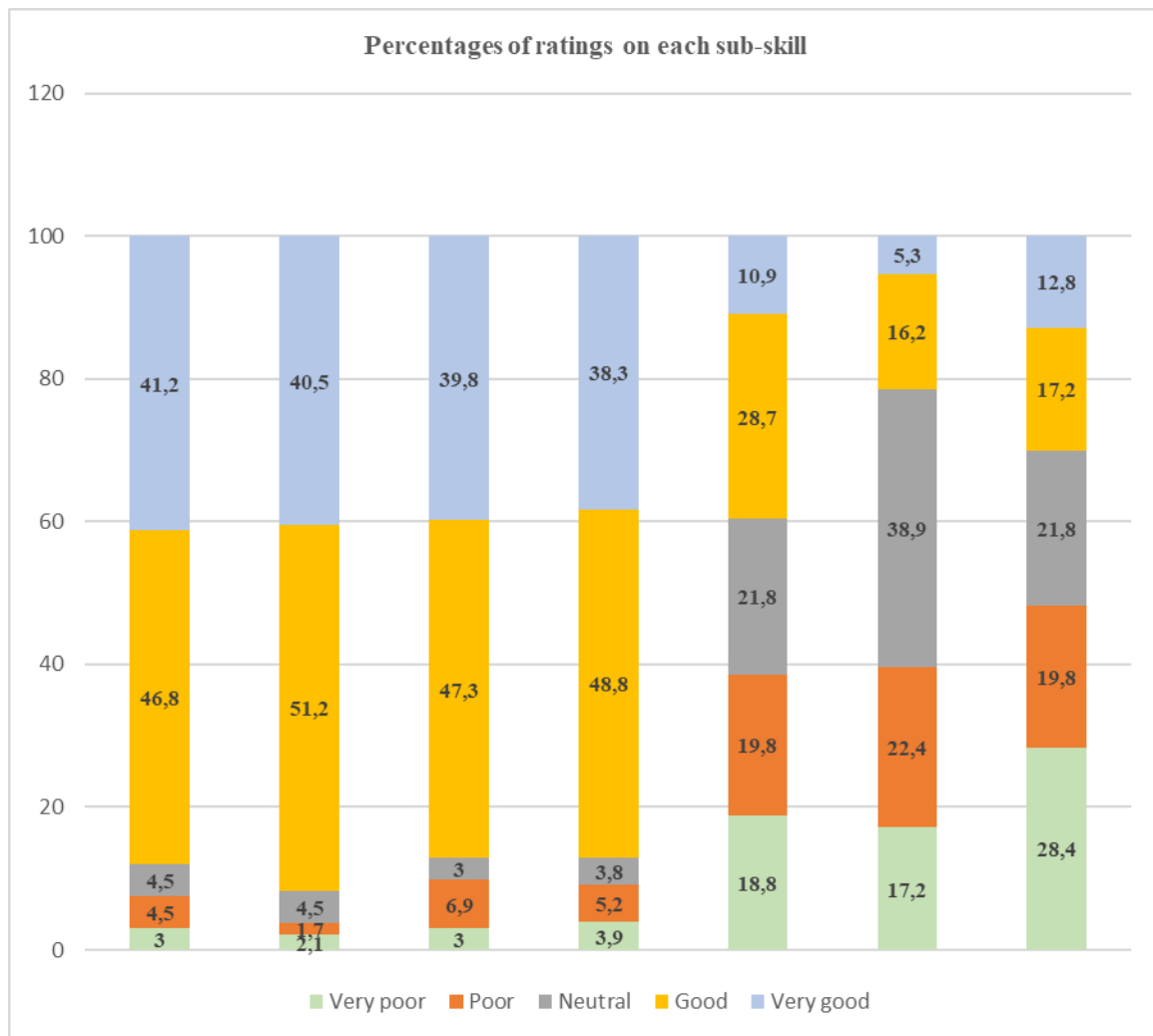
**4. Digital Content Creation**

**Mean**

4.1. I use a variety of tools and software to create multimedia content in a variety of formats.	3.0
4.2. I am able to use different media and methods to present ideas in a creative way.	3.4
4.3. I am able to edit, modify, improve and combine existing resources to create new and relevant content and knowledge.	3.9
4.4. I understand the basic knowledge and laws of intellectual property and the licensing of information and digital content when working with ICTs.	3.2
4.5. I know the basics of digital processes, understand the principles of programming and what is behind a programme.	2.4
4.6. I make modifications to computer programs, applications, configurations and equipment as needed	2.3

Graph 5. University students’ self-evaluation of digital competence on Digital Content Creation

Referring to Graph 5, digital content creation is the fourth digital literacy skill that requires students to be productive. The depressing point is that around 46% of the students revealed that they could not apply various tools and software to create multimedia contents. The figures are even higher in terms of understanding the principles of programming (60.8%) and making modifications to computer programs or applications (67.3%). These two aforementioned sub-skills also have very low mean scores, with 2.4 and 2.3 respectively. However, the optimistic finding is discovered when more than half can creatively create contents and present ideas through different media. They also show a good understanding of laws and principles of intellectual property (49.3%).



**5. Safety**

**Mean**

5.1. I understand the risks associated with the use of online tools and devices.	4.2
5.2. I protect my equipment and multimedia content.	4.3
5.3. I keep data security and protect my personal privacy.	4.1
5.4. I understand the health risks associated with the use of related technologies.	4.3
5.5. I prevent and avoid physical and mental health threats when using the Internet	2.9

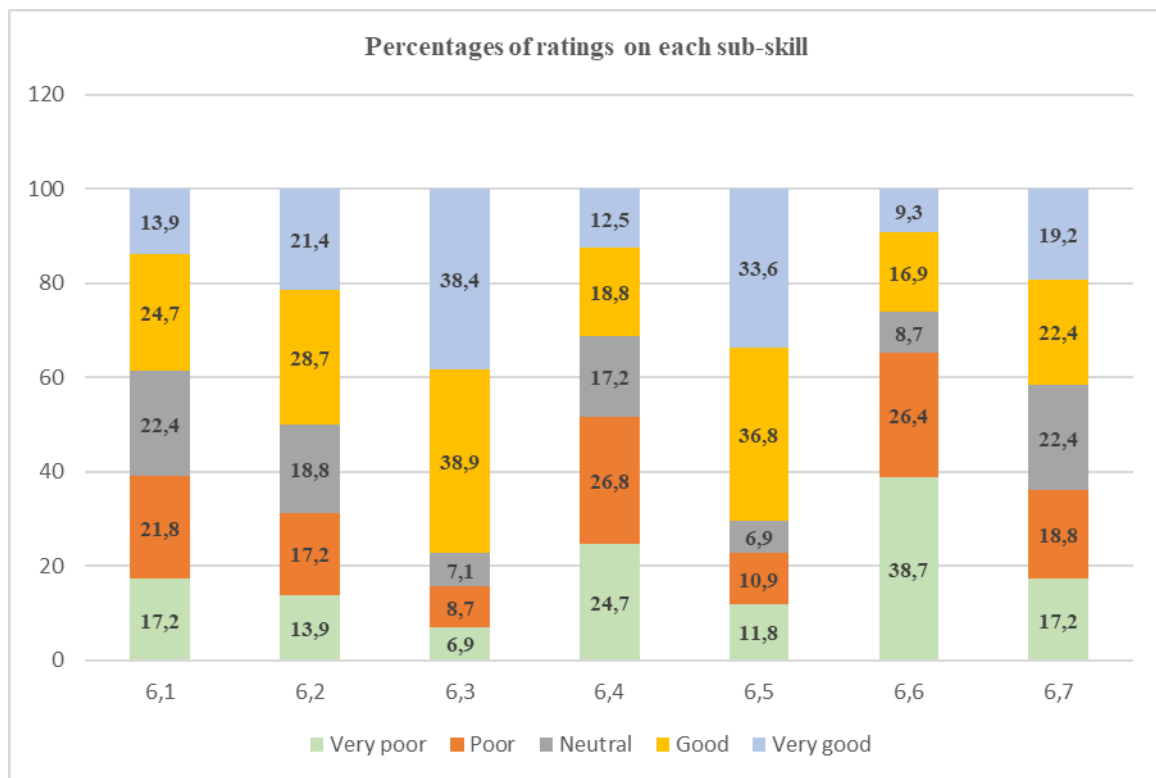
and multimedia devices, such as poor sitting posture and cyberbullying.

5.6. I know the positive and negative aspects associated with the use of technology on the environment. 2.7

5.7. I apply basic measures to save energy, recycle devices and protect the environment. 2.7

Graph 6. University students' self-evaluation of digital competence on safety

Another very important digital literacy skill is safety whose sub-skills, as shown in Graph 6, are unevenly rated. The sub-skill 5.1, 5.2, 5.3 and 5.4 own mean values higher than 4.0. In particular, approximately 90% of students are confident in their understanding of personal risks related to the use of technologies and they are also able to protect the privacy of their equipment and multimedia contents. Interestingly, although up to 87% of participants claimed to know the possible physical and mental health risks caused by the use of technologies, not many (only 39%) made attempts to prevent and avoid negative health effects. Moreover, environmental risks are also less concerned by the young generation, with only 18% knowing about environmental problems caused by the technologies and taking action to protect the environment.



**6. Problem Solving**

**Mean**

6.1. I am familiar with the operation of digital devices and am able to identify possible technical problems.	3.0
6.2. I solve daily technical problems.	3.3
6.3. I evaluate and select appropriately a tool, device service to perform my tasks and	3.9

meet my needs.

6.4. I keep myself updated on new developments and emerging technology trends, and innovate using digital technology. 2.7

6.5. I use various methods such as text, images and audio to make my expression more creative and innovative. 3.7

6.6. I actively attend events and workshops on digital creation, and participate in collaborative multimedia and digital projects. 2.3

6.7. I understand the needs to improve and update my own competence and to help others in developing their digital competence. 3.1

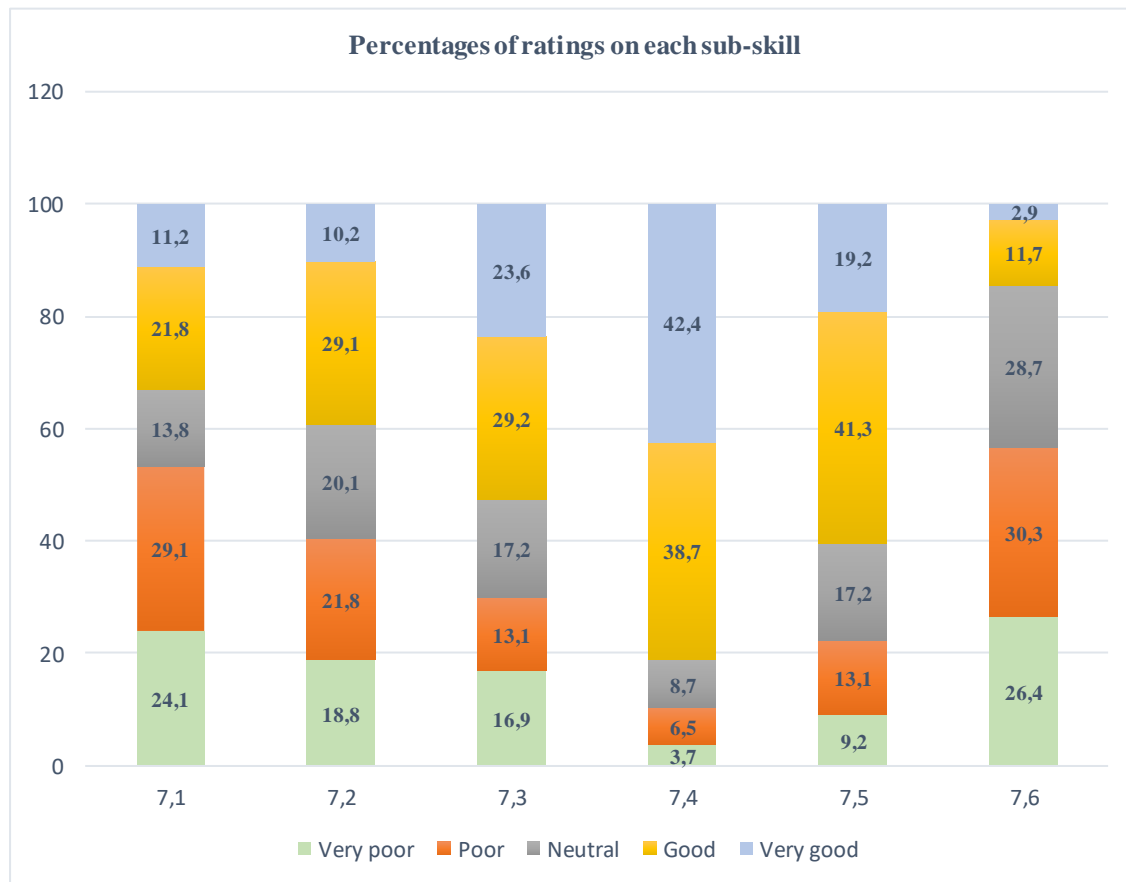
Graph 7. University students' self-evaluation of digital competence on Problem Solving

Graph 7 points out students' self-assessment in the sixth digital skill – problem-solving, whose means are generally lower than other previously mentioned skills. There are no sub-skills whose means are higher than 4.0, with the highest coming to the ability to evaluate and select appropriate tools to meet the needs, at 3.9. In fact, up to 77% of students rate themselves “good” and “very good” in this sub-skill. It is closely followed by sub-skill 6.5, whose mean is 3.7 and the positive rating is around 70%.

Conversely, students do not find themselves familiar with technical problems relating to digital device operation (with up 39% rating “poor” and “very poor” and 22.4% holding a “neutral” idea about that). Half of the students, moreover, do not particularly care about keeping themselves updated on new developments or technology trends. The bright side of the problem-solving literacy skills is that students are able to evaluate and select appropriate tools and services to accomplish their tasks (77%) and use a variety of methods and tools such as texts, images and audio to make their expressions more innovative (70.4%).

In Graph 8 below, the seventh competence is the essential digital literacy skill due to its career-related roles. It can be recognized that students gained an acceptable level of career-related competence as the means of subskills are mostly higher than 2.5. In particular, the ability to use different media and methods to present ideas is a proud subskill to the students (with both “good” and “very good” ratings being 80%). In addition, 60% of students have good knowledge of laws of intellectual property and the licensing of information when working with ICTs.

For creating multimedia contents for work purposes, the proportion is relatively lower, accounting for 52.8%. It is then followed by the ability to edit, modify, improve and combine existing resources for new career-related products (40%). Students seem less competent in the operation and process of some specialized digital technologies in their career fields (with only 53.2% rating “very poor” and “poor”). Just a small percentage of them (13.6%) are able to modifications to computer programs, applications and equipment to serve my career purposes.



7. Career-related competence	Mean
7.1. I understand how specialised digital technologies of my career field operate and process.	2.7
7.2. I am able to edit, modify, improve and combine existing resources to create new and relevant career-related digital products.	2.9
7.3. I use a variety of tools and software to create multimedia contents for my work purposes.	3.3
7.4. I am able to use different media and methods to present ideas to my colleagues, employers and partners in a creative way.	4.1
7.5. I understand my career-specialised knowledge and laws of intellectual property, and the licensing of information and digital content when working with ICTs.	3.5
7.6. I make modifications to computer programs, applications, configurations and equipment to serve my career purposes.	2.3

Graph 8. University students' self-evaluation of digital competence on Career-related competence

## Discussion

Digital literacy has become indispensable for every global citizen, whether to communicate, to find

comprehensive employment, to achieve education, to socialize, and even to survive. Acquiring the right series of digital skills is not only compulsory for learning and workforce readiness but also essential to a more open, inclusive and secure community. It is widely known that digital literacy skills, like other 21<sup>st</sup>-century literacy skills, should start at school. Therefore, it is important to have a very primary consideration of the learners' own assessment of their current level of digital literacy before any further steps should be made. There are no digital competence areas under the survey record low level of students' self-evaluation.

Findings from the study pinpoint that students perceive a moderate level of digital competence. This is an unsurprising finding due to the fact that all of the participants (ranging from 18 to 21) belong to Generation Z, who is coined "digital natives". Although the current outcome is noticeably lower compared to those in developed countries such as Finland in the study of Khan and Vuopala (2019), Canada in the study of Son, Park and Park (2017), in which students rated their own e-skill competence "highly develop" and "very good", the outcome is more positive compared to previous studies in Asian regions. In specific, Vietnamese students surpassed Japanese students in the study of Cote and Milliner (2017), Indonesian students in the study of Mega (2020), and as competent as Malaysian students. Most interestingly, this study is inconsistent with a previous paper conducted in Northern Vietnam by Nguyen and Habók (2021), which depicts the students' level of technological skills just hovering around low to average.

When the defined areas of digital competencies are considered, the obtained results indicate that students in the Mekong Delta stated that their digital competencies are most developed in the areas as follows: device and software operation, information and data literacy, communication and collaboration, and digital content creation. Such results are understandable when Vietnamese children are allowed to use gadgets at the early ages (VVN, 2016). On the other hand, students assess their digital competencies as less developed in the remaining three areas: safety, problem-solving, and career-related competence. This is in line with the study of Zulkarnain et al. (2021) whose participants also claimed not to be very literate in areas of problem-solving and digital content creation. It can be assumed that students perceive basic competencies related to how to run a technological device and software, and use technologies to create digital content serving their study and career purposes. This can be explained by the fact that students have become used to the activities that have frequently conducted at school and in their daily life.

It is known that the Vietnamese curriculum from the very beginning level of education integrates lessons in using technologies. In detail, pupils in primary schools are taught to know how to operate a technological device as the first step before being instructed on how to create digital contents at the secondary level, how to solve digital problems in high school, and finally how to apply digital literacy in a career in tertiary level. Virtually, solving technical problems, and ensuring the protection for devices, data, health and the environment are more complex competencies that require more critical thinking, additional work and more applications. It might be possible that the syllabus and teaching materials at different faculties do not sufficiently incorporate elements from the last three areas of competence, given that they cover different scientific fields.

## Conclusion

To the best of my knowledge, this research can be considered as a pioneer study in the Mekong Delta that uses DGLF as a standard for the self-assessment of the young generation's digital competence. The empirical results show that all the respondents were satisfactorily competent in the areas such as information and data literacy, communication and collaboration, digital content creation and safety, and the abilities for the appropriation of technologies and the digital practices presented by Vuorikari et al. (2016). This pinpoints that they possess the ability to express themselves through digital means with respect the security measures such as reliability and privacy. However, it is not the same in the case of problem-solving (i.e., an individual's capacity to understand and resolve problem situations), which has been found as an under-developed area of competence. More specifically, by identifying the highest and lowest competency, it was delightful that Southern Vietnamese students show a highly moderate proficiency in safety which refers to the awareness of "netiquette" including behavioral norms, online, cultural, and generational diversity in digital environments. Whereas, the finding revealed that career-related competence (i.e., an individual's capacity to perform career-related tasks) is the least well-performed one in the seven areas of DLGF. It is also evident from the findings of the study that individuals' responses toward the information produced and processed by these technologies are unique. However, they possess deep connection with the society where information flows and knowledge evolves (Dunaway, 2011).

In the wake of rapid economic growth and significant innovation in technology, digital literacy is more important than ever. Digital literacy skills are paramount to 21st-century citizens who make the choice of either controlling or being lost out in the world of information explosion that is sweeping through all the sectors. Because our young generations will have to cope with new challenges and risks coming with living with technology, there is no way that we need to expose and prepare them with the skills to stay safe and thrive. A digitally-implemented education system should be in discussion to ameliorate digital citizenship and intense students' cognitive competencies beyond the classroom (Rafi et al., 2019). When it comes to introducing digital learning into the curriculum, it is the role of the government, online providers, parents, and teachers who are prompted to work together to support and protect their children online. This study, to some extent, highlights a case of the Mekong Delta students' digital literacy skills as a useful resource for further curriculum development and research.

The current study cannot avoid some limitations that should be acknowledged when interpreting the results. The research covers a wide range of senior students from different majors in four institutions in Vietnam. Therefore, to draw more specific conclusions, future researchers should focus on students in some particular field. Additionally, the study sample only focused on last year students from universities in the Mekong Delata in Vietnam; hence, the study results cannot be generalized to all educational contexts. It is suggested that further research can be done in which digital literacy level of students in more various age range throughtout Vietnam can be compared using DLGF. Furthermore, regarding to the participants' digital skills, as all survey questions



required them to self-assess their skills, it is also vital that students need to have accurately assessed their digital skills via a test or a tool. In other words, the discrepancy between their perceived and actual skills may be trivial (Aesaert et al., 2017), or there may be some gap between students' self-rated skills and their actual skills (Gross and Latham, 2012). Future studies can discover students' actual skills from practical digital tasks or compare their perceived and actual skills of using technology in some specific context.

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## Pre-service and in-service Elementary School Teacher's Procedural and Representational Knowledge of Fractions

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**Abstract:** The main purpose of this study is to assess pre-service and public elementary mathematics school teachers' conceptual understanding and computational abilities of fractions. 20 pre-service mathematics teachers and 24 in-service mathematics teachers participated in this study. In-service teachers were divided into two categories; one for teachers having a degree in mathematics and the other for teachers having a degree in any other discipline. Results showed that both pre-service and in-service teachers' computational knowledge is greater than their representational knowledge. However, in-service teachers had difficulties in multiplication of mixed numbers (41.7% correct answers). The study revealed that regarding the computational knowledge no significant difference was found between in-service and pre-service teachers. When considering representational abilities, pre-service teachers were able to perform better than in-service teachers. The difference was significant ( $p < 0.005$ ). however, when we compared preservice teachers' performance to in service teachers who graduated from the faculty of pedagogy, there was no significant difference ( $p = 0.717$ ). Moreover, faculty of pedagogy graduate in-service teachers performed better than preservice teachers which shed a light on the importance of teachers' specialization even in elementary classes.

**Keywords:** Fractions, Representational abilities, Computational abilities, Inservice teachers, Preservice teachers

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### Introduction

The NCTM' Principles and Standards for School Mathematics (NCTM, 2000) states that fractions are fundamental because of their significant application in daily-life situations. It is a concept that extends over most of the elementary grades (from grade 3 till grade 7 in the Lebanese curriculum and often revisited in all mathematics subject areas) and in which students have difficulties in almost all levels. Sowder & Wearne found that even in the middle grades, fractions represented a challenge for students. Results of their research showed that students have a weak understanding of fraction concepts (Sowder & Wearne, 2006). This lack of understanding is then transposed into difficulties with 'fraction computation, decimal and percent concepts, and the use of fractions in other content areas, particularly algebra' (Brown & Quinn, 2007; National Mathematics Advisory Panel, 2008).

In parallel, teachers that do not understand fraction and are not able to interpret them conceptually will find difficulties in helping their students make sense of that concept (Ball, 1990; Graeber, et al., 1989; Redmond & Utley, 2007). Representations and conceptual understanding are very important to help students understand operations on fraction (Mewborn, 2001).

In teacher education program in the Lebanese university, elementary mathematics education students experience three years of learning how to teach mathematics to students ranging from grade one to grade six. They learn methods of teaching mathematics through three required method courses in year one and year two. Yet, their certification is not a requirement for the Lebanese ministry of education to enable them to enter elementary classes in public schools. Any university degree is acceptable to teach elementary mathematics according to the ministry of education.

The purpose of this study is to assess Lebanese University mathematics pre-service teachers' and public elementary schools' teachers', whether having a degree in teaching mathematics or not, knowledge in fractions, including their conceptual understanding and computational abilities.

### **Review of literature**

When students start learning about fractions, they start constructing their understanding of a different type of number system with its own representations and symbols (Wright, 2008). Students should be taught operations with fractions in concrete terms (Martin & Sebesta, 2004; Patterson, Capraro, Kemp, Standish & Sun, 2003) once the concept is introduced to them (Naiser, Wright & Capraro, 2004). That is why it is very important for teachers to construct activities for student to develop conceptual comprehension of fractions and operations involving fractions. The achievement of such conceptual comprehension can be accelerated through the use of mathematical models and representations like physical and mental actions; a picture, drawing, symbol, or a concrete means entailing the relationship conveyed by a mathematical concept. The representations can be employed to enable students develop new concepts and relationships in their minds, to help students establish the relationships between concepts and symbols, and to assess the level of comprehension in students' mind (Olkun and Toluk Uçar, 2012).

Literature has shown that pre-service teachers' understanding of fraction content knowledge is very weak (Simon, 1993; Cramer, Post, & del Mas, 2002). Ball (1990) found that pre-service teachers have difficulties with the concept of fractions and the meaning of division of fractions. Other researchers showed that pre-service teachers have difficulty in explaining fractions to children and why algorithms work (Chinnappan, 2000). Pre-service teachers will be teaching mathematics in elementary schools and their weak performance may cause serious problems. Therefore, this issue is extremely important and should be addressed.

In-service elementary teachers also showed difficulties in explaining the concept behind operations of fractions. In their research that aimed at looking for in service teachers' knowledge on multiplication and division of

fractions at primary schools, Veloo & Puteh (2017) found that teachers prefer algorithmically approach in their work rather conceptual approach. Their practices showed that they lacked understanding of conceptual explanations. Although they came up with correct solutions, they were unable to give explanations for their work through drawings.

Teachers need to have the necessary specialized knowledge, such as knowledge of a variety of representations including concrete models and real-world problems, to help students understand mathematical concepts (Taber, 2000). Yetkiner & Capraro (2009) recommended that middle school teachers should be "equipped with the necessary knowledge to help students develop conceptual understanding of fractional concepts such as accurate and appropriate representations."

### **Theoretical background**

The visual takes a wide space in our lives. Everything around us is filtered through our eyes before analyzing and understanding it. Also in the learning process, visual representations play a very important role. Many psychological studies confirm that using visual representations in teaching help a deeper understanding of concepts. "For a mathematical thinking and communication, we need to represent in some way the elements of mathematical structures. Communication requires external representation in the form of language resources, written symbols, figures and objects" (Lesh, Post& Behr, 1987).

Cognitive psychologists defined two types of representations:

- External representations that can be: enactive, iconic and symbolic (written and spoken language, symbols).
- Internal representations: they are the mental representations that cannot be directly observed but needed in order to conceptualize about a mathematical concept.

Cognitive psychologists have formulated two hypotheses on representations:

- 1) There is a connection between internal and external representation of a concept. We can make logical deduction about internal representation, about their quality with the help of manipulating external representations.
- 2) Internal representations are interconnected, they form a network, that of mathematical concepts and principals. These connections can be simulated by constructing the right connections between external representations (Ambrus, 2001, cited in Debrenti, 2013 ). External representations, such as figures and text definitions influence the nature of internal representation. This also holds the other way round. The way a student reperesents his/her knowledge externally shows the way he/she represents the information internaly (János, 1998 cited in Debrenti, 2013)

Visual representations facilitate sense making and understanding because people remember images better than words (Ambrus, 2001). "Using concrete and iconic representations is necessary not only for the so called slow students or elementary students. These representations are important for all students and are useful throughout the entire learning process" (Wittmann, 1998)

Didactics states that iconic representations are important in the early stages of learning, and as students' age and

mental development increase symbolic representations take over. However, there are other views that suggest that iconic representation should be implemented at all stages (Ambrus, 2001).

According to NCTM (2000) representations are useful in all areas of mathematics because they help us develop, share, and preserve our mathematical thoughts. "[They] help to portray, clarify, or extend a mathematical idea by focusing on its essential features" (p 206)

Cognitive theories prefer the term representation while researchers prefer model and modeling. The two terms are to a large extent interchangeable especially when researches in science and mathematics are involved (Gravemeijer, Lehrer, Van Oers, & Verschaffel, 2003; Greer, 1997).

### Research Questions

Three questions are posted:

- 1) To what extent could pre-service and in-service mathematics teachers solve problems involving operations on fractions and how do they compare?
- 2) To what extent could pre-service and in-service mathematics teachers demonstrate their solving of comparison, addition, subtraction, and multiplication of fractions with representations and how do they compare?
- 3) How do in-service teachers with mathematics education degree and in-service teachers with other degrees compare in solving and representing fraction problems?

### Method

#### Participants

A total of 44 teachers participated in the study for data collection. Participants consisted of 20 pre-service mathematics teachers and 24 in-service mathematics teachers. Pre-service teachers are enrolled in a 3-year mathematics teacher education program at the Lebanese University, faculty of Pedagogy, branch1. These University- Faculty have completed the required 9 credit hours in mathematics education. In service teachers are actually teaching elementary mathematics in several public schools in Beirut. Ten of them have a degree in teaching mathematics from the Lebanese university and 14 of them are other faculties' graduates. The table below shows the profiles of the participants.

Table1. Teachers' profiles

Pre-service teachers	In-service teachers			
	Faculty of Education		Other Faculties	
	Years of experience			
	≤ 5	> 5	≤ 5	> 5
20	4	6	8	6

## Instrument

One instrument was used in this study. A fraction knowledge test, adapted and adopted from several previous studies on teachers' knowledge of fractions, was constructed to provide emphasis on both procedural and conceptual knowledge. The test consisted of five tasks that measure areas related to: (1) comparison, (2) addition, (3) subtraction, (4) multiplication, and (5) division. An item exemplified as "How much is  $\frac{3}{4}$  of  $\frac{2}{3}$ ?" is considered as a procedural knowledge item, and an item exemplified as "Explain how you determined your answer by giving an illustration or representation for  $\frac{3}{4}$  of  $\frac{2}{3}$ ?" is considered as representational knowledge. The test contains contextual and non-contextual tasks.

## Data collection and analysis method

Data was collected by using a fraction assessment test. Test was submitted by hand to each participant who answered the test items in presence of the researcher. All items were corrected according to a rubric that categorized the answers as true, partially true or false. An answer was considered false if no work was shown at all or the answer is inappropriate. Partially true if the answer is not complete and true if it is correct and complete. Descriptive statistics was used in order to answer the research questions. Percentages were found for each item of the test. In addition, Pearson correlation was used to explore whether there is a significant relationship between two sets of points.

## Results

The data collected in this research was intended to portray pre-service and in-service teachers' knowledge of computing and representing fractions. Educational background of in-service teachers was also taken into consideration. The results are presented in the following section in a way to answer the research questions.

### Comparison of fractions

When teachers were asked to compare two fractions the pre-service teachers were 85% able to give true answers while the in-service teachers had 100% true answers. When they were asked to use a representation (model) to clearly demonstrate the comparison only 30% of pre-service teachers and 16.7% of in-service teachers gave a full true answer. The below table illustrates the answers.

Question1: comparison of fractions					
Pre-service Teachers			In-service teachers		
Computation					
True	False	Partially true	True	False	Partially true
17	1	2	24	0	0
85%	5%	10%	100%	0%	0%

Representation					
True	False	Partially true	True	False	Partially true
6	12	2	4	16	4
30%	60%	10%	16.7%	66.7%	16.7%

Table2. Pre-service and in-service teachers' results of Q1

40% of in-service teachers who were graduated from the faculty of education were able to represent correctly the comparison of two fractions while 0% who graduated from other faculties were able to do so.

Table3. In-service teachers' results of Q1

Question1: comparison of fractions					
In-service- teachers Q1					
Faculty of Education teachers			Other faculties teachers		
Computation					
True	False	Partially true	True	False	Partially true
10	0	0	14	0	0
100%	0%	0%	100%	0%	0%
Representation					
True	False	Partially true	True	False	Partially true
4	4	2	0	12	2
40%	40%	20%	0%	86%	14%

### Multiplication of fractions

When teachers were asked to multiply two fractions less than one, 85% of pre-service teachers had a completely true answer compared to 75% of in-service teachers. When they were asked to explain by giving an illustration or representation of how they multiplied the fractions, 45% of PST and 25% of IST gave complete true answers

Table 4. Pre-service and in-service teachers' results of Q2

Question2: Multiplication of Fractions					
Pre-service Teachers			In-service teachers		
Computation					
True	False	Partially true	True	False	Partially true
17	3	0	18	6	0
85%	15%	0%	75%	25%	0%
Representation					
True	False	Partially true	True	False	Partially true



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9	4	7	6	12	6
45%	20%	35%	25%	50%	25%

Of all IST who had correct representation of multiplication of two fractions 40% were Faculty of Education graduates and 14% were from other faculties.

Table 5. in-service Teachers results of Q2  
Q2: Multiplication of fractions. In-service teachers

Faculty of Education teachers			Other faculties teachers		
Computation					
True	False	Partially true	True	False	Partially true
6	4	0	12	2	0
60%	40%	0%	86%	14%	0%
Representation					
True	False	Partially true	True	False	Partially true
4	2	4	2	10	2
40%	20%	40%	14%	72%	14%

### Multiplication of mixed numbers

In question3 where teachers were supposed to calculate and represent multiplication of two mixed numbers, 70 % of pre-service teachers and 41.7 % of in-service teachers answered correctly while only 35 % of pre-service teachers and 8.3 % of in-service teachers were able to represent the multiplication correctly.

Table6. pre-service and in-service teachers results of Q3

Question3: Multiplication of Mixed Numbers					
Pre-service Teachers			In-service teachers		
Computation					
True	False	Partially true	True	False	Partially true
14	3	3	10	14	0
70%	15%	13%	41.7%	58.3%	0%
Representation					
True	False	Partially true	True	False	Partially true
7	9	4	2	22	0
35%	45%	20%	8.3%	91.7%	0%

60% of in-service teachers who are faculty of education graduates computed the multiplication of mixed numbers correctly compared to 86% of graduates of other faculties. On the other hand, 40 % of those who are FOE graduates represented the multiplication of mixed numbers correctly compared to 14% of other faculties

graduates.

Table 7. In-service teachers result of Q3

Q3: Multiplication of mixed numbers. In-service teachers					
Faculty of Education teachers			Other faculties teachers		
Computation					
True	False	Partially true	True	False	Partially true
6	4	0	12	2	0
60%	40%	0%	86%	14%	0%
Representation					
True	False	Partially true	True	False	Partially true
4	2	4	2	10	2
40%	20%	40%	14%	72%	14%

### Addition of fractions

In question4 teachers were supposed to add two fractions and then to represent the addition by a model. 70% of pre-service teachers and 83.3% of in-service teachers did the computation correctly, while 60% of pre-service teachers and 25% of in-service teachers were able to give a model for representation

Table 8. pre-service and Inservice results for Q4

Question4: Addition of fractions					
Pre-service Teachers			In-service teachers		
Computation					
True	False	Partially true	True	False	Partially true
14	5	1	20	4	0
70%	25%	5%	83.3%	16.7%	0%
Representation					
True	False	Partially true	True	False	Partially true
12	4	4	6	12	6
60%	20%	20%	25%	50%	25%

80% of in-service teachers from the faculty of education added correctly two fractions and 40% of them were able to represent this addition, while 85.7% of teachers from other faculties added the two fractions correctly and only 14.3% were able to represent the addition.

Table 9. in-service teachers result for Q4

In-service teachers Q4	
Faculty of Education teachers	Other faculties teachers

Computation					
True	False	Partially true	True	False	Partially true
8	2	0	12	2	0
80%	20%	0%	85.7%	14.3%	0%
Representation					
True	False	Partially true	True	False	Partially true
4	6	0	2	6	6
40%	60%	0%	14.3%	42.9%	42.9%

### Division of fractions

In question 5 teachers were asked to divide then model a division between two fractions. 95% of pre-service teachers and 91.7% of in-service teachers did the division correctly, but only 40% of pre-service teachers and 16.7 % of in-service teachers gave a correct model.

Table 10. pre-service and in-service results for Q5

Question5: Division of fractions					
Pre-service Teachers			In-service teachers		
Computation					
True	False	Partially true	True	False	Partially true
19	1	0	22	2	0
95%	5%	0%	91.7%	8.3%	0%
Representation					
True	False	Partially true	True	False	Partially true
8	6	6	4	20	0
40%	30%	30%	16.7%	83.3%	0%

100% of in-service teachers from the faculty of education divided the two fractions correctly and 40% of them represented the division, while 85.7 % of in-service teachers from other faculties divided correctly and no one of them was able to represent the division by a model

Table 11. in-service teachers result for Q5

In-service teachers Q5					
Faculty of Education teachers			Other faculties teachers		
Computation					
True	False	Partially true	True	False	Partially true
10	0	0	12	2	0
100%	0%	0%	85.7%	14.3%	0%
Representation					
True	False	Partially true	True	False	Partially

4	6	0	0	14	true
40%	60%	0%	0%	100%	0%

A t test comparison of percentages of correct answers for representations of fractions between in-service and pre-service teachers showed a significant difference ( $p=0.006221$ ,  $p<0.05$ ), while no significant difference was noted when comparing their computational skills.

A t test comparison of percentages of correct representations of different types of fraction operations between in-service teachers having a degree in mathematics education and those having other university degrees revealed a significant difference ( $p<0.05$ ). no significant difference was revealed between the two types of in-service teachers regarding the computational skills.

## Conclusion

In conclusion, the results of this study showed that there is a difference between computational abilities and representational abilities of both in-service and pre-service teachers in all studied domains: comparison of fractions, multiplication of fractions and of mixed numbers, addition of fractions and division of fractions. The results showed that pre-service and in-service teachers' computational knowledge is greater than their representational knowledge. However, in-service teachers had difficulties in multiplication of mixed numbers (41.7% correct answers). The study revealed that regarding the computational knowledge no significant difference was found between in-service and pre-service teachers.

When considering representational abilities, pre-service teachers were able to perform better than in-service teachers in all the studied domains. The difference was significant ( $p<0.005$ ). however, when we compared preservice teachers' performance to in service teachers who graduated from the faculty of pedagogy, there was no significant difference ( $p=0.717$ ). Moreover, faculty of pedagogy graduate in-service teachers performed better than preservice teachers in all domains which shed a light on the importance of teachers' specialization even in elementary classes.

There still are some limitations to this study. First, the sample was small in size. Second, only students enrolled in the education program of the Lebanese public university participated in the study. Also, in-service teachers were only public-school teachers. Another study with a larger representative sample could validate the results of this study if its results were similar.

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## Determination of Cognitive Structures of Secondary School Students on Active Citizenship Theme in Social Studies Course

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**Abstract:** Student's learning and retention of academic content in a meaningful way depends on strengthening their cognitive structures. Once this structure, which provides a framework in which new knowledge will be included, is ascertained, engaging in teaching activities can create an opportunity for learners to have a different learning experience. Word association test are very functional in revealing the networks between the cognitive structure of the students and the concepts in this structure. The aim of this research is to reveal the cognitive structures of secondary school students who take social studies course towards the concepts in the unit of "active citizenship". In the research conducted in the survey model, the word association test was used as a data gathering tool in the study. As a result of the research, it has been observed that students mostly associate the concept of institution with school, organization with country, management with presidential, involvement with vote, and active citizen with mindfulness.

**Keywords:** Social studies, Cognitive structure, Word association test, Active citizenship

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### Introduction

Social studies is a discipline that aims to understand the world, guides how to use what has been learned in life, and strives for the participation of responsible individuals in society (Barr, Barth, & Shermis, 1977). Adopting an interdisciplinary understanding will ensure the integration of social sciences and will be effective in fulfilling the competencies expected from the student. The primary purpose of social studies is to raise effective citizens. An active citizen is a citizen who has adopted the values of the society he lives in and lives in harmony with the society culturally (Safran, 2015). Raising citizens who learn from the past, have decision-making skills and have high awareness in the society are among the duties expected from social studies (Levstik, & Tyson, 2008).

Today, there are basic skills aimed at gaining students. Social studies play a leading role in gaining these skills. Learning units within the social studies discipline are prepared for the acquisition of these basic skills. Each learning unit also contributes to the development of different thinking skills in students (Mutluer, 2013). The active citizenship study area within the scope of the social studies course has undertaken an intermediary mission in drawing the boundaries of the definition of the ideal citizen and in raising awareness of active participation as a citizen. Within this learning unit, it was aimed to reveal some questions in the cognitive structures of the students and they were provided to find answers to these questions: What does the concept of citizenship mean? What is active participation? What are our rights and responsibilities as citizens? What is the role of individuals in management? What is the place of non-governmental organizations in society? (Myers et al., 2002). Cognitive structure provides a broad visualization of how various concepts are perceived by students.

In order for students to perform a meaningful learning without falling into misconceptions, they should be provided to construct knowledge by associating information with correct concepts, away from rote understanding (Ausubel, 1968). The individual tries to complete the process by associating the newly learned concept or knowledge with another concept in his cognitive structure in the meaningful learning stage. Failure to make the correct association between concepts causes misconceptions to emerge at the end of the process (Novak, et al., 2005). Piaget stated that if there is a disconnection between newly acquired knowledge and existing knowledge, new connection points can't be created where this relationship can be established. Thus, a new pattern can be created in the cognitive structure of the student (Ünal, 1999). Social studies is one of the disciplines in which meaningful learning is provided by associating the information in the learning fields. Revealing the cognitive structures of the students related to the active citizenship learning field, which is within the scope of the social studies discipline, provides information about the realization of the meaningful learning goal (Doğanay, 2008). Social studies programs aim to raise principled citizens in themselves. The cognitive structures of the students related to the active citizenship learning unit are indicative of the level of realization of these goals. The fact that this field of study adopts the principle of raising individuals with various skills, respectful to democratic values, and social consciousness also serves the purpose of the social studies course (Parker, & Jarolimek, 1984). Especially in recent years, it has been accepted by societies that social studies have an undeniable effect on the ideal of being an active citizen. This situation was supported by the active citizenship learning unit. This learning unit aims to raise individuals who have acquired moral values, are conscious of human rights and are highly aware of the obligations of their rights. This emerging situation responds to the expectation of the society about the active citizen (Ross, 2006).

In the literature, there are studies on the field of active citizenship learning (Akar, 2021; Avcı, et al., 2020; Çağrı, 2020; Yeler, & Ocak, 2021). It is seen that the studies are not aimed at examining the cognitive structures of the students related to this learning unit. The aim of this study is to reveal the cognitive structures of students at different grade levels towards the learning domain of active citizenship. At the same time, this study is also important in terms of making determinations about whether there is conceptual confusion about the concepts in the learning field.



## Method

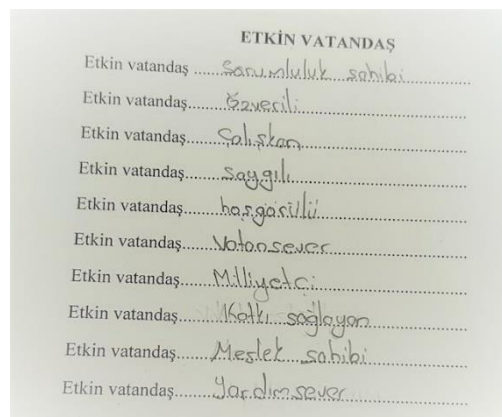
The research's based on survey model since it is tried to explain the existing cognitive structures of secondary school students regarding the concepts of institution, organization, management, participation and active citizen. In descriptive studies, the situation that is the subject of the research is described in its own conditions and as it exists (Karasar, 2012).

## Participants

The participants of the study consist of 213 students studying in 5 (n=71), 6 (n=70) and 7th grades (n=72), one private and two public secondary schools located in a city center in Turkey. 108 of the students are female and 105 are male. While determining the schools, diversity was tried to be ensured, and students taking the social studies course were included in the study.

## Data Collection and Analysis

The cognitive structures of the students for the concepts selected from the active citizenship learning unit of the social studies course curriculum were collected by using the word association test. On the first page of the word association test, an application example and an instruction on how to perform the application are presented. Then, a page layout was created with each concept on one page. Key concepts were written ten times under each other to prevent chain response risk (Bahar, & Özatlı, 2003). During the application phase of the test, a 45-second period was given for each key concept, and students were asked to write down the words that came to their minds about the key concept during this time. The process was completed in 10 minutes, including the necessary instructions about the test and the sample application.



**Figure 25.** Response sheet of one of the participants

After the implementation of the WITs, the words obtained regarding the concepts were examined in detail and a

table showing the frequency of the words was prepared. Considering the frequencies in the table, word clouds and concept networks were created. While the frequency of the words produced about the key concepts are included in the word clouds, the relationships between the words and concepts in the cut-off range determined by using the cut-off points technique (Bahar, Johnstone, & Sutcliffe, 1999) are shown in the concept networks. For example, concepts with a cut-off point in the range 31-45 represent participant-generated response words between 31-45.

## Results

The results obtained from the research are presented with tables and figures. The frequencies of the words produced for the concepts of institution, organization, management, involvement, and active citizen are given in Table 1, and the frequency of the words produced for each key concept, taking into consideration the frequencies, is given in the word clouds.

**Table 1.** Frequencies of produced words related to key concepts

Response words	Key words				
	Institution	Organization	Management	Involvement	Active citizen
Important	2	1	3	2	1
Private	4	-	1	-	1
Family	4	1	1	-	-
Educational	5	1	-	-	-
Organization	9	-	2	-	-
Country	-	43	33	-	10
Place	9	3	7	-	-
Region	-	1	-	-	-
Established	2	6	-	-	-
Institution	-	13	4	1	-
Good	-	-	3	1	19
Leadership	1	-	23	1	-
Presidential	7	-	112	5	1
Control	-	-	1	-	-
Socialization	-	-	1	-	1
Rationale	-	-	-	1	-
Saving	-	-	-	-	2
Beauty	-	1	-	-	1
School	160	27	25	4	1
Hospital	58	16	3	-	-
Public	-	-	4	2	3

	www.icres.net	May 18-21, 2023	Cappadocia, Turkiye		www.istes.org
Election	-	2	8	6	5
Involvement	1	-	2	2	1
Vote	-	1	6	24	46
Nation	3	1	1	-	1
Republic	1	3	4	-	-
Authority	-	1	2	-	-
Principal	11	-	69	-	-
Responsibility	-	-	2	1	51
Tax	-	-	-	-	57
Patriot	-	-	-	-	10
Community	5	3	-	-	-
Justice	-	-	4	-	5
Manage	12	4	8	7	-
Right	-	-	2	1	17
Democracy	-	-	8	6	3
Rule	-	-	1	-	2
Political	1	-	1	-	-
Mindfulness	-	-	-	-	59
Helpful	-	-	-	-	35
Individual	-	1	-	4	9
State	22	16	22	2	2
Governor	10	-	34	-	-
Civil society	-	11	-	-	-
Municipality	15	-	12	-	-
Ministry of					
National	2	1	1	-	-
Education					



Figure 26. Frequency of words produced about the institution key concept

The frequency of the words produced by the students regarding the institution key concept is presented in the word cloud image above (Figure 2). The words most frequently associated with the key concept are school

(f=160), hospital (f=101), state (f=22), municipality (f=15), manage (f=12), principal (f=11) and governor (f=10).



Figure 1. Frequency of words produced about the organization key concept

The frequency of the words produced by the students regarding the key concept of organization is presented in the word cloud image above (Figure 3). The words most frequently associated with the key concept are country (f=43), school (f=27), hospital (f=16), state (f=16), institution (f=13) and civil society (f=11).



Figure 2. Frequency of words produced about the management key concept

The frequency of the words produced by the students regarding the key concept of management is presented in the word cloud image above (Figure 4). The words most frequently associated with the key concept are president (f=112), principal (f=69), governor (f=34), country (f=33), school (f=25), state (f=22), leadership (f=13) and municipality (f=12).

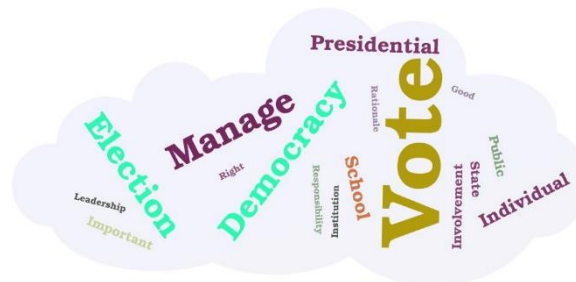


Figure 3. Frequency of words produced about the involvement key concept

The frequency of the words produced by the students regarding the key concept of participation is presented in

the word cloud image above (Figure 5). The words most frequently associated with the key concept are vote (f=39), manage (f=7), democracy (f=6), election (f=6) and presidential (f=5).



Figure 4. Frequency of words produced about the active citizen key concept

The frequency of the words produced by the students regarding the active citizen key concept is presented in the tree image above (Figure 6). The words most frequently associated with the key concept are mindfulness (f=59), tax (f=57), responsibility (f=51), helpful (f=35), vote (f=31), right (f=30), patriot (f=22), good (f=19) and country (f=10). In the analysis of KIT results, the number of common answer words given to key concepts and the order in which they are said are also important, as well as the types and frequency of the answer words given to the key concepts. It enables the analysis of semantic closeness between these keywords and transforming it into a concept network. The concept network is constructed using data from the frequency table. The concept networks prepared for the answer words given to the key concepts in the research with a frequency value above 15 are shown below.

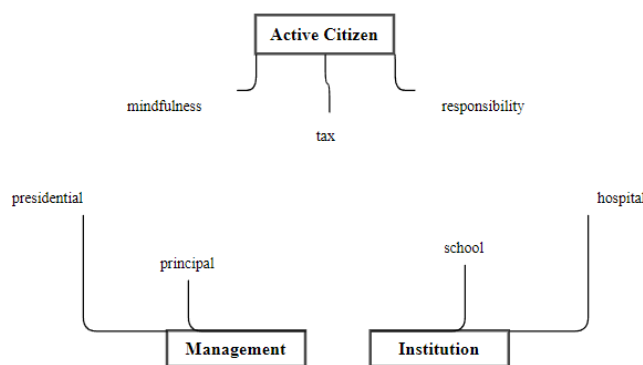


Figure 5. Concept network structured according to cut-off point 46 and above

In Figure 7, there is a concept network created according to the cut-off point 46 and above. When the figure is analyzed, it is seen that the key concept of active citizen is associated with the word's mindfulness, tax and responsibility, the key concept management with the words president and principal, and finally the key concept institution with the words school and hospital. There was no relationship between key concepts in this range.

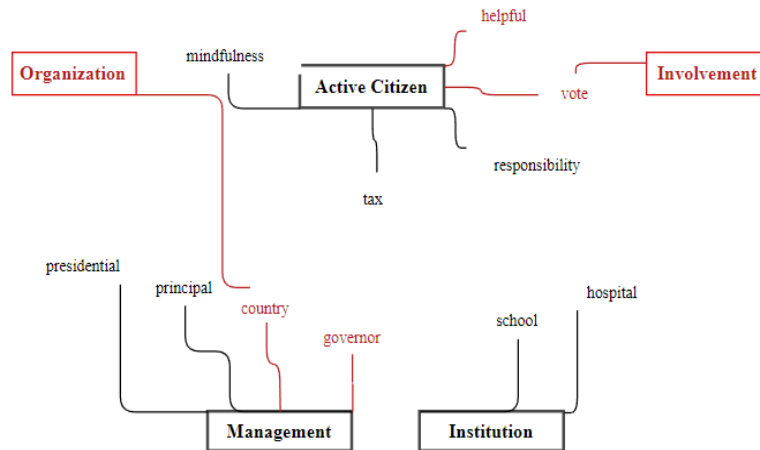


Figure 6. Concept network structured according to cut-off point 31 and 45 range

Figure 8 shows the concept network created for the breakpoint between 31 and 45. When the figure is examined, it is seen that words related to the key concept of involvement (vote) and organization (country) are produced. Relationships between key concepts started in this interval, thanks to the word vote, between the concepts of active citizen and involvement; Thanks to the word country, a relationship has been established between the key concepts of organization and management. In addition, the word helpful was produced for the concept of active citizen.

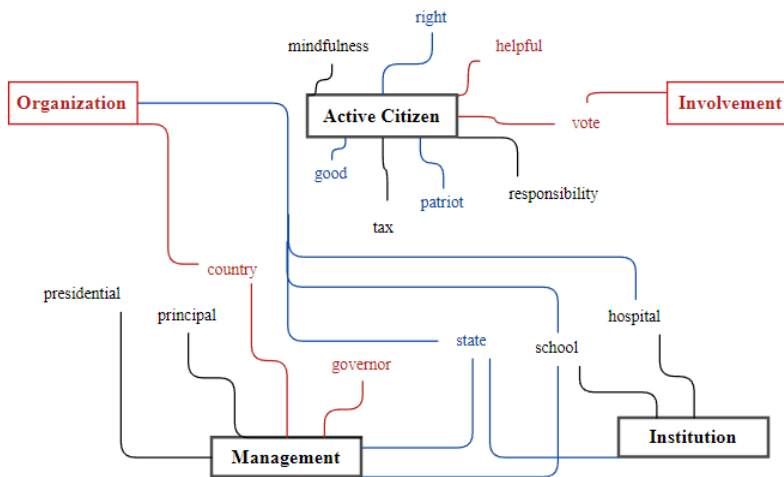


Figure 7. Concept network structured according to cut-off point 16 and 30 range

Figure 9 shows the concept network created for the breakpoint between 16 and 30. It is seen that words related to the active citizen (right, patriot, good) and management (state) key concepts are produced when the figure is observed. According to associations between the key concepts, it is clarified that there is a relationship between the concepts of organization, management and institution thanks to the word state. In addition, in this interval, the answer word school mediated the link between the key concept of institution and organization and management.

## Conclusion, Discussion and Recommendations

In this study, the cognitive structures of the students for the key concepts of institution, organization, management, involvement, active citizen in the 7th grade active citizenship learning field were studied. It has been observed that the students derive 48 different words while associating the given key concepts. The fact that the resulting words are semantically far from each other can be interpreted as different cognitive structures of the students. It is seen that the key concept of Institution is associated with words such as school, hospital, state, municipality. Considering the words associated with the concept of Institution, it is seen that each of them is state-affiliated institutions. The fact that students especially relate the concepts of institution and state enables us to confirm that they accept institutions as parts of the state. Studies in this area also confirm the discourse that the state cooperates with institutions. Ayhan (2009) claims in his study that the prerequisite for the existence of nations by becoming a state is to have institutions.

It has been seen that they associate the key concept of organization with words such as country, school, hospital, civil society. The reason why they associate the key concept of organization with the word civil society may be the similarity in the pronunciation of the words. Besides, the first thing that comes to mind when it comes to organization in society is civil society. This may be due to civil society organizations influencing people with their beneficial activities. Şahin and Akboğa (2019) supported this view with their studies. According to this study, people wanted to be a part of civil society institutions in order to be involved in democracy and be beneficial to society. The fact that the words associated with the concepts of institution and organization are the same indicates that there is conceptual confusion regarding these two key concepts.

The key concept of management is often associated with words such as president, principal, governor, country, school. Associating the key concept with the qualifications representing the managerial position of various institutions allows us to say that the concept of management is positioned correctly in the cognitive structures of students. We can also interpret that people in these positions are seen as leaders by looking at the associated words. Bulut and Bakan (2005) expressed a similar view in their studies and associated the concept of management with leadership. They stated that people who are managers should also have leadership characteristics. The keyword involvement is associated with words such as vote, manage, democracy. Considering the words associated with the concept of involvement, it can be said that this concept has a political counterpart in students' cognitive structures. In the studies in the literature, the concept of involvement has mostly been used to meet a political meaning (Eser, & Sarışahin, 2016; Gökçe, Özdemirci, & Ceylan, 2017; Gökçimen, 2008; Özdemir, 2019; Özgüşi, 2014).

Participants often associated the key concept of active citizen with words such as mindfulness, tax, responsibility, helpful, vote, right, patriot. Based on the associated words, we can interpret that the person defined as an active citizen has positive characteristics in students' cognitive structures. In addition, the concept of active citizen has been associated with words expressing some social duties. A similar situation is also valid

in the studies in the literature. In the study of Kara, Topkaya and Şimşek (2012), students defined active citizens as citizens who know their rights and responsibilities. In the study conducted by Aydın and Çelik (2017), the students emphasized that the person defined as an active citizen should be beneficial to the society. Dere and Akdeniz (2021) stated in their study that a person who is defined as an active citizen should be helpful, patriotic and responsible. In their study, Eryılmaz, Bursa, and Ersoy (2018) stated that with the concept of active citizen, participatory, conscious, using their rights correctly and responsible people should come to mind.

While the key concepts of organization, management, institution are related through the answer words state, school; There is no common relationship including the concept of active citizen and involvement. The fact that the relationship between concepts belonging to the same learning unit is limited, based on common words, can be interpreted as the fact that the students cannot make enough connections between these concepts and therefore cannot make enough sense of them. The fact that the words associated with some concepts cannot meet the meaning in the literature shows that there is conceptual confusion in students.

In the findings, while the frequencies of the concepts of organization, management and active citizen are high, institution and involvement is striking that the frequencies of concepts are significantly low. This shows that while some of the concepts have equivalents in students' cognitive structures, their knowledge of some of them is limited. The gap in the cognitive structures of the students for these concepts may have been caused by the lack of learning or the forgetting of some information by the students. Learning is a process in which knowledge and skills are acquired for the student. In this process, the active participation of the student in the process should be ensured by the instructor in order to ensure permanent learning (Ünal, 1999). On the other hand, the parallelism of the words that students associate with key concepts with titles such as rights, responsibilities, benevolence, citizenship in the 5th, 6th, and 7th grade social studies textbooks shows that students achieve a certain level of success towards the goals of this learning unit.

- ✓ Studies can be carried out to identify and eliminate misconceptions about the learning field.
- ✓ By identifying the key concepts that students have the most difficulty in producing words, interdisciplinary studies can be carried out to teach these concepts.
- ✓ By organizing trips to various institutions and organizations, which are among the key concepts, it can be ensured that students gain concrete experiences regarding these concepts.

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## An Impression that Lasts: Assessing the Impact of a Co-Curricular Service-Learning in Chemistry

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**Abstract:** Co-curricular service-learning has increasingly attracted participants from students as it can enrich their experience of learning chemistry, among others. An example is *Kimikamahika*, wherein chemistry students from a Catholic university in the Philippines volunteer in public schools, orphanages, daycare centers, and local organizations to promote interest in chemistry among children by demonstrating eye-catching experiments. However, studies are few on the lasting impression of co-curricular service-learning among students compared to their peers without such community engagement. Hence, this mixed-methods study assessed the long-lasting impact of *Kimikamahika* on its past volunteers vis-a-vis their peers not part of this service-learning in terms of gains in course-related skills, real-world application, career opportunities, leadership skills, and community engagement. A one-tailed Mann-Whitney U Test ( $\alpha = 0.05$ ) of the survey responses revealed significantly higher ratings given by 54 volunteers of *Kimikamahika* in the acquisition of course-related skills ( $p = 0.033$ ), application of classroom learning to real-world situations ( $p = 0.045$ ), and participation in community engagement ( $p = 0.013$ ) against the ratings of 24 peers not involved in this service-learning. A thematic analysis of interviews with thirteen past *Kimikamahika* volunteers further showed the lasting impression of a co-curricular service-learning on their academic, personal, professional, and civic life.

**Keywords:** Service learning, Co-curriculum, Chemistry education, Higher education, Impact assessment

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## Introduction

Many higher education institutions have undergone curricular reforms to respond to the demands of equipping undergraduate students for a life beyond their degrees (Sewry & Paphitis, 2018). They recognize their unique responsibility to prepare undergraduates not only with the essential knowledge related to their discipline, but also with the much-needed “skills and dispositions to be active citizens through both their personal and professional lives” (Richard et al., 2016, p. 60). For instance, students taking an undergraduate degree in chemistry, as Sewry and Paphitis (2018) point out, “need to be educated not only in the theory and practice of chemistry, but also equipped with critical skills to navigate society and the employment market” (p. 973).

However, most undergraduate students in the field of science, technology, engineering, and mathematics (STEM), such as chemistry, have been heavily trained for specialization, disciplinary knowledge, and research (Najmr et al., 2018). Their opportunities for community engagement have been limited. As a result, they are often far removed from issues that matter in society (McGowin & Teed, 2019).

A well-established academic practice in providing undergraduate students with powerful learning experiences that can transform communities is service-learning (Cooper, 2002). Bringle, Hatcher, and Hahn (2017) define service-learning as:

a course or competency-based, credit-bearing educational experience in which students (a) participate in mutually identified service activities that benefit the community, and (b) reflect on the service activity in such a way as to gain further understanding of course content, a broader appreciation of the discipline, and an enhanced sense of personal values and civic responsibility (p. 10).

This widely used definition particularly refers to curricular service-learning, which has been commonly associated with improved cognitive goals and course-related skills, enhanced interpersonal and leadership skills, increased community engagement, better career opportunities, improved self-esteem, self-efficacy, and self-confidence, and increased ability in applying course content to real-world situations (Esson, Stevens-Truss, & Thomas, 2005). For undergraduates in chemistry, curricular service-learning has allowed them to learn about society beyond the laboratory (Sewry & Paphitis, 2018). They have also come to understand how their chosen profession would fit society (McGowin & Teed, 2019).

Notably, service-learning can take place as well in co-curricular settings (Judge et al., 2011). This form of experiential learning can exist without being based on a course subject that students would earn credits for (Griswold, 2013). Co-curricular service-learning applies to community engagements wherein students participate voluntarily outside their normal class (Bartkus et al., 2012; Farokhi et al., 2022). This community engagement seeks to enrich the students’ prescribed curriculum (Bartkus et al., 2012). An example of co-curricular service-learning is community engagement by a campus organization (Judge et al., 2011). Although not formally part of the students’ curriculum, co-curricular service-learning still incorporates the necessary

elements to be considered service-learning in its broadest sense (Cooper, 2002; Griswold, 2013).

However, most empirical evidence on the impact of service-learning among students is curricular in nature (Griswold, 2013; Richard et al., 2016). “The potential contribution of co-curricular service-learning to develop engaged citizens,” as Keen and Hall (2009) emphasize, “is relatively unexplored” (p. 59). There are also a few studies that have assessed the enduring influence of co-curricular service-learning on graduates, who participated in this form of community engagement while they were in college (Keen & Hall, 2009; Richard et al., 2016).

Hence, this study aims to assess the long-lasting impact of co-curricular service-learning through a longitudinal follow-up. Specifically, it seeks to determine if ratings on course-related skills, real-world application, career opportunities, leadership skills, and community engagement are significantly higher among past volunteers of a co-curricular service-learning in chemistry compared to their peers not part of such undertaking. It also intends to examine closely the lasting impression of a co-curricular service-learning in chemistry on past volunteers in terms of the various areas stated above. This assessment of a co-curricular service-learning in chemistry can help higher education institutions, faculty, and campus organizations in identifying strengths and areas for improvement, which can contribute to their program planning so that service-learning will remain faithful to its purpose.

## Method

In assessing the long-lasting impact of a co-curricular service-learning in chemistry, this study carried out a mixed-methods research design to gather a more comprehensive understanding from both quantitative and qualitative datasets (Leavy, 2023). Specifically, it employed an explanatory-sequential approach to follow up the quantitative results with qualitative data (Edmonds & Kennedy, 2017). This explanatory-sequential approach seeks to contextualize the quantitative results from a survey using qualitative findings from interviews (Leavy, 2023).

## Setting and Participants

This mixed-methods study was set in a Catholic university in one of the highly urbanized cities in the Philippines. The Catholic university in this study seeks to form its undergraduates into leaders, who can contribute to nation-building, through the education of the whole person. Its liberal arts curriculum aims to prepare its graduates not only for excellence in their chosen professions, but also for a life of service to their community as professionals-for-and-with-others.

One of the co-curricular service-learning for undergraduate students in this Catholic university is *Kimikamahika*. Depicted as a magic show in chemistry, *Kimikamahika* strives to draw interest in chemistry within and outside

the university through eye-catching experiments performed by student volunteers from a campus organization. Instituted in 2004, *Kimikamahika* aims to address underachievement in science in the country by promoting a better appreciation of chemistry as a field that children can take part in. This co-curricular service-learning has since engaged with public schools, orphanages, daycare centers, and local organizations by showing chemistry and science as fun and simply a “magic show” to enjoy by children.

After securing ethics clearance from an accredited institutional review board, this mixed-methods study recruited participants from the list of undergraduate students and graduates belonging to the campus organization responsible for *Kimikamahika* from 2004 to 2021. For the quantitative phase, an email notification was sent to them to provide details about the study and to seek their participation in a survey. Survey respondents, who took part in *Kimikamahika*, were assigned to the volunteer group, while those who have never been involved in this co-curricular service-learning while they were in college were placed in the comparison group. For the qualitative phase, this study invited past volunteers of *Kimikamahika* for an interview until data saturation was reached or, as Saunders et al. (2018) describe, when no new data emerged.

### Data Gathering

An online survey was conducted using Google Forms for its ease of collecting data as it is not bound by time and location (Levefer, Dal, & Matthíasdóttir, 2007). The survey questionnaire contained items asking for the respondents’ demographic information, such as their age, gender, and employment. It also included an instrument that was adopted from Gelmon et al. (2001) and Esson et al. (2005) to measure course-related skills (e.g., *I become more knowledgeable about chemistry*), real-world application (e.g., *I can identify the chemistry behind real-world situations*), career opportunities (e.g., *The organization assisted me in clarifying my career plans*), leadership skills (e.g., *Participation in the organization helped me enhance my leadership skills*), and community engagement (e.g., *I have a responsibility to serve my community*). Each area in the instrument consisted of five items. Survey respondents were requested to rate the truthfulness and applicability of each item to them on a Likert scale of 1 (i.e., *strongly disagree*) to 7 (i.e., *strongly agree*). The developed instrument exhibited high reliability (i.e., overall  $\alpha = 0.93$ , course-related skills  $\alpha = 0.85$ , real-world application  $\alpha = 0.72$ , career opportunities  $\alpha = 0.73$ , leadership skills  $\alpha = 0.85$ , and community engagement  $\alpha = 0.85$ ) and is deemed suitable for the purposes of this study.

The semi-structured interviews of past volunteers of *Kimikamahika* were carried out through Google Meet as videoconferencing platform. Interviewing using videoconferencing offers the same features as in-person interviews aside from the flexibility and convenience it affords (Irani, 2019). To gain a better understanding of the lasting impression of *Kimikamahika* as a co-curricular service-learning in chemistry, some of the questions asked to start the interview are the following:

- 1) Can you describe your experience in *Kimikamahika*?
- 2) What did you learn through this experience?
- 3) Have you done anything differently as a result of your experience?

- 4) Has *Kimikamahika* created any new opportunities for you?
- 5) What did you find most challenging and rewarding? Why?

When needed, the past volunteers were probed to elaborate on their responses. The interviews were video-recorded for documentation purposes. Each video-recording was transcribed verbatim. Before data analysis, the verbatim transcripts were anonymized and each interviewed participant was assigned a pseudonym.

### Data Analysis

Mean and standard deviation were utilized as descriptive statistics for continuous data, while frequency and percentage distribution were used for nominal data. Chi-square tests were performed to determine if there are significant differences in the characteristics of the volunteer and comparison groups. To determine if the ratings on course-related skills, real-world application, career opportunities, leadership skills, and community engagement among the volunteer group are significantly higher than the comparison group, one-tailed Mann-Whitney U Tests were carried out at a 95% confidence interval and 0.05 level of significance. Non-parametric statistics were employed since assumptions for normality and homogeneity of variance were not met.

Thematic analysis was carried out to make sense of the qualitative data gathered from the interviews. It involved familiarization with the data by reading the transcripts several times and writing down analytical memos when insights would occur. Codes were then assigned to selected words or phrases from the transcripts to describe the likely meanings they represented. Predetermined or a priori codes based on the study of Esson et al. (2005) were applied along with spontaneous or in vivo codes. Related codes were thereafter categorized together. Finally, patterns were looked for among the identified categories to come up with emerging themes (Bergin, 2018; Creswell & Poth, 2018; Yin, 2016).

Several steps, as suggested by Stahl and King (2020), were taken to ensure the trustworthiness of this study's findings. First, this study provided a detailed account of the research process to facilitate an audit trail. Second, data triangulation was done by following up the survey with interviews to strengthen the credibility of the findings. Third, the identified themes were reviewed against the verbatim transcripts. Fourth, reported themes were supported by relevant quotes from study participants. Lastly, the initial findings of this study were presented to a panel of experts as part of peer debriefing.

### Results

A total of 78 respondents participated in the survey. 54 of them were past volunteers of *Kimihama* and 24 were not involved in this co-curricular service learning while they were in college. Table 1 shows their distribution by age, gender, and employment. Chi-square tests at a 0.05 level of significance revealed there were no significant differences in the distribution of the volunteer and comparison groups by age ( $\chi^2 = 1.56$ ,  $df = 2$ ,  $p = 0.458$ ), gender, ( $\chi^2 = 0.01$ ,  $df = 1$ ,  $p = 0.939$ ), and employment ( $\chi^2 = 5.99$ ,  $df = 4$ ,  $p = 0.200$ ). These results demonstrated that the volunteer and comparison groups were relatively similar based on their age, gender, and

employment.

Table 1. Characteristics of the Study Population

<i>Characteristics</i>	<i>Volunteer Group</i>	<i>Comparison Group</i>
<i>Age</i>		
Under 25 years old	11 (20.37%)	8 (33.33%)
25 to 34 years old	36 (66.67%)	13 (54.17%)
35 to 44 years old	7 (12.96%)	3 (12.50%)
<i>Gender</i>		
Female	23 (42.59%)	10 (41.67%)
Male	31 (57.41%)	14 (58.33%)
<i>Employment</i>		
Undergraduate Student	6 (11.11%)	3 (12.50%)
Graduate Student	4 (7.41%)	6 (25.00%)
Employed	40 (74.07%)	12 (50.00%)
Self-Employed	4 (7.41%)	2 (8.33%)
Not Employed	1 (1.85%)	1 (4.17%)

The mean average ratings for course-related skills, real-world application, career opportunities, leadership skills, and community engagement between the volunteer and comparison groups are shown in Table 2. One-tailed Mann-Whitney U Tests revealed participants from the volunteer group significantly rated themselves higher than the comparison group for course-related skills ( $p = 0.033$ ), real-world application ( $p = 0.045$ ), and community engagement ( $p = 0.013$ ). However, the effect sizes or the magnitude of their differences in these areas were relatively small (less than 0.50).

Table 2. Mean Average Scores on Five Areas between the Volunteer and Comparison Groups

<i>Areas</i>	<i>Volunteer Group</i>	<i>Comparison Group</i>	<i>p value</i>	<i>Effect Size</i>
Course-related skills	4.96 ± 0.94	4.57 ± 1.12	0.033	0.26
Real-world application	5.80 ± 0.72	5.38 ± 0.99	0.045	0.24
Career opportunities	4.19 ± 1.15	4.62 ± 1.29	0.904	0.18
Leadership skills	5.40 ± 0.90	5.10 ± 1.47	0.296	0.08
Community engagement	6.03 ± 0.76	5.42 ± 1.20	0.013	0.32

Thirteen past volunteers of *Kimikamahika* underwent semi-structured interviews. Three (23.08%) were under 25 years of age, nine (69.23%) were 25 to 34 years of age, and one (7.69%) was 35 to 44 years of age. Three (23.08%) were females, whereas ten (76.92%) were males. Two (15.38%) were undergraduate students in their senior year, ten (76.92%) were currently employed, and one (7.69%) was self-employed.



Five themes emerged from the responses of the interviewed participants about the long-lasting impact of *Kimikamahika* on them. Specifically, the past volunteers felt this co-curricular service-learning gave them opportunities to develop course-related skills, appreciate real-world application of chemistry, and deepen their community engagement. They also brought up how *Kimikamahika* helped them strengthen their leadership skills and recognize career opportunities despite survey results showing no significant differences in comparison to their peers not involved in this co-curricular service-learning.

First, their experiences in *Kimikamahika*, according to the interviewed participants, helped them to acquire further the necessary skills for their chemistry-related course subjects. For example, Participant 4 considered their involvement in this co-curricular service-learning allowed them “to deepen their knowledge about chemistry.” Participants 1, 3, and 4, among others, were also challenged to apply the concepts in their chemistry-related course subjects so that they can better communicate the science behind the magical experiments. That is why Participant 1 recognized that they should not “just show the experiments,” but they should “discuss them as well.” Moreover, they, as Participant 4 emphasized, “must communicate the science in simpler terms for the children to understand them.” The experiments demonstrated in *Kimikamahika*, as stated by Participants 1 and 4, should also be “entertaining” and “engaging” for the children. As the experiments should have a “wow factor,” many of the interviewed participants narrated how this co-curricular service-learning contributed to their development of course-related skills, such as the skills needed for better science communication.

Second, this co-curricular service-learning provided the interviewed participants with opportunities for real-world application of their learning in the classroom. Participant 6, for instance, was able to use “what [they] know and what [they were] learning for the sake of others” because of *Kimikamahika*. Most of the interviewed participants, such as Participants 8 and 9, also found *Kimikamahika* as an “avenue” for them to apply chemistry to the “outside world.”

Third, their involvement in *Kimikamahika* helped the interviewed participants to deepen their community engagement. In fact, all interviewed participants pointed out how community engagement is the “biggest impact” of this co-curricular service-learning on them. They, including Participant 4, considered their efforts in *Kimikamahika* have in one way or another contributed to a better appreciation of chemistry and science among less privileged children. Participant 1 also looked back on how *Kimikamahika* became a starting point for them to build lasting relationships with those in their service-learning community considering that they would still communicate with them even after they graduated from college. Because of these instances, Participant 9 and others felt “a sense of fulfillment that [they] did their best in reaching out to people... [and that they] did something to change other people’s lives.”

Fourth, taking part in *Kimikamahika* as a co-curricular service-learning allowed the interviewed participants to strengthen “invaluable soft skills,” such as leadership skills. Since they must prepare before their demonstration of experiments to children in public schools, orphanages, daycare centers, or local organizations, Participants 1,

2, 5, and 7 learned the importance of communication and collaboration in planning projects. Until now, Participant 13 and others would tap on the leadership skills that they learned from *Kimikamahika* in “dealing with different personalities, managing timelines, and setting expectations” in their workplace. Furthermore, they, according to Participants 10 and 12, were prepared by this co-curricular service-learning on how to lead in “high-pressure situations” because of the “work ethics” that they picked up.

Finally, *Kimikamahika* exposed the interviewed participants to career opportunities. Their involvement in this co-curricular service-learning helped many of them to pursue careers based on their “talents” and “capabilities.” For Participants 3 and 9, *Kimikamahika* made them realize career opportunities aside from the industry. Specifically, this co-curricular service-learning influenced them to take on a career in teaching as they found joy in demonstrating experiments to children and explaining the science behind them.

## Discussion

Mounting evidence has shown that curricular service-learning is a high-impact educational practice that can prepare students for a life beyond their degrees (Faulconer & Kam, 2023; Kilgo, Ezell Sheets, & Pascarella, 2015). Also, research on curricular service-learning has documented its usefulness among students of chemistry (Esson et al., 2005; Faulconer & Kam, 2023; Sewry & Paphitis, 2018). However, literature is scarce on the impact of co-curricular service-learning. Studies are also few on its long-lasting influence among students involved in this type of service-learning, particularly in chemistry.

This mixed-methods study aims to fill this gap in knowledge by assessing the lasting impact of co-curricular service-learning through a longitudinal follow-up. Survey results showed past volunteers of *Kimikamahika* rated themselves higher in course-related skills, real-world application, and community engagement compared to their peers not involved in such co-curricular service-learning. These results were supported by a thematic analysis of interviews with thirteen past volunteers of *Kimikamahika*. Survey results also revealed that past volunteers and their peers did not differ in leadership skills and career opportunities. However, findings from the interviews of past volunteers identified leadership skills and career opportunities as emerging themes on the likely impact of co-curricular service-learning on them. There is a discrepancy probably because their peers could have acquired these two outcomes from other co-curricular activities of the campus organization. Furthermore, not all past volunteers took on leadership roles during their involvement in *Kimikamahika*.

Research on curricular service-learning has demonstrated the acquisition of course-related skills among chemistry students involved in such community engagement (Esson et al., 2005; Faulconer & Kam, 2023). This study offered a new perspective that course-related skills can likewise be developed in co-curricular service-learning even if it is not associated with a credit-bearing course subject. An explanation for this observation is that past volunteers of *Kimikamahika* drew from their learning in chemistry-related course subjects to come up with entertaining demonstrations of experiments. Similar to the study of Najmr et al. (2018) wherein curricular

service-learning in chemistry can offer opportunities among undergraduate students to practice science communication, this study suggests that skills necessary for science communication can likewise be fostered in co-curricular service-learning since past volunteers of *Kimikamahika* must explain to the children the science behind the “magic” in simpler terms and an understandable manner.

Based on its definition, service-learning entails applying course content in addressing the articulated needs of the community (Bringle et al., 2017). It involves rendering community service, such as the educational shows of *Kimikamahika*, as part of solving real-world problems like underachievement in science in the country. This study showed that real-world application is possible too in co-curricular service-learning as past volunteers of *Kimikamahika* used eye-catching experiments in chemistry to encourage interest in science among children in the hope of alleviating their underperformance in science.

Numerous studies have revealed the civic outcomes that come along with curricular service-learning (Kilgo et al., 2015). A growing number of studies have also documented civic identity, social responsibility, and commitment to community service, among others, as the effects of a curricular service-learning done for a chemistry class (Esson et al., 2005; McGowin & Teed, 2019). In this study, past volunteers of *Kimikamahika* expressed how their involvement in this co-curricular service-learning has largely influenced their community engagement. They learned to relate with those in the community and build lasting relationships.

The development of leadership skills is another outcome of curricular service-learning that has been demonstrated in literature (Cress et al., 2010; Esson et al., 2005; Wurr & Hamilton, 2012). Noticeably, leadership positions in campus organizations can provide formative experiences for students to learn how to lead (Wurr & Hamilton, 2012). In this study, past volunteers of *Kimikamahika* occupying leadership roles benefited most from their involvement in this co-curricular service-learning. They recalled how the leadership skills they learned in *Kimikamahika* have become handy in their workplace.

Lastly, research has shown career development as an outcome of curricular service-learning (Bowen, 2007; Esson et al., 2005). Experiences in curricular service-learning that are concretely aligned with their chosen discipline can aid students make informed decisions about their careers (Bowen, 2007). Most importantly, these experiences of community engagement can influence students to choose careers inclined toward civic commitment (Mitchell & Rost-Banik, 2019). This study documented how past volunteers of *Kimikamahika* realized there are career opportunities for them aside from working in the industry. Several of them, for example, became involved in science education.

## **Limitations and Future Directions for Research**

This mixed-methods study encountered several limitations, which can affect how its findings can be generalizable. First, there is selection bias given that purposive sampling was used in recruiting study

participants. Future studies should employ probability sampling and consider multiple settings to address this bias. Second, the study participants could have given socially desirable responses when answering the survey and responding to the interviews. Later studies should ensure anonymity and data confidentiality during the informed consent process to minimize socially desirable responses. Third, recall bias is likely as study participants were asked to recollect their experiences of co-curricular service-learning while they were in college and relate them to their current circumstances. Future research should consider carrying out prospective studies to manage recall bias. Fourth, baseline data on course-related skills, real-world application, career opportunities, leadership skills, and community engagement are not available. Some of the study participants might have scored higher in these areas at the onset. This constraint can be addressed in future research by conducting prospective studies to measure baseline information so that a better understanding of the lasting influence of co-curricular service-learning can be arrived at. Lastly, other factors may have contributed to the long-lasting impact of co-curricular service-learning among study participants. The Catholic university in this study, for instance, has a strong tradition of community service, which can inspire its students to be oriented toward community engagement. Further research is warranted to explore how other factors interplay.

## Conclusion

Despite not being tied to a credit-bearing course subject, co-curricular service-learning can offer the same benefits as curricular service-learning. The impact of co-curricular service-learning among students, as shown in this study, includes far-reaching effects on areas, such as their course-related skills, real-world application, and community engagement. Co-curricular service-learning can also bring about leadership skills when students are given the occasions to lead in their campus organizations. Furthermore, it can provide them with career opportunities particularly when community engagement is asked for. In sum, co-curricular service-learning can leave an impression that lasts on a student's academic, personal, professional, and civic life. It does so by complementing and enriching the curriculum of students, such as those in chemistry.

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## From Ancient Gymnastics to Online Fitness Training – Evolution and Perspectives in Physical Training

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**Abstract:** All the Olympic Movement activities have been set to promote sport, culture and education, drawing inspiration from the physical training practiced by the ancient civilizations in the **Middle East and Asia. From the very first evidence of men's interest in training the body through disciplined exercises, 7000 years ago, the spread of sport was meant to cultivate** the joy found in effort, the educational value of good example and respect for universal fundamental ethical principles. The present study analyzes the alternatives offered by sports trainers and fitness coaches, highlighting the positive, long-term aspects, as well as the evolutionary and revolutionary steps taken towards the diversification of physical training programs in accordance to a large variety of the public. If ancient gymnastics involved only athletes, we currently observe a tendency to identify the movement needs of people according to age, ailments, the body's ability to withstand effort, etc. The modern trend is to design and customize training according to one's needs, and online training programs are well suited to successfully accomplish this mission. Therefore, we are going to prove the importance of online fitness apps for the continuing education of mind and body together with the perpetuating of Olympic education principles.

**Keywords:** Olympism, Motivation, Exercise, Fitness, Adulthood.

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### Introduction

All the activities of the Olympic Movement have been aimed at promoting sport, culture and education to build a better world, taking their starting point and inspiration from the physical training practiced by ancient civilizations in the Middle East and Asia.

Since the earliest evidence of man's interest in training the body through disciplined exercise 7000 years ago, the spread of sport has been designed to cultivate the satisfaction found in effort, the educational value of good

example and respect for universal fundamental ethical principles, but never, until the coronavirus pandemic, did people feel so keenly the importance of movement and sport.

This study reviews the alternatives offered by sports coaches in general and fitness trainers in particular during the period of isolation and highlights the positive, long-term aspects as well as the evolutionary and revolutionary steps made towards diversifying physical activity training programs according to a wide variety of audiences. The modern trend is to design and customize training according to personal needs, and online training programs are well suited to successfully accomplish this mission. Therefore, we propose to demonstrate the importance of Olympism in the formation of motivations and physical culture of personality through traditional and online fitness applications aimed at continuous training of mental and psychomotor sphere of women and men of early adulthood in the conditions of modern society (Shephard, 2018).

According to several scholars (Sion, 2003; Schioppa & Verza, 1997; Trofaia, 2007), the first period of adulthood is a whole string of maximum achievements of the human personality. This period of age (35-45 years) represents the period of highest productivity in work, because high yields are achieved with minimum energy consumption. This is because the stabilisation, harmonisation and psychological (of interests, skills, abilities, and the character traits involved in the work process) and social (of ways of interacting with others), which began in youth, take on a stable form in mature people (Schioppa & Verza, 1997). The main specific features of this age period are: professional activity - engagement in productive, valued and socially useful work; family relations - care for one's own children, extension of responsibilities for family life and concern for other members of society. Often at this age there is further training, retraining, a university degree or doctorate, etc. Social statuses and roles start to become more loaded with responsibilities (Mocanu et al., 2020; Sion, 2003; Verza, 2000).

Thus, the stabilization, harmonization and psychological (interests, skills, abilities, character traits implicit in the work process) and social (ways of interrelationship), begun in youth, take their stable forms in the mature man. In addition to these characteristics of psycho- and socio-behavioural normality, i.e. characteristics that individualise the maturity of the human personality, its psychophysical and psychosocial health and psychomotor training are a particularly important aspect of an integral and active personality, capable of successfully resolving the multiple objectives of everyday life.

## **Results and Discussion**

Taking into account that the main factor contributing to the formation and maintenance of a higher level of psychophysical health, psychosocial adaptation and psychomotor training of the personality is physical exercise, we carried out a questionnaire on a sample of 202 women and 202 men aged 35-45 years. The purpose of conducting this questionnaire was to determine the importance and preferred forms of organising motor activities in the practice of daily life.



To the question "Do you know the importance and role of regular exercise on the human body?", the answers given by the respondents were evenly distributed among both women and men:

- 98% of respondents confirmed the value and role of exercise in maintaining the level of psychophysical health and psychomotor fitness needed for activities of daily living;
- and only 2% (4 people) mentioned "relatively" to this phenomenon.

At the same time, for the response variants that we proposed, i.e. these values of purposeful motor activity are of greatest importance for this age group of both male and female respondents, the responses were distributed in the following order (see Figure 1).

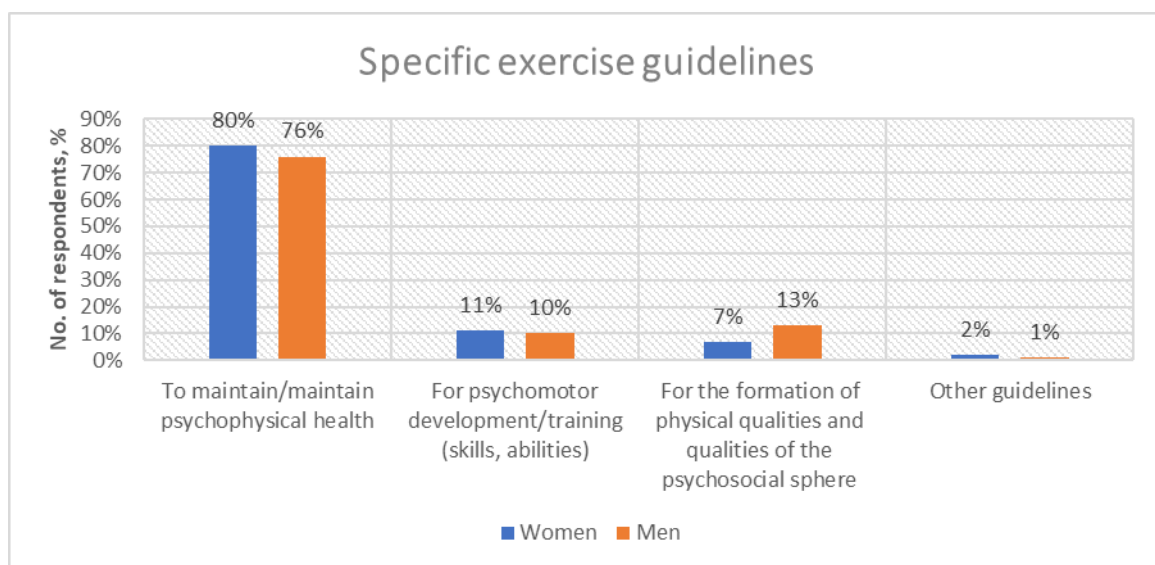


Figure 1. Respondents' views on the importance and role of systematic exercise on the body

The majority of respondents believe that exercise helps to increase, strengthen and maintain their psychophysical health (80% women and 76% men). Given the specificity of their bodies and psychology, the index is higher in women and this can be explained by the fact that women are more attentive to any changes, restructurings that occur in the process of maturity. While men consider health as a constant state of well-being and pay attention to it in problematic situations. Compared to women, men have a lower level of psychological personality anxiety.

Equally important for women and men, but much less so than in the previous indices, is the factor of "psychomotor training" in terms of the formation of motor skills and abilities. Note here the close homogeneity of the statistical indices for women and men (11% and 10% respectively). Such a low evaluation of this factor can be explained by the fact that, in general physical education practice, the knowledge aspects of motor skills and skills training are not adequately reflected and it is believed that once exercises are performed, they are formed in the same context through repeated practice.

At the same time, we can note the relatively low indicators of the factor of physical and psycho-social qualities (women 7%, men 13%), which can be explained from the point of view of this age group, where the main value orientation is to maintain the acquired physical condition. The higher rate of this factor in men (13%, almost 2 times) than in women can be explained by the following:

- the specific nature of male professions which place certain demands on the manifestation of personal psychophysical qualities (strength, stamina, speed, etc.);
- the specificity of strength training exercises, which are preferable for men in terms of building body culture.

Thus, we can note the heterogeneous distribution of respondents' opinions on the importance of equivalent factors due to a low level of information (knowledge) in the main categories of physical education. In this context, the determination of sources related to obtaining such information and knowledge is of particular interest.

In the context of classifying the sources of information that determined the importance of exercise for respondents, we proposed some response variants, which as a result were distributed differently between women and men in the following order (see Figure 2):

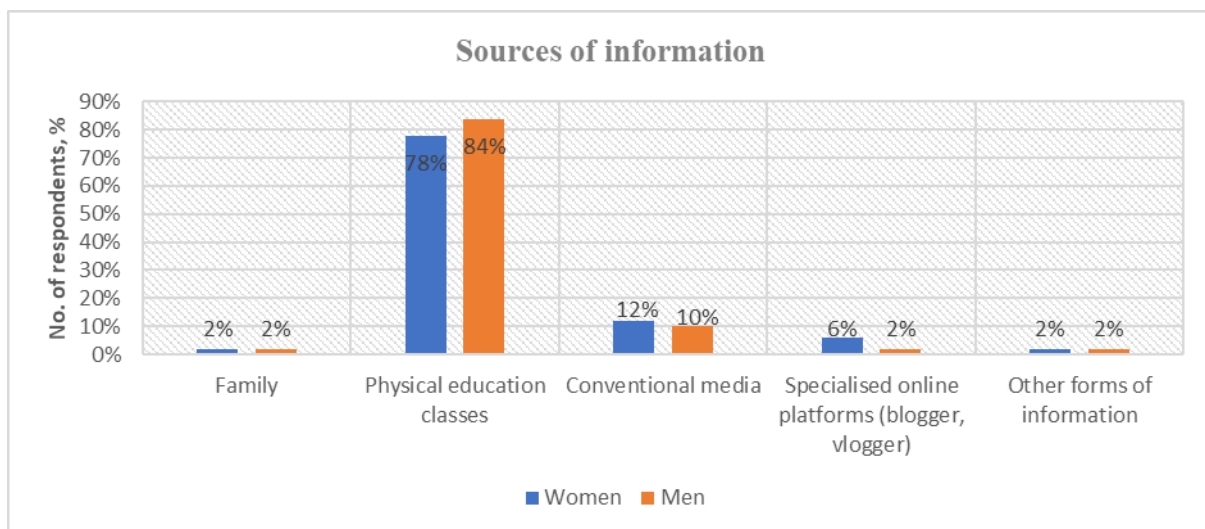


Figure 2. Sample responses on identifying sources of information that determined the importance of exercise

From what is illustrated in Figure 2, we observe that the basic and main source of determining the importance of physical exercise in a person's daily life for both groups of respondents is previous experience related to the educational content of the school subject "Physical Education" (females - 78%, males - 84%). A certain predominance of this factor in males can be explained by the fact that this subject is of greater interest to male schoolchildren at all stages of education.

In second place in terms of the importance of factors, we note "Media", which are roughly equally distributed between women and men - 12% and 10% respectively. This can be explained by the fact that in recent years the

media has paid more and more attention to educational programmes on the use of physical exercise with a focus on health and recreation.

The same unequivocal distribution can also be stated for the insignificant factors "Family" (2% each for both groups) and "Other forms of information" (2% each for both groups). The low indicator of the factor "Family", we believe, is due to the fact that the family relies almost entirely on school and does not pay enough attention to this sphere of education.

At the same time, the 2% indicator in the "Other sources of information" factor allows us to see that a fairly small number of people are looking for additional sources of information other than traditional ones. And as they see it, more rational and efficient.

Of particular interest, in terms of its non-homogeneous indicators, is the factor "Specialized online platforms" (6% of women and only 2% of men). Such a difference, we believe, can be explained by the fact that women are more attracted by the external attributes that accompany the process of exercise sessions (design, equipment, composition of participants, forms of rhythmic accompaniment, etc.).

At the same time, to the question "What are the major events and mainstream sports forums that support the attraction, value and motivation to exercise as part of a modern lifestyle?", the statistics of the female and male groups were almost evenly distributed across all response options in the proposed questionnaire (see Figure 3).

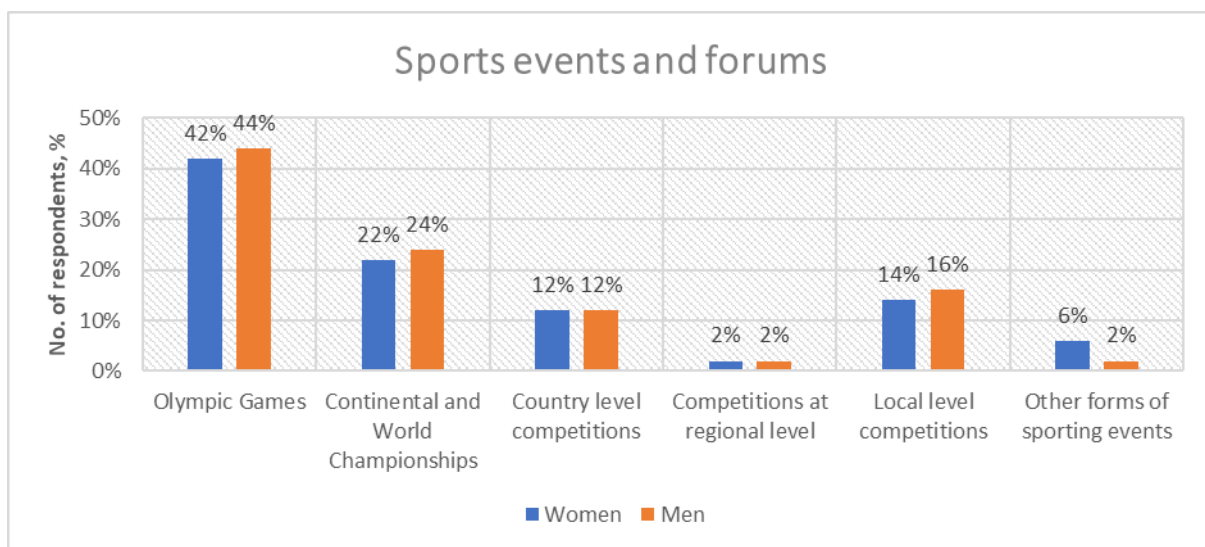


Figure 3. Respondents' answers on the source of motivation for exercising as a component of the modern way of life

The predominant majority of respondents (42% women and 44% men) mentioned the Olympic Games as the main factor supporting their motivation to practice general motor exercises and sports events through the cultural attractiveness of world events.

Also with relatively lower statistics are "Continental and World Championships" (22% women and 24% men)

and "Country Competitions" (12% each for women and men). The given statistics, in our opinion, can be explained by the fact that for this level of competitions programmes with a certain narrow diapason of sport specializations are characteristic, which limits the interest of the general public by the complex level of perception of professional procedures in competitions.

This opinion can also be confirmed by the statistical data resulting from the relatively high values for the impact of the factor "Local competitions" (14% for women and 16% for men), as this level of competitions is of particular interest given their involvement and the possibility of their direct participation in these events.

The low rating we mention in the factor "Competitions at regional level", which can be explained by their specialized character, unrated sports performances and their poor presentation in the media.

Thus, mass sports events, which are a main component of the Olympic Movement, are factors that update and stimulate the motivation to value and practice motor activities as an integral part of the active personality.

The majority of respondents, including 74% of women and 64% of men surveyed, say that specific exercise is an integral part of their daily regimen. In their opinion, for purposeful exercise, depending on the form of organisation and content of the sessions, 20 to 60 minutes are offered.

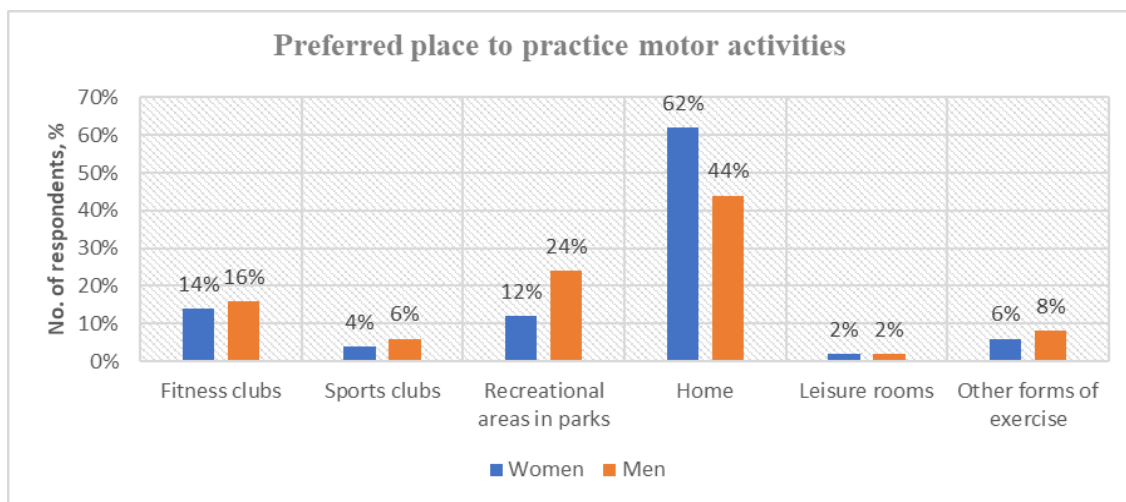


Figure 4. Respondents' answers on their preferred place to practice motor activity

According to the statistics of this survey (see Figure 4), home conditions are the most preferred form of organising physical exercise for both groups of respondents, where this index is much higher for women than for men (62% and 44%, respectively). This is explained by the fact that the very content of the sessions is a traditional complex of hygienic and maintenance gymnastics, which are performed at a convenient time and do not require special conditions and additional time for their execution. Also, a higher rate in women can be explained by the fact that women at this age prefer constancy of conditions, comfort, in any kind of activity. While men prefer variable conditions and exercises associated with large movements in space - running in the

background, overcoming various obstacles, etc., this may explain their higher indicator of the form of organisation "Leisure area in parks" (24% compared to 12% indicator in women).

It should be mentioned that in recent years, professionally organised sessions in fitness clubs have become increasingly popular among both men and women and are one of the main forms of exercise with various formative and developmental orientations, which is confirmed by the survey indicators, where such a form of motor activity is in third place, is used equally by women and men (14% and 16% respectively). Also noteworthy are independent, amateur forms of organised motor activity, significant in terms of their indicators (6% women and 8% men), which points to the need to study this experience in order to introduce it massively into the practice of physical culture for the adult population.

The results of the statistical data analysis of the questionnaire survey allow us to judge that among the different forms of exercise practice, the most practiced are with physical trainer (42% women, 38% men) and with online/mixed trainer (40% women, 38% men) (see Figure 5). Here we note the fact of close homogeneity of the indices in both groups of respondents, and the value of the rating of the form of organisation, in our opinion, is due to the specificity of the process as a professionally pedagogically organised activity under the leadership of the specialist in the field.

- individual (12% women, 22% men);
- other forms (4% women, 2% men).

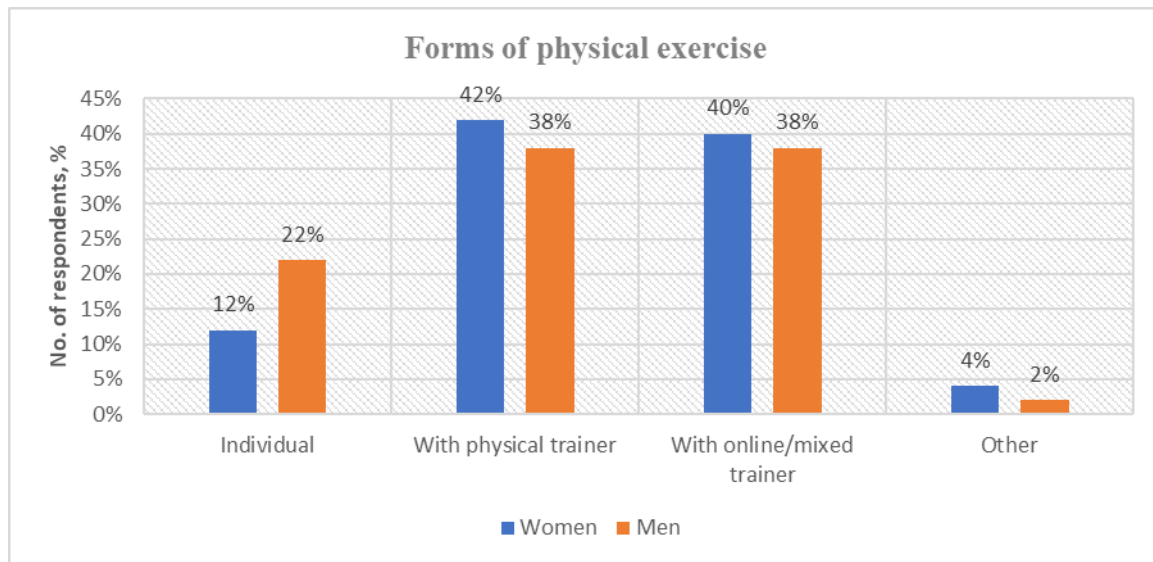


Figure 5. Respondents' answers on their preferred form of exercise

At the same time, the significant values of the "individual form" indicators allow us to see that this form is more preferential for men (22%) and less for women (12%), which can be explained by the greater inclination of women towards group communication.

In this socio-pedagogical study, we also established the main factors that motivate the need for systematic exercise (see Figure 6).

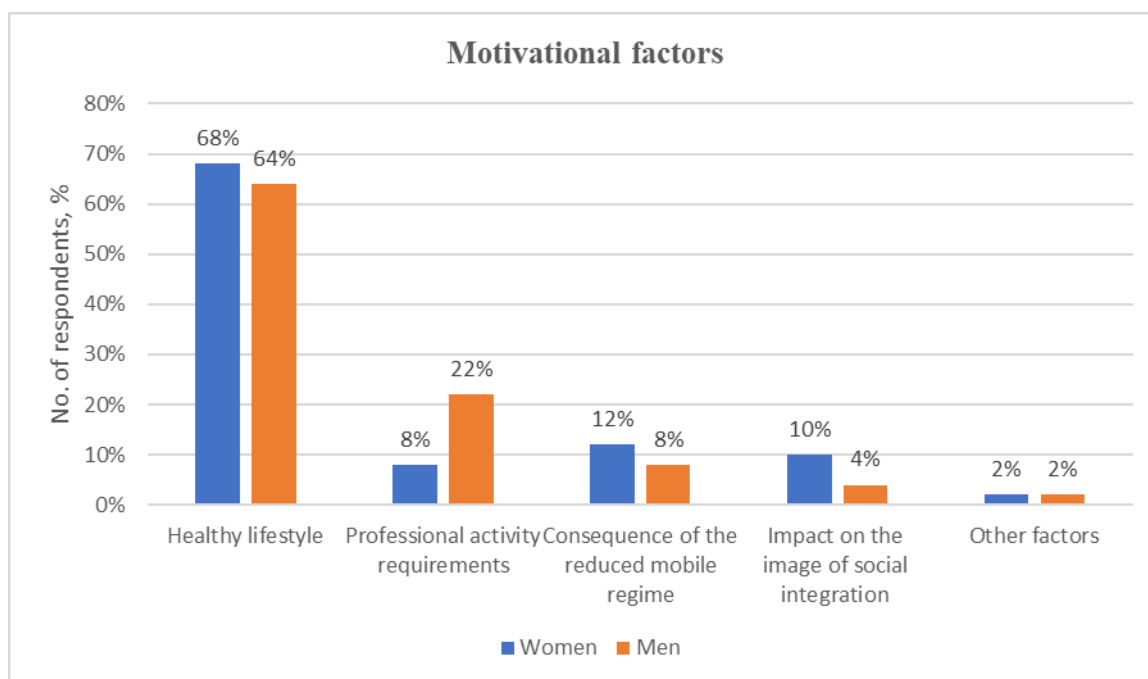


Figure 6. Sample responses on determining motivational factors for exercise

Analysing the data illustrated in Figure 6, we can mention that the main factor motivating respondents to exercise is the factor of a healthy lifestyle, as one of the most important conditions for maintaining health and achieving success in any kind of psycho-social and professional activity, which ensures a higher level of quality of life in an integral context. In this specific case we note the homogeneity of the value indices of the answers of the women's group with those of the men's group (68% and 64% respectively).

It is worth noting that for men, one of the most significant motivational factors listed is "Job requirements" (22%), while for women it ranks second to last (8%) of all options presented. This distribution can be explained by the fact that, in general, men work mostly in professional fields where their activities are associated with some physical effort, unlike women. For women, this position is confirmed by the second most important factor among those represented "Consequence of reduced mobility regime" (12%) and less significant at the same time for men (8%), which can be explained by the specificity of female professions that are not associated with intense physical effort and multiple movements.

It should also be noted that for women the factor "As impact on images of social integration" (10%) is at the same level, which can be explained by their desire to improve and maintain body harmony as a factor of social significance. While for men this option is one of the least significant (4%).

Thus, it can be stated that for men, of all the factors presented, only two of them are significant, while for women, the significance of all the factors is evenly distributed, which can be explained both by the specifics of the professions and by differences in the psychosocial status of women and men.

## Conclusions

- The phenomenon of Olympism is one of the most important factors that actualize and stimulate the motivation to value and practice motor activities as an integral part of the active personality;
- The main sources of information that have determined the importance of physical exercise for the formation of physical culture of personality and healthy lifestyle in adults are the educational content of the subject "Physical Education" and conventional mass media;
- The main forms of organised motor activities in the early adult population are fitness clubs and "at home", practiced under the guidance of the physical trainer and the online/mixed trainer in order to maintain a healthy lifestyle, general work capacity and eliminate the consequences of a reduced dynamic regime.

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## The Use of Cultural Elements in Primary School Textbooks Towards Reshaping Their Attitudes in Learning English: Malaysian Primary Pupils' Perception

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**Abstract:** The adaption of the Common European Framework Reference (CEFR) as a guideline in Malaysian English language education has led the Ministry of Education to replace locally-developed English textbooks with a selection of imported titles. While considering the significance of intercultural skills in the English curriculum, there is a need to look into the aspect of relevance in using imported texts to suit local cultural demands. This study is dual focal in nature; it investigated not only the impacts of cultural elements embedded in imported textbooks on Malaysian students' attitude but also gathered their perception on the aspect through survey research. For the purpose of this study, it specifies on the use of English Plus 1 – an imported textbook, published by Oxford University Press. A questionnaire which was adopted from Xiao (2010), was then distributed to 39 Malaysian pupils of suburban Chinese-type primary schools in Perak who were selected using a convenience sampling technique. The findings indicated that the use of English Plus 1 has impacted pupils' attitude where it was observed that their perception towards learning English became more negative due to the focus of the textbooks inclines towards a culture that was not familiar to Malaysians. The implications derived from this study suggest teachers' flexibility at adopting a range of teaching approaches that might also need to be creative in its nature in order to impart cultural information to the young learners. Simultaneously, a more pro-active solution could be taken at the administrative level by carefully scrutinizing the cultural elements embedded in imported texts to adopt cultural suitability for young learners.

**Keywords:** Cultural elements in textbooks, ESL textbooks, language acquisition, learners' attitude and perception, primary school pupils.

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## Introduction

As a *lingua franca*, English remains as one of the widely spoken languages across the globe that creates a dynamic spectrum between the native and other types of language users (i.e. second/foreign/international) at many levels. At one level, these language learners would probably understand a link between language and culture. In general, language serves as a vehicle that carries the culture(s) during any language learning experience (Duranti, 1997). A language is not taught without its culture (Byram, 1988); they are intertwined (Kramsch, 2013) because individuals use language not only to present facts and ideas but also to reflect their attitudes, which are gradually evolved through the way they live in societies. Although the importance of culture in teaching English as a second language (ESL) is widely acknowledged, new issues have emerged in the teaching and learning process (e.g. the categories of culture, the culture of the target users, and the scope of culture that the target learners should learn in the language classroom). As such, integrating target-native culture should be an essential part of language acquisition. This is especially important with the current evolving framework of English at the worldwide level. Language teachers must continue to associate this importance with the main roles of second language cultural learning, which are global cultural consciousness and intercultural citizenship. As such, Shin et al. (2011) argued that diverse voices and cultural opinions should be included in ESL textbooks to allow language learners to understand the diversity of cultural values and ethics. These ESL materials should include the target language culture along with the multiple foreign cultures, since this will likely assist learners in negotiating knowledge about both values – the native and target language speakers' in developing solidarity (Nguyen, 2011). An absence of either contributors would not accurately reflect the present English linguistic landscape (Jenkins, 2014; Seidlhofer, 2011). Based on Smith's (1976) definition of international language which is a language that allows people who do not have a common native language to communicate, McKay (2002) identified four characteristics in English presented as an international language. The characteristics of an international language are as follows: First, the international language is in need due to the advancement of global integration, which includes economic, scientific, cultural, and intellectual life. Second, it coexists with other languages in multilingual situations. Third, people from all strata of society study it. Fourth, it spreads through a large number of people learning the language rather than through speaker migration. As an international language, an essential function of English is to allow speakers to express their ideas and culture with others from a range of language and cultural backgrounds. These four characteristics support the pedagogical notion of English learning that English language learning should focus on increasing learners' capacity to comprehend cultures, including their own, and to communicate with individuals from different cultures successfully, called Intercultural Communicative Competence (ICC). It is this competence that allows successful and appropriate communication with culturally and linguistically different individuals (Savignon, 1997). Learning about various cultures helps learners become more open-minded about international understanding, improve communication with people from different cultures, and better understand his own culture by comparing it to other societies.

Recognizing the significance of English language proficiency within the current global learning challenges, the

Ministry of Education (MoE) devised the Malaysian Education Blueprint (2013-2025), which aims to reform the education system. Since 2013, MoE has incorporated the use of the Common European Framework of Reference for Languages (CEFR) into the English language curriculum, resulting in adjustments to the syllabus, assessment, and materials to align with the global reference set. This has led to the use of English Plus 1 published by Oxford University Press – a foreign textbook, to replace the prior local textbooks for Year 5, starting 2021. Under the national identity aspect in the Malaysian Education Blueprint (2013-2025), every child is identified as a Malaysian regardless of his ethnicity, religion, culture or socioeconomic status. Yet, some teachers observe that students are unable to fundamentally understand Malaysian culture at a satisfactory level based on the required criteria in the curriculum. This links to a possible reason for the given exposure. In one case, the adopted textbook focuses on the target culture, instead of source cultures. At times, students were sometimes unable to finish a discourse regarding local cultural information. This problem shows a mismatch between the curriculum objectives and students' actual performance on source culture understanding in Malaysia.

Culture and language learning is a broad concept that encompasses many variables, such as students and teaching materials (Tajeddin & Bahrebar, 2017). According to Gardner et al. (1985), an effort is linked with a desire to achieve the purpose of language acquisition and positive attitudes about language learning. The primary function of teaching materials in the foreign language classroom is to facilitate language acquisition where textbook contents appear to have a major impact on students. In some cases, textbooks may either directly or indirectly convey cultural values, known as 'hidden curriculum' (Cunningsworth, 1995). Most English teachers regard the textbook as essential references for their teaching, where the students are required to spend time in the classroom using them. This is because these imported textbooks were viewed to be connected with the CEFR goals for linguistic communicative proficiency (Chin & Rajaendram, 2017). Past studies on locally written English textbooks have indicated that these textbooks have broader cultural relevance with more inclination at fulfilling intercultural objectives, as compared to imported ones (e.g. Zawiah, 1999; Rahim & Manan, 2013; Hajar & Jalalian Daghig, 2019). In fact, the cultural content of imported ELT textbooks focuses primarily on target and foreign contexts, frequently neglecting learners' own cultures (Chao, 2011; Shin et al., 2011; Tajeddin & Teimournezhad, 2015). An interesting exploration over the relevance of choosing between foreign-based and local-based texts was issued by Haja Mohideen et al (2020) arguing a deficit in engagement if foreign texts are used in Malaysian language learning settings. Gray (2002) also asserted that ESL foreign textbooks have a particularly negative impact on learners in the outer and expanding circle settings, who rely on familiar contexts to connect their reality with the world of English, to comprehend 'the role of the local in the global.' Although numerous studies on foreign textbooks and culture are obtainable worldwide, the students' perspectives on incorporating cultural aspects in their English textbooks have yet to be explained in the Malaysian context, especially at the primary school. To date, little to no previous study has been conducted to analyze Malaysian students' perceptions of cultural aspects in English Plus 1. This research investigated the status of reference to various cultural categories in the ESL textbook currently in use, as well as students' views of cultural components in the textbook and students' attitudes toward learning English by asking three questions:

- (1) What are the students' perceptions on the use of foreign cultural elements in English Plus 1?
- (2) How do cultural elements in the textbook affect students' attitudes towards learning English?

## Literature Review

### Language and culture

Language serves a human technique of conveying thoughts, feelings, and desires via deliberately generated symbols (Sapir, 1921) that is non-instinctive and plays an important role in cognitive development, especially during the formative language competence development phase (Vygotsky, 1962). In fact, it is social in nature where it is subsequently internalised and becomes an important instrument in the moulding of cognitive processes related to creating the abstract symbolic system that would allow the child to organise thinking. Many experts believe that language and culture are inextricably linked (e.g. Kramsch, 2014) since they are both essential aspects of human existence for communicating. Language and culture are inextricably linked and form a human experience of communicating. According to Jiang (2000), language is a mirror of culture in the sense that individuals can observe a culture via its language. Language and culture can have a variety of connections, according to Wardhaugh (2002). One possibility is that social structure influences or determines language structure and/or behaviour. A second possibility is diametrically opposed to the first. Linguistic structure and/or behaviour can affect or be determined by social structure or worldview. Certain suggested language changes are based on this belief: if we alter the language, we can influence social behaviour. A third possibility is that the impact is bidirectional: language and society may affect one another. Certain language reforms can also be viewed as dependent on this viewpoint; the reforms are implemented in response to changes in societal norms. A fourth possibility is to believe that there is no link between linguistic structure and social structure and that one is completely independent of the other. Linnel (2001) stated that language is a recognised system of arbitrary vocal symbols that plays a critical role in preserving meaning and experience, as well as developing, elaborating, and transmitting acquired and shared ideas, values, practises, and behaviours as a culture. This is not the only vital purpose of language; it is also a tool for social adaptation, assimilation, and self-expression (Sitidoan, 1984). Language is vital in human life since it always facilitates the development of culture. In brief, there is a strong and essential link between culture and language. Culture affects and moulds language, and the latter serves as a main platform of spreading culture.

Language is not only a cultural product, but it is also a cultural symbol (Gleason, 1961) where it is a taught set of values, beliefs, and/or standards shared by a group of people (Greedy, 1994). Kuo and Lai (2006) echoed this, claiming that cultural knowledge is essential for acquiring linguistic competency because a society's culture can evolve based on the language spoken. Language should be conceived and incorporated as a component of a society's and culture's identity. Lado (1957) proposed that if specific components of a second language differ significantly from those of the learner's native language, the student is likely to struggle. Because languages differ in grammar, pronunciation, and structure, it may be presumed that learning a second language is enhanced if there are parallels between that language and the learner's mother tongue. Perhaps the diversity of languages

can be addressed and students' learning pressures alleviated through cultural assistance and understanding. Learners will get long-term advantages from their language learning experience if culture is included in language study (Omaggio & Hadley, 1986). Children who are provided cultural information, entrenched in a culturally rich setting, and exposed to culturally fundamental content may acquire a second language more easily because their prior knowledge of the second-language culture makes understanding easier. Culture must be explicitly included as a component of second language learning and teaching. Students will be successful in their target language acquisition only when cultural problems are included in the language curriculum and learning. Crozet and Liddicoat (1997) claimed that culture must be included in the teaching of language knowledge and abilities in order for students to learn to speak and write in culturally acceptable ways.

Many academics define culture in diverse manners. Condon (1973) stated that culture can be thought of as a way of life. There are several elements to culture. It encompasses the ideas, customs, skills, arts, and tools that define a group of people at a particular moment; it also includes the beliefs, values, and tangible items that shape our way of life. Culture creates a foundation for each individual's cognitive and affective activity. It impacts individual assessment and attitudes and practical areas of life, such as the activities people are interested in doing in life. Culture is also a matter of routine, and it is routine that gives rise to tradition, which gives rise to culture. Locals begin with regular acts and progress to the formation of shared preconceptions. Condon went on to say that stereotypes give group traits to individuals only based on their cultural affiliation. People's thoughts, words, actions, and interactions are all influenced by cultural stereotypes. Anthropologists describe culture as "a people's or group's entire way of life." According to this definition, culture is a specific system that incorporates all social activities that bind a group of people together and subsequently differentiates them from others. Thanasoulas (2001) defines culture as all the accepted and regular modes of conduct of a specific group. It is that aspect of human existence that people learn as a product of belonging to a certain group; it is that aspect of learnt behaviour shared with others. This definition provides an understanding that culture is anything that is gained or learnt and handed down from one generation to the next. Culture is thought to be concerned with the tangible products from which a group of people defines itself, but the definition emphasises people's knowledge, ideas, and attitudes. As a result, foreign language acquisition is linked to culture learning, and culture has been implicitly taught in the foreign language classroom. Culture in language acquisition, according to Kramsch (1993), is constantly in the background in classrooms when language learners are seeking excellent communicative skills and pushing their capacity to make sense of the world around them. Over the years, the notion of culture learning has evolved for English language teaching and learning.

Grammar-translation was the dominant tendency in language instruction in the 1950s. During that time frame, foreign language instruction focused on grammar, vocabulary, and reading in the target language. As a result, evaluation took the shape of translation tasks, vocabulary lists, dictations, and fill-in-the-blank activities intending to measure language improvements. Instead of communicative and sociolinguistic ability, the emphasis was on cognitive comprehension and rote replicating language norms. Culture learning was incorporated into foreign language education in the 1960s. The pedagogical innovation of the time resulted in a greater emphasis on building students' practical language abilities, which could be employed in language

classroom instruction. Through this sense, culture was taught in foreign language teaching through the words and acts of daily people in everyday life (Kramsch, 1998). Many foreign language theorists proposed including culture in a foreign language course in the 1970s and 1980s because English learners should gain knowledge based on culture content in order to use a foreign language, and points of contact would improve students' ability to communicate appropriately in language use situations (Lado, 1957). According to Seelye (1984), when students are armed with this "super aim" for the teaching of culture, they will be able to establish perceptions and behaviours necessary to communicate within a society that speaks the target language. Since the 1990s, Intercultural Communicative Competence (ICC) seems to be the dominant trend in language teaching. According to Byram (1997), ICC necessitates the promotion of specific attitudes, knowledge, and skills to complement linguistic, sociolinguistic, and discourse competence. Curiosity and openness are mentioned, as well as "readiness to suspend scepticism about some of the other cultures and belief about one's own" (Byram, 1997). According to Lund's (2006) study, the above-mentioned perspectives within the literature have led us to the conclusion that foreign language acquisition consists of different aspects, comprising grammatical competence, communicative competence, language proficiency, and attitudes toward cultural competence.

### **The role of textbook in language learning**

Textbooks play a crucial role in the classroom and help to equip students for future education. Richard (2001) stated that textbooks are a key component of most language instruction and, in many cases, serve as the foundation for the input language. Textbooks are the most common source of learning materials for students. In addition to instruction, teachers provide critical impact on students' learning, which can assist them develop in acquiring the language. According to Roger (1989), the function of a textbook is to foster the learner's interest in books as well as the habit of utilising textbooks to enhance knowledge and look for information. According to Pearson (2014), an influential textbook was a combination of non-native teachers' teaching expertise and actual user feedback from the native tongue. When looking for source material, we must evaluate the collaboration between native and non-native perspectives. Given the justifications for incorporating culture into ESL learning, a consideration of textbooks is necessary. The various components in the textbooks serve in assisting the second language teaching and learning process in the classroom, emphasizing the importance of textbooks.

The textbook, according to Cortazzi and Jin (1999), "could be a teacher, a map, a resource, a trainer, an authority, a de-skinner, and an ideology". Aside from offering linguistic and subject contents that genuinely represent the ideology embedded in the ESL environment of a particular circle, the textbook may be a significant source of cultural components. Textbooks from around the world have varying cultural orientations, depending on whether they are based on source cultures, target cultures, or worldwide target cultures (Abdullah, 2009). Johar and Aziz (2019) claimed that using a foreign textbook as the primary English textbook may be a bit overwhelming, given its extensive cultural content, lexical density, layout, and a few other factors to consider. Global textbooks, according to Hooi and Knight (2015), are "irrelevant, culturally unsuitable, incompatible with the newest teaching technique, of mixed levels, and just generally fail to fit the various demands of their wide range of audience". Ahmadi and Derakhshan (2016) commented that the textbook's lack of cultural material of

Malaysia makes it detrimental since it gives students with inappropriate cultural knowledge, which ultimately fails to provide contextualised language practices and sufficient discourse competence. It is possible to infer that textbooks do play an essential role in English teaching and learning. The usage of textbooks may be helpful and productive for both students and teachers in a variety of ways. However, owing to teachers' and students' reliance on textbooks and the foreign textbooks used in Malaysia, the cultural elements of textbooks have a significant impact on students.

### *Students' attitudes towards learning language*

Attitude, both good and bad, is assumed to significantly influence students' performance in language learning. A student's attitude has repeatedly been recognized to be an essential element in second language acquisition methodology. Learning a second language is a reasonably major educational challenge that students encounter during their high focus in certain situations, while it is a direct path to bilingualism in others. Researchers appear to accept from both situations that "affective factors such as attitudes influence language learning" (Masgoret & Gardner, 2004). According to Karahan (2007), "positive language attitudes allow learners to have a positive perspective toward learning English". A positive attitude is also regarded as assisting foreign language acquisition, whereas a negative attitude works as a psychological obstacle (Dörnyei & Csizér, 2002). Empirical data supporting these hypotheses. Nikolov (2001), for example, discovered that students' unfavourable attitudes against Russia or Russians were to blame for their inability to learn or retain the language. Gardner and Lambert (1972) also show in their vast research that good attitudes about language improve competence. Many studies claim that attitudes are composed of cognitive, emotional, and behavioural components (Wenden, 1991). Beliefs or perceptions about the social phenomena associated with the attitude comprise the cognitive component. The emotional component refers to one's sentiments and emotions about an item, such as 'likes' or 'dislikes,' 'with' or 'against'. Because of the behavioural component, various attitudes tend to drive learners to adopt specific learning behaviours. Rahimi and Hassani (2012) stated that in second language acquisition, researchers have primarily focused on two types of attitudes: attitudes toward language learning and attitudes toward the target language community. The first set of attitudes is educational in nature, whereas the second is more social in nature.

Attitudes toward language acquisition appear to be linked to the environment in which learning occurs (Krashen, 1997). It is fundamental for students to have a strong desire and a good attitude toward the target language when studying a second language. This is since many linguists have revealed that motivation and attitude are inextricably linked in influencing the effectiveness of second language acquisition (Gardner & Lambert, 1972). Language learners who are more motivated and have a good attitude will be more successful, and conversely. According to Brown (2000), favourable views regarding oneself, one's native language, and one's target language group improve second language competency. He says that a good attitude assists a language learner and that a bad attitude can lead to a decline in motivation, input, and interaction, which leads to poor proficiency achievement.

## **Methodology**

### ***Research Design***

This research intended to discover the suitability of cultural elements embedded in the textbook. However, to appropriate the applicability of the questionnaire, a study was administered to ensure the validity of the translated version of the questionnaire (Ruel et al., 2015).

Textbook analysis

Content Analysis was employed to study on the cultural elements in the textbooks, where these elements were related to the pupils' perception on learning English. The cultural elements were analysed based on 2 types: (1) Culture Origin: 1) Target culture (UK, US), (2) Source culture (Malaysia), (3) international culture (other than UK, US and Malaysia), and (2) Big C and little c. Big C includes music, literature, Art. (politics, economy, history, literature, geography, science) whereas little c concerns daily routines (food, holiday, living style, values).

### ***Questionnaire***

A questionnaire was self-developed and administered for this study. Prior research was carried out to build the questionnaire where the researchers reviewed past studies on the function of cultural learning, types of culture, categories of culture, and learners' cultural implementation in English teaching and learning areas in the past. These concepts were used to develop the questionnaire items. The questionnaire adopted a three-pronged approach, including the development of a 5-point Likert scale answer option, rank order questions and an open-ended response.

The questionnaire consisted of 3 main parts (28 items): Part 1 consists of 20 items investigating students' attitudes towards culture learning and English Plus 1 and their perception about the culture in the textbook. The respondents were required to express their opinions using the rating scale ranging from 5 (Strongly Agree) to 1 (Strongly Disagree). Meanwhile, Part 2 is made up of 5 items related to the importance of cultural aspects which requires the respondents to rank the options according to the degree of their perceived importance. Part 3 contains 3 open-ended questions concerning their expectations on cultural learning in terms of categories of culture and their attitudes towards learning English. They were also required to give reasons and support for their choices.

In order to facilitate better understanding about the questions in the questionnaire, dual language statements (English and Chinese) were provided. All items were first constructed in English and upon receiving approval from the supervisory committee to ensure content validity, the researchers then translated the items into Chinese. The translation was then thoroughly checked by three Chinese English teachers for the purpose of translation and content validity.

### *Sampling for the Questionnaire*

This study employed 39 Year 5 students (M=20; F=19) from a Chinese Primary school at Lawan Kuda as its respondents. Lawan Kuda is a small town in Gopeng, Perak – in the west coast of Malaysia, where the population is mostly made up of a more elderly community where the younger generation have relocated for better working opportunities in the bigger cities (e.g. Kuala Lumpur or Singapore). At present, the main economic activities are farming, plantation and animal husbandry, leaving the only available economic opportunity in small shop lots, food courts and farming.

The respondents can be classified into two different classes of a similar age. 38 of them are Chinese by race where Chinese is their main language spoken at home while one respondent is an Indian who speaks Indian at home. They were selected using a convenience sampling strategy. Their English proficiency was rated as weak to intermediate. In October of 2021, all the students will complete the English Plus 1. Upon selection, the respondents were given a briefing about the questionnaires.

### *Data Analysis Procedures*

#### *Textbook analysis*

To answer the first and second research questions, the data from the textbook analysis were categorised into culture free categories, big "C" and little "C" cultures under target, source, and international culture, and further quantified using frequencies and percentages to provide support in answering research questions one and two. Quantitative statistics focused on the amount (percentage and frequency) of cultural material provided in the textbook. The qualitative data in the textbook focused on the kind (categories and types) of cultural material and the variations (themes) of big C and little C cultures.

#### *Questionnaire*

To answer the second and third research questions, data from the completed questionnaire was analysed using the Statistical Package for Social Science (SPSS) v.20. To answer both Research Question 2 (*What are the students' perceptions on the use of foreign cultural elements in English Plus 1?*) and Research Question 3 (*How do cultural elements in the textbook affects students' attitudes towards learning English?*), descriptive statistics was used to compute the frequency, average scores and standard deviations. To facilitate data analysis of both Research Question 2 and 3, an interpretation was provided to provide an understanding of the means (Table 1).

Table 1. Interpretation of Means

1.00-1.80	Strongly disagree
1.81 -2.60	Disagree



2.61-3.40	Moderately agree
3.41-4.20	Agree
4.21-5.00	Strongly agree

In addition, the rank order scores on individual items were calculated to determine their relative importance as perceived and expected by students. The data responding to the open-ended questions was also transcribed. Then, the information was analysed and summarized.

## Findings

### Students' perception towards learning English

The questionnaire enabled an early projection of responses regarding the respondents' perception on learning English. The findings in Table 2 answer the first research question on the students' perception on the use of foreign cultural elements in English Plus 1. As shown in Table 2, the majority of the respondents (95%) specified their preference of learning English. This analysis section is divided into 3 themes: (1) learning English within Malaysian context only, (2) learning English about Malaysia and other countries, and (3) learning English about other countries only.

Table 2. Students' perception on the use of foreign cultural elements and learning English

Items	Students' perception on the use of foreign cultural elements in English Plus 1 and learning English	Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly agree (%)
1	I love learning English.	0	2 (5.1)	20 (51.3)	17 (43.6)
2	I love other subjects more than English.	5 (12.8)	15 (38.5)	15 (38.5)	2 (5.1)
3	I like to learn about Malaysia and Malaysia's culture.	0	4 (2.6)	20 (51.3)	15 (38.5)
4	I like to learn about other countries.	2 (5.1)	2 (5.1)	25 (2.6)	10 (25.6)
5	I like to learn about other countries more than Malaysia and Malaysia's culture.	0	9 (23.1)	20 (51.3)	10 (25.6)
6	I prefer to learn English with content	0	29	5	5

	about Malaysia only.		(74.4)	(12.8)	(12.8)
7	I prefer to learn English with content about other countries only.	12 (30.8)	20 (51.3)	7 (17.9)	0
8	I prefer to learn English with content about Malaysia and other countries.	0	0	30 (76.9)	9 (23.1)
9	I don't understand English lessons when the topic is about Malaysia.	5 (12.8)	30 (76.9)	4 (2.6)	0
10	I don't understand English lessons when the topic is about other countries.	2 (5.1)	7 (17.9)	25 (64.1)	5 (12.8)
11	I understand English lessons better when the topic is about Malaysia only.	0	10 (25.6)	24 (61.5)	5 (12.8)
12	I understand English lessons better when the topic is about other countries only.	7 (17.9)	25 (64.2)	7 (17.9)	0
13	I understand English lessons better when the topic is about Malaysia and other countries.	0	3 (7.7)	29 (74.4)	7 (17.9)

Based on *Item 3*, the majority of the respondents (51.3% agreed and 38.5% strongly agreed) like to learn about Malaysia and its culture and only 4 (2.6%) stating their lack of preference to learn about the country and its culture. Other than that, 61.5% agreed and 12.8% strongly agreed that they understand English lessons better when the topic is about Malaysia only (*Item 11*). Similarly, the bigger percentage indicated their learning English about Malaysia and other countries, where only 7.7% disagreed (*Item 13*). It is also worth noting that all the respondents agreed that they prefer to learn English with content about Malaysia and other countries rather than just learn English with content about Malaysia only (*Item 8*). However, 74.4% did not prefer to learn English with content about Malaysia only (*Item 13*), thus the suggestion of combining both local and international culture in learning English.

Table 3. Mean scores of students' perception

Item	Students' perception	Mean scores	Level of agreement
1	I love learning English.	3.38	Strongly Agree

2	I love other subjects more than English.	2.38	Agree
3	I like to learn about Malaysia and Malaysia's culture.	3.28	Strongly Agree
4	I like to learn about other countries.	3.10	Strongly Agree
6	I prefer to learn English with content about Malaysia only.	2.38	Agree
7	I prefer to learn English with content about other countries only.	1.87	Disagree
8	I prefer to learn English with content about Malaysia and other countries.	3.23	Strongly Agree
9	I don't understand English lessons when the topic is about Malaysia.	1.97	Disagree
10	I don't understand English lessons when the topic is about other countries.	2.85	Agree
11	I understand English lessons better when the topic is about Malaysia only.	2.87	Agree
12	I understand English lessons better when the topic is about other countries only.	2.00	Agree
13	I understand English lessons better when the topic is about Malaysia and other countries.	3.10	Strongly Agree

Table 3 lists down the mean score of the levels of agreement about the perception of cultural contents in English Plus 1. Based on the data from the questionnaire, the results can be divided into 3 themes: (1) learning English within Malaysian context only, (2) learning English about Malaysia and other countries, and (3) learning English about other countries only. It is in Items 3,6 and 11 which concern the learning English within Malaysia context only. Respondents strongly agreed with Item 3 (*I like to learn about Malaysia and Malaysia's culture*) with the mean score of 3.38, that they could relate their preference to learn English when the topic is about Malaysia and its culture. For Item 6 (*I prefer to learn English with content about Malaysia only*), with the mean score of 2.38, students agreed that they prefer to learn English with content about Malaysia only. With a mean score of 2.87, the respondents indicated that they understand English better when the topic is about Malaysia only. Items 4,7,10 and 12 are about learning English in other countries only. Students strongly agree with item 3 that they like to learn about other countries. However, in Item 7 (*I prefer to learn English with content about other countries only*), the respondents disagreed that they prefer to learn English about other countries only. They also agreed that they did not understand the English lesson when it included a discussion on other countries. With the mean score of 2.00, some of the respondents agreed that they understand the English lesson better when the topic is about other countries only (*Item 12*). The theme of learning English about Malaysia and other countries can be found in Item 8 (*I prefer to learn English with content about Malaysia and other countries*) and Item 13 (*I understand English lessons better when the topic is about Malaysia and other countries*) where the respondents strongly agreed that they prefer to learn English with content about Malaysia and other countries.

The respondents also strongly agreed that they understand English lessons better when the topic is about Malaysia and other countries. There was a significant difference between *Items 11,12* and *13*. For *Item 11 (I understand English lessons better when the topic is about Malaysia only)* and *Item 12 (I understand English lessons better when the topic is about other countries only)*, students agreed with the statements there but students strongly agreed with *item 13*. Students strongly agree that they understand English lessons better when the topic is presented by combining Malaysia and other countries. Majority of the respondents prefer to learn English with content about Malaysia and other countries, echoing that they understand English lessons better when the topic combines a discussion on both Malaysia and other countries. This is consistent with Lado (1957), arguing that if a second language's particular components deviate greatly from the learner's original language, learning is liable to incur, which explains for students' better understanding of English lessons when the content that they can easily relate with, which is in this case, cultural relatedness (Haja Mohideen et al., 2020). When students can relate with the content in the textbook, this makes learning easier to grasp which enables a closer engagement with their daily life. In some countries, English is a second language while in others, it is regarded as a third language where students need to learn in school. They are not able to associate with the culturally-embedded vocabulary and the usage of words in the sentences. Thus, it is important to enable students with a linkage of what they learn in the class with their prior knowledge or familiar contextual knowledge since English Plus 1 is a foreign textbook that is used for Malaysian primary Year 5.

Since most of the content in the textbook is not related to Malaysian content, it can be concluded that this type of content has affected students' perception in learning English. As indicated *Item 10* (Table 2), 76.9% did not understand the English lesson when the topic is about other countries, contradicting when the content of the lesson is about Malaysia where 92.3% respondents understand the lesson better. This result is aligned with Johar and Aziz's (2019) study on the usage of foreign textbooks in Malaysia where they concluded that a high percentage that making use of a foreign textbook as the fundamental English textbook might be intimidating due to its substantial cultural content, vocabulary size, layout, and a few other variables to consider. 92.3% of the respondents agreed that they understand English lessons better when the topic is about Malaysia and other countries compared to students that understand the English lesson better when the topic is about Malaysia only with 74.3% of the respondents agreed to it. Students did not want to learn just about Malaysia but they wanted the mix of Malaysia contents and other countries' contents. This finding is, to some extent, consistent with Brown's (2000) that stated the positivity toward oneself, one's native language, and one's target language group improves second language proficiency. Hence, it is important to have native content and target content in one textbook to ensure that students can learn English with what they have learned and at the same time, learn about other cultures.

### **Students' Attitudes on learning English**

In order to investigate the students' attitudes towards learning English when using English Plus, they were asked to answer a section that consists of 10-items, which is divided into two themes. The first theme (*Item 1-6*) elicited responses regarding the importance of learning different cultures from students' perspectives. The

second theme (*Item 7-10*) investigated whether the cultural content in the textbook affects students' attitudes towards learning English. Table 4 shows the findings.

Table 4. Students' attitudes towards learning English

Items	Attitudes	Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly agree (%)
1	It Is very important for me to know Malaysian culture.	0	0	17 (43.6)	22 (56.4)
2	It is very important for me to know the culture of English-speaking countries such as England and America.	5 (12.8)	11 (28.2)	10 (25.6)	13 (33.3)
3	It is very important for me to know the culture of non-English-speaking countries such as Thailand, Japan, Brazil, etc.	10 (25.6)	15 (38.5)	10 (25.6)	4 (10.3)
4	It is very important for me to know about daily living and cultural patterns such as food, holidays, lifestyles, and customs in Malaysia.	0	7 (17.9)	17 (43.6)	15 (38.5)
5	It is very important for me to know about daily living and cultural patterns such as food, holidays, lifestyles and customs in English-speaking countries such as England and America.	6 (15.4)	18 (46.2)	10 (25.6)	5 (12.8)
6	It is very important for me to know about daily living and cultural patterns such as food, holidays, lifestyles and customs in non-English-speaking countries such as Thailand, Japan, Brazil, etc.	9 (23.1)	20 (51.3)	6 (15.4)	4 (10.3)
7	I love to learn English when the topic is about daily living and cultural patterns such as food, holidays, lifestyles, and customs in Malaysia only.	4 (10.3)	14 (35.9)	19 (48.7)	2 (5.1)
8	I love to learn English when the topic is about daily living and cultural patterns such as food, holidays, lifestyles, and customs in English-speaking countries such as England and America only.	5 (12.8)	19 (48.7)	15 (38.5)	0

<b>9</b>	I love to learn English when the topic is about daily living and cultural patterns such as food, holidays, lifestyles, and customs in non-English-speaking countries such as Thailand, Japan, Brazil, etc.	20 (29)	14 (35.9)	5 (7.3)	0
<b>10</b>	I love to learn English when the topic is about daily living and cultural patterns such as food, holidays, lifestyles, and customs in Malaysia and other countries.	0	2 (5.1)	20 (29)	17 (44)

In general, all respondents acknowledged the importance of knowing Malaysian culture. Yet, when it comes to knowing another culture, only 25.6% agreed and 33.3% strongly agreed that it is important to know the culture of English-speaking countries (e.g. the United Kingdom or United States of America) (*Item 1*). Meanwhile, only 35.9% valued the importance of knowing the culture of non-speaking English countries (*Item 7*). Here, we can observe a hierarchical ranking of importance over cultural importance; knowing Malaysian culture is far more significant than others. There is a range of opinions when it comes to knowing about other countries' cultures; some even disagreed. Thus, this reiterates the importance of inserting some Malaysian cultural elements into the textbook so as to motivate learning engagement. It was also indicated in the findings that 48.7% strongly disagreed (*Item 8*) that they love to learn English when the topic is about daily living and cultural patterns such as food, holidays, lifestyles, and customs in English-speaking countries such as England and America only. This indicated dissociation between learners' familiar culture to those that they can make connection with. 43.6% disagreed with participating in the activities during English lessons when the topic is about English-speaking countries only (*Item 4*). Only one student agreed with the statement that they like to participate in English learning activities when the topic is about non-English speaking countries.

Table 5. Mean scores of students' attitudes

Items	Students' attitudes	Mean scores	Level of agreement
1	It Is very important for me to know Malaysian culture.	3.56	Strongly Agree
2	It is very important for me to know the culture of English-speaking countries such as England and America.	2.79	Agree
3	It is very important for me to know the culture of non-English-speaking countries such as Thailand, Japan, Brazil, etc.	2.21	Agree
4	It is very important for me to know about daily living and cultural	3.21	Strongly

	patterns such as food, holidays, lifestyles, and customs in Malaysia.		Agree
5	It is very important for me to know about daily living and cultural patterns such as food, holidays, lifestyles and customs in English-speaking countries such as England and America.	2.36	Agree
6	It is very important for me to know about daily living and cultural patterns such as food, holidays, lifestyles and customs in non-English-speaking countries such as Thailand, Japan, Brazil, etc.	2.13	Agree
7	I love to learn English when the topic is about daily living and cultural patterns such as food, holidays, lifestyles, and customs in Malaysia only.	2.49	Agree
8	I love to learn English when the topic is about daily living and cultural patterns such as food, holidays, lifestyles, and customs in English-speaking countries such as England and America only.	2.26	Agree
9	I love to learn English when the topic is about daily living and cultural patterns such as food, holidays, lifestyles, and customs in non-English-speaking countries such as Thailand, Japan, Brazil, etc.	1.62	Disagree
10	I love to learn English when the topic is about daily living and cultural patterns such as food, holidays, lifestyles, and customs in Malaysia and other countries.	3.38	Strongly Agree

Table 5 displays the mean score for the levels of agreement about students' attitudes towards learning English. Items 1, 4 and 7 identified respondents' attitudes towards learning English when the topic of lesson is about Malaysian culture. With the mean score range from 3.56 (*Item 1*) to 2.49 (Table 7), responses from the participants indicated good on those statements asking about Malaysian culture in the English lesson. The participants agreed that it is important for them to know about Malaysian cultures through English lessons. They also agreed that they love to learn English when the topic is about daily living, cultural patterns and customs in Malaysia. Items 2, 5 and 8 discussed the participants' attitudes about the Target culture elements in the textbook towards their English learning. The participants agreed for all the 3 items with mean scores ranging from 2.26 to 2.79. Items 3, 6 and 9 discussed International Culture. The participants agreed with Items 3 and 6 that it is important to learn about International Culture. However, students disagreed with the statements that they love to learn English when the topic is about International Culture. Students strongly agree with the mean score of 3.38 that they love to learn English when the topic has the integration about Malaysian and other countries. This finding implies consistency with those of Brown's (2000) on attitudes towards learning English and the cultural content in the textbook.

Brown (2000) asserts that positive attitudes about oneself, his native language, and his target language group promote second language ability. Students feel motivated to participate in learning English when they feel confident and know about the topic. Since students are more familiar with the Malaysian context where they have prior knowledge about the topic, this will likely boost their confidence to engage in the lesson. This is supported by the statement from *Item 10* (that asks the students whether they like to learn English using English Plus 1 in the class. 77.9% of the respondents did not like to use English Plus 1 to learn English. Some of the responses received stated that they cannot relate the topic that discusses other countries with their prior knowledge. This might probably be because the participants believe that it is challenging to understand the meaning of the sentences and at the same time, they need to imagine the settings of the topic. These factors affect students' attitude towards learning English. Obviously, cultural elements in foreign textbooks affect students' attitude towards learning English. This supports the arguments that native elements and foreign elements should blend in a textbook. A good textbook cannot be solely presented in foreign cultural elements only or in native culture only.

The textbook must be presented with the combination of different cultures. Students feel comfortable to learn something that they are familiar with but at the same time they also want to learn new things and cultures they have never experienced before. The data from both textbook analysis and questionnaire responses may lead to the conclusion that somehow the target culture was the primary concern of cultural teaching and learning, while the source culture and foreign culture got only a little fraction of events. Despite their belief that target culture has been the most significant element for their English subject, this group of students showed a desire to learn regarding source culture in the English classroom. It has become worth mentioning that 100 percent of survey respondents said Malaysian culture (source culture) was highly important in their Language classroom. Students also expressed a desire to actually learn about Malaysian culture and expressed a willingness to do so in the English classroom. This confirmed the results of Zhang and Ma (2004), who revealed that more than 50% of local students favoured having cross culture in instructional materials, encompassing source and foreign culture, rather than only target culture.

Findings from the present study contradicts arguments forwarded by Crystal (1997) and Mckay (2002), declaring that ESL learning should be altered and foreign culture should play a larger role in promoting students' International Communicative Competence (ICC). In the current era of globalization, English has become one of the worldwide languages due to political, economic, military, scientific, technical, and cultural connections with all nations across the globe Crystal (1997). In this modern global trend, English has been changed into a variety of Englishes, which play a significantly higher role in communications between non-native English speakers than native speakers in terms of frequency, quantity, and importance. According to Mckay (2002), the relevance of cultural classroom instruction is to help students to appreciate the variety that abounds within all cultures, especially in this globalised day where tourism and migration are far more common than in the past. Consequently, Hatoss (2004) states that one of the specifications of intercultural communicative competence is that language learners develop a conscience of their own cultural context in an attempt to see it as a benchmark for acknowledging the paramount perspectives of target language speakers. According to student rebuttals, this



group of students is unfamiliar with their own cultural identity, but they recognise the crucial function that source culture helps in creating comprehensible input. Unfortunately, the results of the textbook evaluation and the students' questionnaire replies indicate that the textbook may not meet students' requirements in terms of source culture elements, since the textbook only contains 3.1 percent of source cultural components. According to Hatoss (2004), a major worry with language textbooks is that students are expected to characterise cultural distinctions with no intentional effort on the part of teachers to motivate them to recognise their cultural knowledge or improve their view of their own culture. One of the prerequisites for dealing with cultural material in a foreign language classroom is emphasised by McKay (2002). She emphasised the need of tailoring educational materials to help students to consider their own culture in relation to others, so supporting them in establishing a sense of intercultural conversation. One advantage of this notion is that it may induce cultural content in teaching materials to emphasise students' source culture, as well as the target culture and globalized society, in promoting the awareness of intercultural competence.

How doable would it be to discover source culture contents in foreign language textbooks, given that commercial textbooks are frequently written for global markets and frequently do not portray the desires and concerns of students in a specific country or area (Richards, 2001), particularly when it comes to cultural contents? One of the long-term goals of a commercial textbook is to be widely relevant in order to gain a good retail coverage rate. Through this general framework, a commercial textbook is unavoidably heavy on Target culture and potentially competent at showing worldwide cultures, but it is usually hard to provide a typical source culture specifically suited for one country. As a result, it stands to reason that locally-created textbooks authored by Malaysian educators should include more source cultural information than commercial textbooks published by English native speakers. We might also assume that one of the benefits of locally produced English textbooks is the exposure of source cultural materials. Because such textbooks, unlike commercial textbooks, may provide the source cultural materials more genuine and relevant for local learners. It is not to argue that local textbooks should be developed with all source cultures in mind while neglecting other sorts of culture. It is just to suggest that locally created textbooks may have advantages in terms of assisting English learners in learning how to speak about their source culture in English while studying language skills and the target culture. Up to this point, the target textbook discusses the cultures of big "C" and small "c," but given the respondents' need for additional cultural information, this may not be sufficient. Furthermore, given the strong linkages between small "c" culture and English fluency the focus on big "C" culture in English Plus 1 may need to be reassessed and acknowledged in order to develop students' interpersonal communication awareness.

## **Conclusion and Recommendations**

This research analysed a English Plus 1 primary Year 5 textbook in Malaysia to see what type of culture were covered in terms of target, source, and foreign cultures, as well as what sorts of culture were emphasized on in terms of big "C" and small "c" cultures. The target cultural contents were found to have a much greater frequency than the source culture and foreign culture. Based on the much greater proportion of target culture, it

is clear that the structuring of cultural materials is primarily aimed to improve students' awareness of the cultures of English-speaking nations. One of the 16 themes, "Holiday," for example, was observed by providing subjects such as summer vacation, Christmas holiday and winter break. The research also discovered that a preference for big "C" culture comprised education, social norms, history, and geography. There was a low proportion of cultural material with the small "c." It is possible to deduce that such limited provision of discussion on small "c" culture may be inadequate for the students to attain the goal of foreign language proficiency. The research's second goal is to examine students' perceptions of cultural elements stated in the textbook. The students were mostly in agreement that the culture of English-speaking nations was the central topic of English Plus 1. Meanwhile, they disputed that the emphasis in English Plus 1 was mostly on Malaysian culture and that of non-English-speaking nations. In terms of students' attitudes on the significance of culture and cultural and English learning, the findings revealed that the majority of students were eager to study both target and source cultures. As per the students' reasons, they viewed target cultural learning to be the most valuable part of their English, whereas source cultural learning was advantageous for them to understand Malaysian culture, allowing them to present Malaysia to foreigners in an intercultural competence context. Unfortunately, the majority of students were uninterested in learning about other people's cultures. In other words, the students did not regard foreign culture as an important component of their English subject.

The outcomes of this research may provide useful information for language classroom teaching and learning, as well as for producing instructional materials. The present study's results reveal students' preferences for both target and source cultures. However, the activity in the textbook contains just a limited amount of Malaysian culture. International authors of instructional materials should consider including cultural variety in textbooks as a way to address current lack of learning engagement, as those experienced by Malaysian students. At the same time, local textbook publishers should feel compelled at expediting Malaysian English learners' skills to express Malaysian culture by including more local cultural knowledge in textbooks. Furthermore, textbooks should give guidelines and explanatory explanations to teachers on how to impart cultural topics. As a consequence, instructors will be more conscious of the importance of cultural materials, and students will be introduced to the cultural information communicated by this affidavit. Because there was a limited percentage present in small "c" culture, writers of course resources should re-evaluate the proportion and mix of kinds of culture, with a focus on building students' language competence. In terms of topics, it was assumed that textbook writers should pay more attention to subject areas such as values, norms, holidays, gestures/body language in order to improve students' social skills, such as sociolinguistic competence and thinking skills. Special attention should be paid to the teachers' teaching approaches in order to impart cultural information to their students, as well as assist students in analysing and eliminating any barriers to cultural learning. It is critical that teachers make an extra effort to motivate pupils to learn about and become more aware of their own culture. As a result, the students are able to acquire a self-awareness of their own culture, allowing them to utilize the source culture as a basis for evaluating the contrasts and variety that exist within all cultures.

The current research looked at the English Plus 1 Year 5 English Textbook for primary Year 5 students in Perak, Malaysia. Even though research revealed some findings about the cultural contents of the big "C" and small "C"

under focus, as well as source and international culture, the conclusions on cultural orientation were based on just one textbook. To acquire a better and more complete perspective, a whole sequence of English textbooks from Year 1 to Year 6 should be explored to get a better picture of the English education journey for primary school in Malaysia. Other varieties of textbooks, such as local textbooks and commercial textbooks, should also be evaluated. In terms of cultural categories and types, it would be useful to study the cultural contents offered in commercial textbooks and local textbooks. The findings might be useful in the field of textbook editing for cultural teaching and learning. Another topic of research is the content of textbooks from the perspectives of cultural, context, and linguistics. It is argued that regardless of whether textbooks are developed to allow students to use the language in real-life situations, students must also comprehend the difference between language, context, and culture, as well as function with and delve deeper through some of the elements of setting that play a role in situations of language use (Kramsch 1993).

As this study targets a specific Year 5 primary kids from one school in Perak, Malaysia, it is hard to generalise or make inferences about comparable attitudes and perceptions across other Malaysian Year 5 primary students. The questionnaire answers may give restrained and constrained recommendations from such a tiny group. Thus, it would be beneficial to do a comparable study with a bigger number of subjects from different levels of students to see if students with different levels of English proficiency have different attitudes and views about culture learning and cultural materials in textbooks.

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## **Peculiarities of E-Learning in The Formation of Kazakh Patriotism in Adolescents on The Basis of National Values**


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**Abstract:** This article discusses some features of online learning in a personality-oriented aspect in the system of formation of Kazakh patriotism of adolescents on the basis of national values within the scientific project "Scientific and methodological foundations for the formation of Kazakh patriotism among adolescents on the basis of national values", funded by the Abai Kazakh National Pedagogical University since the beginning of 2022. A new understanding of the main scientific categories (learning activities, learning environment, learning tasks) in the conditions of modern technologized education is clarified. The diagnostic tool included one questionnaire, developed by the research team to identify the degree of awareness, personal attitude of teaching staff to the problem of patriotic education of young students and, accordingly, the level of quality of work to develop the desired personal characteristic in them. The author's questionnaire "Ideas about Kazakh patriotism" was validated by a specialist. The sample consisted of 106 respondents in random order, regardless of the age and pedagogical experience of the participants, as well as the academic disciplines taught. Of the presented 15 questions of the questionnaire (1, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15) when rounded gave a value of 0.7 (Cronbach's Alpha: 660927 and Standardized. Alpha: 669767), which corresponds to the required norm and confirms the validity and reliability. The result of the study is also the highlighted relationship of patriotism with the formed

level of spiritual and moral culture and social experience of the individual, underlying civic behavior. Highlighted as a result of observation, as an initial method of empirical knowledge, psycho-pedagogical, methodological features of e-Learning at present will allow teachers and students to adjust their activities in time to achieve their goals in the system of learning the formation of Kazakhstan patriotism based on national values.

**Key words:** modern conditions of learning, person-centered learning, technologization of education, distance learning, e-Learning, youth education, national values, patriotic education, Kazakhstani patriotism of teenagers.

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## Introduction

Modern society is dynamically developing, constantly involving the man himself in its mechanisms, placing new demands on him. At the present stage of development of modern Kazakhstan, the problem of patriotic education of teenagers is one of the priorities, since the development of the nation and the state as a whole depends on the level and nature of civic position and civic consciousness of the younger generation. Patriotic education, as a complex purposeful process of forming a high sense of patriotism, patriotic consciousness, a sense of loyalty to their homeland, its historical heritage, as well as a willingness to perform civic duty, is currently an important internal mobilizing resource for the development of society, the active civic position of the individual.

Today, for our society, patriotic education is one of the main tasks, as there is an alienation of young people from the national culture, the fall of spiritual and moral values, the loss of patriotism as one of the spiritual values of our people. Therefore, in the conditions of the modern system of education "patriotic education should become the main idea, such a core, within the framework of which high, socially significant feelings, principles, values and aspirations of the younger generation are formed" (Bakhtin, 2014). Besides, formation of patriotism, in our opinion, assumes purposeful education and consecutive development of a whole complex of positive personal qualities of the modern teenager.

The very system of the formation of Kazakh patriotism is a systematic and purposeful activity of public authorities, social institutions, including the family, to educate citizens with high patriotic consciousness, a sense of loyalty to their homeland, culture and language.

The formation of patriotism, on the one hand, is aimed at fostering such values as people, family, social



equality, justice, health, life, but at the same time is completely based on the same values.

As we know, the purpose of patriotic education is to educate a person's patriotic consciousness and behavior, which are based on universal moral and ethical values and principles of the people. We believe that it is on the basis of national values and possible formation of the Kazakh patriotism of a modern citizen, that is, a teenager. The relevance of the problem of scientific research is due to the general state of development of the issue of patriotism in the domestic and foreign scientific space and the very degree of importance of Kazakhstan patriotism for a full harmonious life of citizens in the modern world. It is well known that the main priority of the national ideology of Kazakhstan is to promote the state power to pursue a policy of implementation of the main strategic constitutional task - "to assert itself as a democratic, secular, legal and social state, the highest values of which are the person, his life rights and freedoms" (Akorda).

Kazakh patriotism as an actual problem of formation of a full healthy personality of a citizen is considered by us in the aspect of national values. In this regard, we initiated a focused comprehensive study of Kazakh patriotism of adolescents in the framework of the scientific project "Scientific and methodological foundations for the formation of Kazakh patriotism among adolescents on the basis of national values", funded by the Abai Kazakh National Pedagogical University since the beginning of 2022. This publication presents the results of the theoretical part of the study, as the initial stage is assumed, first of all, a scientific-theoretical justification of the relevance of the research problem.

It is well known that in modern scientific education in recent years more and more attention is paid to the connection between knowledge and issues of social importance. In world practice, social-science problems (SSI) - complex, often controversial issues related to the development of science and technology, the development of society as a whole - are widely recognized as an important area of the educational program, contributing to the academic and scientific literacy of students. For example, scholars L.Chen and S.Xiao have identified that today's educators partially understand the principles of teaching based on sociological problems; they lack clear strategies for dealing with various problems; and collaboration among stakeholders is necessary to support pedagogical practice (Chen et al, 2021). Therefore, these identified facts are very important to consider, especially for educational policy makers and professionals, also educators at all levels of the education system facing collaborative learning SSI.

The process of technologization of modern education also becomes relevant, which leads to an increase in patriotic feelings of students in the new IT realities. At the same time, a special role in this process is played by innovations - technologies, methods, new forms and methods of independent work, focused on independence and creativity (Knissarina et al, 2018). Thus, in foreign scientific literature the concept of "Technology-Enhanced Learning" (TEL), which means in translation "technologized learning", is increasingly used. And, according to H. Beetham, R. Sharp, technology-enhanced learning is learning with technology, including information and communication technology (ICT), virtual reality, the Internet, mobile technology, etc. (Beetham, et al, 2019). The design of active learning in technology-enhanced contexts depends on learning

activity theory to inform the development of a model of technology-enhanced learning design practice.

Therefore, the purpose of this research work is to highlight the features of e-Learning implementation in a personality-oriented aspect in the system of formation of Kazakh patriotism of adolescents on the basis of national values.

## Literature review

A scientific-theoretical analysis of the literature showed the existence of several theoretical and methodological approaches to defining the concepts of "patriotism" and "Kazakh patriotism".

In the definition of the concept "Kazakh patriotism" we cite the opinion of B. Abdygaliev "Kazakh patriotism, which can be formed on the basis of respect for the state, respect for the history, traditions, culture and language of the Kazakh ethnos itself, should be at the heart of Kazakh patriotism in the opinion of Kazakh researchers" (Abdygaliev).

Thus, in the State program on patriotic education of citizens of Kazakhstan for 2006-2008 "Kazakh patriotism" is defined as the conscious responsibility of each citizen for the fate, security, and future of his homeland (Program, 2006). Within the framework of this concept only a person brought up in the spirit of patriotism can build a healthy society and a strong state. Therefore, it must be a unique individual, ready to contribute to the building of a state of law and civil society.

The very notion of patriotism (from the Greek *Pathis* - fatherland) means a moral and political principle inherent in a citizen. Therefore, the formation of patriotism should be based on the heroic history of its own people, contributing not only to the moral development of the individual, but also to the formation of citizenship. Reliance on the traditions and achievements of our ancestors creates effective conditions for the development of the nation into the future, and in this process the role of education as the main tool for educating the next generation is great.

It is known that many famous scientists, outstanding teachers, talented writers, philosophers and publicists in their works paid special attention to patriotic education. The theme of patriotism is found in the works of Abai Kunanbaev, Mukhtar Auezov, Ibray Altynsarin, Chokan Valikhanov and many other Kazakh figures. According to the philosopher Abay Kunanbayev, true patriotism is a trinity of such factors as faith in one's people combined with fearlessness, love for one's people accompanied by real sympathy and compassion for their actions, and real practical assistance to their people. Mukhtar Auezov says the following: "Soviet patriotism is a deep thoughtful work for all peoples of their homeland, for all future generations, for fathers, for mothers" (Auezov, 1995).

M.Kozybayev has grounded his views on the role of historical science in formation of civil patriotism in

connection with formation of national idea: "As national idea which should provide normal functioning of society, the idea of strengthening of civil peace and international consent, the idea of national and all-national, all-Kazakhstan patriotism was put forward. Comprehensively emphasizing the idea of national patriotism, in our opinion, it is necessary to investigate the sources of Kazakh national patriotism, which has become an integral part of the mentality of the people. We especially emphasize this aspect because the Kazakh people have a special responsibility in the formation of pan-Kazakh patriotism, the nationwide idea of strengthening civil peace and interethnic harmony" (Kozybayev, 2000).

And according to a domestic scientist, "Patriotic education is aimed at the formation and development of a personality with the qualities of a citizen and patriot and capable of successfully performing civic duties in peacetime and wartime" (Nurligenova, 2017).

A huge contribution to patriotic education was made by Nursultan Abishevich Nazarbayev, the first President of the Republic of Kazakhstan: "Kazakhstan began the third twelve years of Independence with a great spiritual modernization. Within the framework of my program article large-scale work has begun in all regions of the country. One of the important projects being implemented on the basis of the «Рухани жаңғыру» — «Туған жер». The land on which a person was born will always be in his heart. We are all proud of our native land, miss it and take care of it. Love for the native land continues in love for the homeland, care for the native land - in care for the homeland", - said the head of state (Nazarbayev, 2017).

The specificity of our research is caused, first of all, by the necessity of studying the formation of Kazakhstan patriotism among teenagers on the basis of national values from the integrative point of view at the interface of philosophy, culturology, history, sociology, psychology and pedagogy.

## Methods

As it is known, pedagogy is a powerful influence on human education, so pedagogy should actively use in practice the education of patriotism. Since the object of our study is to highlight the features of e-Learning in a personality-oriented aspect in the system of formation of Kazakhstani patriotism among teenagers, it is necessary to clarify the meaning and content of the very concept of e-Learning. So, in recent years, one of the developing educational technologies is distance learning, fully based on information and communication technologies. The ability to gather a learning audience at a distance despite spatial and temporal boundaries is undoubtedly the main advantage of distance learning.

In contrast to distance learning, e-Learning or online learning, which implies a direct connection between the learner and the teacher using modern Internet technologies, has become very popular and even necessary.

According to the definition given by the specialists of UNESCO, e-Learning is learning with the help of the

Internet and multimedia. This means that students participate in online lectures, online classes (SPL, SROP), online seminars, i.e. all interaction with the university and teachers takes place in "online" mode, via the Internet. And e-Learning classes are defined as "the process of learning interaction in real time (video conferencing, by means of Internet messaging, negotiations by telephone)" (Academic Policy, 2020).

Particular attention should be paid to the processes of education and pedagogy as a means of personal formation. The tool which we had to test included one questionnaire which purpose is revealing of degree of awareness, personal attitude to a problem of Kazakhstan patriotism at teenagers and accordingly level of quality of work on development of the searched personal characteristic at them. The questionnaire "The ideas about Kazakh patriotism" for the pedagogical staff of the local schools was specially developed by the research group in the Kazakh and Russian languages in the framework of the ongoing research project in 2022.

The author's questionnaire "Representations of Kazakhstan patriotism" was validated and tested for reliability. A total of 106 respondents from among the teachers of different schools in the city of Almaty were questioned with the help of the online service Google Forms. The results of data of following questions out of submitted 15 questions of questionnaire (1, 5, 6, 7, 8, 9, 10, 11, 13, 14,15) when rounded gave the value of Alpha Cronbach's - 0.7 (Alpha Cronbach's: 660927 and Standardized Alpha: 669767), which corresponds to required norm.

To the question "What forms of classes are most effective in acquiring knowledge?" the following answers were offered: a) lectures; b) conversations; c) business games; d) discussions; e) others. What is distinctive, only a small number of respondents in the option "other" indicated types and forms of training in online form as the most effective. From this we made the relevant conclusion that our teachers are not yet aware of the value and benefits of e-Learning. Perhaps many educators haven't had time to take advantage of and try out interactive types of work online? Or at an insufficient level of awareness of the available possibilities of Internet applications and e-Learning in general, i.e. it indicates a low level of competence and skills of teachers in the field of IT technologies. For the 14th question on determining the "leading factors affecting the successful formation and development of Kazakhstani patriotism in teenagers" out of 100% of respondents chose: 54% - "the content of the educational process"; 27% - "the nature of educational work in school and family"; 10% - "inner psychological characteristics of personality"; 8% - "specificity of leisure and cultural activities". We believe that the preferences of respondents in the choice of the dominant factor are quite predictable and justified, because the final expected learning outcomes depend on the educational content, which is the essence and specificity of the learning process.

To the question "Who is the main role in the formation and development of Kazakhstani patriotism in adolescents?" the following was determined: 49% of respondents chose "family"; 28% of respondents gave their votes to "teachers"; 12% - to "school management"; 11% - to "the learner himself". These results demonstrate the liberal attitude of respondents-teachers towards the very process of developing Kazakhstani patriotism in adolescents, as they believe that the main role in this belongs to the family, the style and examples of upbringing, values and traditions.

## Results and Discussion

Analysis of the obtained data leads us to the idea that, in general, teachers are quite aware of the issue of shaping Kazakhstani patriotism in adolescents, are competent enough in choosing effective methods and forms of developing the studied personality quality, but they lack specific knowledge and clear guidelines for purposeful professional Kazakhstani patriotism in adolescents. Therefore, we will agree with the results of the study of his foreign colleague that educators have a common understanding of "Kazakhstani patriotism": "they felt that they were prepared for this role through meetings on a special curriculum, were not properly prepared for their role..." (Roofe, 2018).

In the educational process of pedagogical interest is also the relationship of "Kazakh patriotism" with national values, with the formed cultural and social experience of the individual, whose direct connection is obvious.

Undoubtedly, the logical consequence of the intensive development of digital technologies in all spheres of activity is the growing interest of researchers in the construction of digital citizenship (DC) in various disciplinary areas. We believe that it is necessary to expand the subject areas of study and application of e-Learning tools in order to obtain the necessary information and knowledge in the study of various scientific problematic issues.

What features of online learning have we already noticed and highlighted for ourselves? The results of the observation of teachers during the learning process in the "e-learning" mode during the quarantine associated with the pandemic 2020-2021: the lack of taking into account the work of regulation and evaluation of teachers of E-Learning, lack of understanding of the role of a teacher in the E-Learning environment, insufficient level of educational competence of teachers when implementing distance learning, not provided with the necessary ICT resources, etc.

Considering the problem of teachers' clarification in e-Learning, it should be noted that many teachers perceived E-Learning as a process of transferring electronic learning materials through the Internet. However, without this misperception, as learners need guidance from educators, as "pedagogy places the responsibility on the teacher to guide the learner toward a specific and productive goal" (Beetham, et al, 2019). Thus, e-Learning distance learning at our university is defined as "the process of interactive interaction of learning participants with each other and with the learning environment through a variety of multimedia technologies (Academic Policy, 2020). The main psychological feature of online learning in the technologized format of learning activities is the content of education itself. In this regard, only the learning activities of students and the results of their activities are important for the whole educational process (Kalinin, 2015). The need to choose an effective design of active learning in the person-centered aspect of modern education has emerged, because now there is an intensive technologization of the educational process (ICT, distance learning, virtual reality, Internet, mobile technologies, etc.). We clarified the very concept of "learning activity" in the aspect of its technologization - "concrete interaction of learners with other people through special tools and resources focused on specific

results" (Beetham et al, 2019). And we also defined important concepts such as "learning environment" - "features of the physical and virtual environment, tool resources and products given in context" and "learning tasks" - "intended outcomes of activities derived from the context" (Beetham et al, 2019).

It should be noted as a psychological feature of modern learning under the conditions of its technologization the categorical characteristic of the design of learning outcomes approved by the Bologna Process as the "basic building blocks" of higher education in the European Community (Gholson et al, 2006). Because the huge variety of knowledge, concepts, values, activities require that the available digital capabilities are properly framed in learning outcomes. And the analysis of foreign scholars has shown that all digital technologies are sufficient to achieve outcomes that do not imply a right/wrong solution.

According to foreign scholars (Laurie E.C.Delnoij, Kim J.H.Dirx, José P.W.Janssen, Rob L.Martens), incomplete higher education is a persistent problem in higher online education. The results of their study showed that learning strategies, academic self-efficacy, academic goals and objectives, institutional adjustment, employment, a supportive network, and faculty-student interaction are modifiable consistent predictors of incompleteness. And coaching, therapeutic teaching, and peer mentoring are ways to address incomplete higher education (Delnoij et al, 2020). Therefore, our primary concern as school educators is to bring the learning process itself to its logical conclusion, regardless of the accompanying educational or social goals.

Highlighting the features of online learning in the aspect of personality-centered approach in the context of systemic work on the formation of Kazakhstani patriotism in adolescents is due, above all, the need to achieve improvement in the quality of educational services.

## Conclusions

So, the first important feature of e-Learning in the aspect of personality-centered approach in the system of Kazakh patriotism in teenagers is related to the ability to choose the right way to distinguish learners from each other in learning: subject experience, knowledge and competence of learners; learning motives and expectations of learners; previous learning experience; social and interpersonal skills; digital and informational literacy of learners, etc.

The next important feature is related to the efficiency of distribution of learners. Nowadays, blended learning, which is characterized by a combination of person-oriented and group types of learning, private learning and cooperative learning, is becoming relevant.

Thus, actively used by our teachers extracurricular learning technologies are based on a wide range of educational interaction between the teacher and students: various voice systems, interactive online applications, video conferencing, chat rooms, etc.

The peculiarities of e-Learning are the effective combination of the main components of E-Learning in the educational process. The first one includes the selection and configuration of LMS (Learning Management System), which allows teachers to place educational content for the whole learning process, such as video instructions, video lectures, tests, text and presentation materials, useful links to external resources, etc. The second component is the direct interactive interaction of the subjects of training in online mode, first of all, video-conference classes (practical and lecture classes) on various platforms (Zoom, Skype, Microsoft Teams, Webex, Google meet, YouTube, etc.). I would like to note that thanks to all these tools e-Learning teachers and students have had the opportunity to manifest and develop not only their intellectual and creative abilities, but also patriotic feelings as a personal characteristic, in online classes through extensive use of all kinds of Internet applications and IT-technologies.

We believe that despite the ambiguity of understanding and acceptance of e-Learning in modern education, the learning format itself contributes to the holistic personal development of all participants in the educational process. Thus, the features of e-Learning in the personality-oriented aspect in the system of formation of Kazakhstani patriotism in teenagers require individualization, clear definition of labor intensity of learning tasks by time and content, effective selection of learning content and specification of a clear plan and scenario of each training session.

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## MALL & Teaching Writing in ESL: What do Teachers Say

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**Abstract:** The use of Mobile-Assisted Language Learning (MALL) in teaching, especially in English as a Second Language (ESL) has become an emerging trend globally. In recent years, many educators have started to deliver lessons online using the concepts of MALL, including those in Malaysia, especially during pandemic Covid-19. Writing is an important skill in English language acquisition but the review of using MALL in teaching writing is scarce. Hence, this review focuses on teachers' perspectives and readiness toward the use of MALL in teaching writing among English as a Second Language (ESL) learners. Therefore, Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines was used to extract 30 articles from the year ranging 2018 to 2022. Two databases, Google Scholar and Educational Resources Information Centre (ERIC), were used to collate the articles for this review. The findings of this review exhibited the positive perspectives and readiness among the teachers towards the use of MALL. Parents' perspectives should be taken into consideration in future research.

**Keywords:** MALL, teachers' perspectives, teachers' readiness, teaching writing in ESL

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### Introduction

Mobile assisted language learning (MALL) is a new and favoured way amongst mobile learning approaches in English Language Teaching (ELT) throughout the whole world. Rafiq, Hashim & Yunus (2021) states that findings in MALL regarding ELT are not much, in either English as a Second Language (ESL) or English as a

Foreign Language (EFL). Despite the use of mobile learning has started to become a trend in education globally, many researchers found that the teachers who know educational mobile applications efficiently are scarce, especially in the under-development countries (Hussain, Mkpojiogu & Babalola, 2020). When the skills and knowledge in mobile learning environments are taken into account, it can be said that teachers, especially those pre-service or novice ones, should have the necessary skills and competence in technological knowledge (Ristić & Mandić, 2018). There are a lot of courses taught in theory but not practically. Most of the English teachers from under-developed countries experienced the same fate, not enough exposure to technical knowledge as well as using applications in lessons (AAI, 2015). Hence, teachers are not competent in using mobile learning although it is slowly becoming a trend now and in the future.

In Malaysia, which is one of the developing countries, mobile learning has just started its journey in the education system, especially during the pandemic Covid-19. With the applications and platforms available in mobile devices such as Google Classroom platform, Google Meet, Zoom App, Youtube, Quizizz, WhatsApp, Telegram, and Kahoot, it is conducive for the pupils to continue learning at home effectively despite certain constraints (Abd Samad, Ihsan & Khalid, 2021). Therefore, the incompetence of teachers in using mobile learning as mentioned in the previous paragraph will affect their readiness in implementing it in the teaching and learning process. It is important to study the teachers' readiness and perspectives to use mobile learning in their teaching especially when blended approach or flipped classroom is applied. Teachers' attitudes on the integration of technology and its value to help students' language acquisition do have a positive effect on the application of the real technology in the classroom (Khlaif, 2017).

English as a Second Language (ESL), or also known as English as a Foreign Language (EFL) in certain countries, aims to improve pupils' English proficiency in four main skills namely listening, speaking, reading and writing. ESL teachers create and carry out various teaching and learning activities for the pupils to help them for their English language acquisition. ESL should allow non-English speaking pupils to gain long-term personal, social and academic success in learning English (Aynur & Nuriyya, 2018). The Common European Framework of Reference (CEFR) has become the main reference of ESL classrooms in a lot of countries. It was widely introduced in Malaysia in 2013 to improve English language users and to create consistency in both educational and cultural matters by providing a general framework on the English proficiency level of the language users (Nawai & Said, 2020).

The purpose of this review is to analyse and synthesise empirical research on the application of MALL in teaching writing skills among ESL learners from the past five years. Since there were many articles and reviews conducted in identifying the effectiveness of MALL in language skills from the students' perspectives but there is still a gap to be filled from the teachers' perspectives especially in teaching writing skills. Thus, two research questions were derived from the focus of this review.

RQ1: What are the perspectives of teachers towards using MALL in teaching writing amongst ESL learners?

RQ2: How are the teachers' readiness towards using MALL in teaching writing amongst ESL learners?

### **Teachers and Teaching Writing in ESL**

Writing can be defined as a way that allows pupils to communicate by sharing their ideas and feelings via a linear or non-linear text. In addition, writing can be said to be an important skill not only in the classroom, but also in daily life. In addition, acquiring writing skill does not only help students to excel in tests but also encourages them to be ready for the future and the global economy (Lim, 2013). Therefore, by mastering writing skill, it grants a lifelong holistic gain for the learners (Morthy & Aziz, 2020).

Common writing issues among Malaysian ESL learners include lack of vocabulary, tendency to translate directly from their mother tongue, incompetency in acquiring spellings that eventually leads to poor sentence structure and grammatical errors. Ghulamuddin et al. (2021) has agreed that most Malay primary school students encountered writing difficulties due to poor mastery in vocabulary, inability to spell words correctly and L1 interference. Siddek & Ismail (2021) also supported the issue regarding interferences of L1 among primary ESL learners that hinders their cognitive ability to organise and structuring the ideas in sentences. Lack of exposure to English language and interference of mother tongue contributed greatly to constant error-making in both sentence structure and grammatical aspects of writing. Harun and Abdullah (2020) evidently posited the influence of interlingual and intralingual causes the pupils to make a lot of errors in their writing. All these factors may affect ESL learners' motivation and interest towards acquiring basic writing skills.

When the teachers are unable to apply the suitable way of giving lessons, pupils' interest in language acquisition are at a minimum level which shows that the teachers did not manage to provide a suitable environment to motivate them. Later on, it might cause language learning to not take place effectively, especially in writing skills (Morthy & Aziz, 2020). The teaching method that is conducted by the educators does not aid in providing a happy and meaningful learning environment (Li & Yee, 2017). Fun teaching and learning ways that cater the students' learning styles should be practised by hoping to increase their motivation in mastering the language they want to learn (Li & Razali, 2019). Hence, mobile learning can be a fun tool that includes happy and meaningful language games that immerse pupils into a healthier thinking process (Hussain et al., 2020). Therefore, it is vital that the level of teachers' competency in the use of mobile learning tools are up to par in order to aid pupils who are facing difficulties in enhancing their writing skills. In order to achieve the objective, it is pertinent to ensure that teachers are fully ready and equipped with sufficient knowledge to navigate through and apply the use of mobile learning in teaching writing.

### **Teachers and M-Learning from Information and Communication Technology**

The use of ICT in ESL classrooms are helping not only the pupils in learning, but also the teachers in teaching. Fučeková & Metruk (2018) stated that Information and Communication Technology (ICT) can be an effective tool in aiding learning English and also within formal teaching practice. With the integration of the m-learning approach, teachers are able to produce teaching materials that are both creative and convenient, as well as to suit their pupils' level of proficiency and indirectly to improve their English language acquisition. The Ministry of

Education Malaysia (2013) has emphasised the importance of using ICT through the introduction of Malaysian Education Blueprint (2013-2025). The ministry hopes to fully utilise the use of ICT for self-paced learning and distance for expanding access to high-quality teaching across Malaysia, as stated in the seventh shift to transform the education system. In order to fulfil the aspiration of the ministry, educators have moved from e-learning to m-learning approach (Ismail et al., 2020) in carrying out their lessons due to the ubiquitous and feasibility of m-learning approach.

Teachers play a vital role in maximising learning outcomes and potentials among the students by integrating m-learning into their lessons. There are many challenges faced by the teachers in integrating m-learning into their lessons. One of the most prominent challenges is the teachers' competencies and perceptions towards the use of m-learning (Betancourt-Odio et al., 2021). Many teachers feel reluctant and still in denial to accept the new learning culture. They opposed the change of trend in employing new technologies into their teaching and learning sessions. They have a strong belief that conventional teaching is more effective compared to m-learning approach. Furthermore, teachers' competencies towards handling the mobile devices per say as well as the integration of the mobile devices into their lessons are still viewed as a major concern. Insufficient guidance and training somewhat are the factors that were affecting teachers' competencies towards the use of mobile in language learning. The study conducted by Khan et al. (2018) evidently yields that the lack of required skills among most teachers hindered the process of developing MALL-based activities for ESL learners.

### **Teachers and Mobile Assisted Language Learning (MALL)**

The use of digital devices has become an essential part in every person's life in the entire world. The use of m-learning in education has become a trend in recent years, showing that it is a useful method applied in solving the current problems of education during and after this pandemic era. Many countries have begun to incorporate mobile learning into their educational systems as one of the ways toward ensuring educational quality and equity in order to promote wholelife learning possibilities for all, as asserted in the Sustainable Development Goals (SDG). United Nations stated that this heightens the essential of education in encouraging and helping future industries, moving towards the year 2030. Stockwell (2012) also stated the importance of mobile learning by saying "mobile learning will continue to take on new shapes and forms as it becomes more familiar to both teachers and learners". Grimshaw et al. (2017) agreed that MALL provides both educators and learners with a lot of useful resources to improve the learning process.

There are quite a number of studies that explore the effectiveness of MALL towards various language skills including writing skills ranging from primary up to higher level education. John and Yunus (2019) conducted a study on learners' writing competence increased significantly with the use of different writing mobile applications. It is proven that the learners not only show positive attitudes towards the writing tasks but they really enjoyed the lessons since it is more interesting compared to the traditional method of teaching writing. Al-Hamad et al. (2019) posited the effectiveness of utilising WhatsApp for developing writing performances among teenagers. The study conducted by Abd Karim et al. (2020) on the use of Mobile-assisted Mind Mapping

Technique Model (MMMTM) towards enhancing Malaysian university students' English writing performance. The result of the study proved the model MMMTM, which also underpinned MALL, impacted positively on students' motivation, critical thinking and creativity in writing apart from augmenting their writing performance.

Since the pandemic Covid-19 in 2020, more teachers have created their own channels on YouTube and became education influencers on TikTok for a good cause of sharing their teaching materials including English language for primary and secondary schools. Although some teachers have started sharing on other platforms such as Blogging and Facebook even before 2020. These sharing allow the pupils to learn and acquire English language using mobile devices at any time and anywhere. That is how mobile learning has started to play a vital role in the ESL classrooms.

### **Teachers and Their Perspectives**

It is essential to collect teachers' perspectives in order to ensure whether an integration is successfully implemented. Every teacher has different experiences, background, academic levels and also point of views. All these will lead to different perspectives and opinions. This allows the researcher to understand how far an integration, in this case, MALL, is applied in teaching writing for ESL learners.

Teachers are the frontliner in the education field. They are the ones who carried out all sorts of education policies that were introduced by the ministry. They are the ones who conducted the lessons with the most suitable methods to cater the pupils' needs. The ease of use and the effectiveness of MALL are the main gists through teachers' perspectives. As teachers are the doers, they know how easy it is to implement MALL in ESL classrooms. Apart from that, assessments are carried out in the lessons, be it either formative assessments or summative assessments. From there, teachers can measure how well the pupils learnt certain topics with the integration of MALL in the lessons. This directly implies how effective it is to use MALL in teaching writing in ESL classrooms. Teachers' perspective should not be neglected as it serves an essential part in deciding the ease of use as well as the effectiveness of implementing an integration.

### **Teachers and Their Readiness**

The readiness of teachers in accepting a new trend is crucial apart from teachers' perspectives. As different teachers have different perspectives, they will have different level of readiness too. How well the teachers are ready to apply MALL in ESL classrooms decides how fast the pupils adapt themselves in the MALL environment.

The teachers' readiness can be seen from two factors: challenges and motivation. The challenges faced by teachers will determine whether they want to keep using the integration. If the teachers are able to face the challenge, they are ready to apply MALL in teaching writing as far as they can. In addition, the motivation received by teachers will also decide on how frequent they use the integration. The motivation here divides into

two which are internal and external. Internal factors include the attitude of the teachers that is willing to learn and accept new methods of teaching. External factors include the training sessions provided by the respective departments in order to support the teachers theoretically and practically for implementing MALL in ESL classrooms. Hence, teachers' readiness is another important element that should be looked into in order to know more about the integration of MALL in teaching writing.

**Method**

According to Pittway (2008), some of the key principles of a systematic literature review are transparency, clarity and extensive findings to facilitate the selection criteria of a journal. This finding is known as systematic review. It is based on the method of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The four stages of this method are shown in Figure 1. PRISMA is one of the researchers' favourite methods for its easy to understand and easy for adaptation to other studies. Thus, the objectives of this review study and the process of the systematic review are shown below.

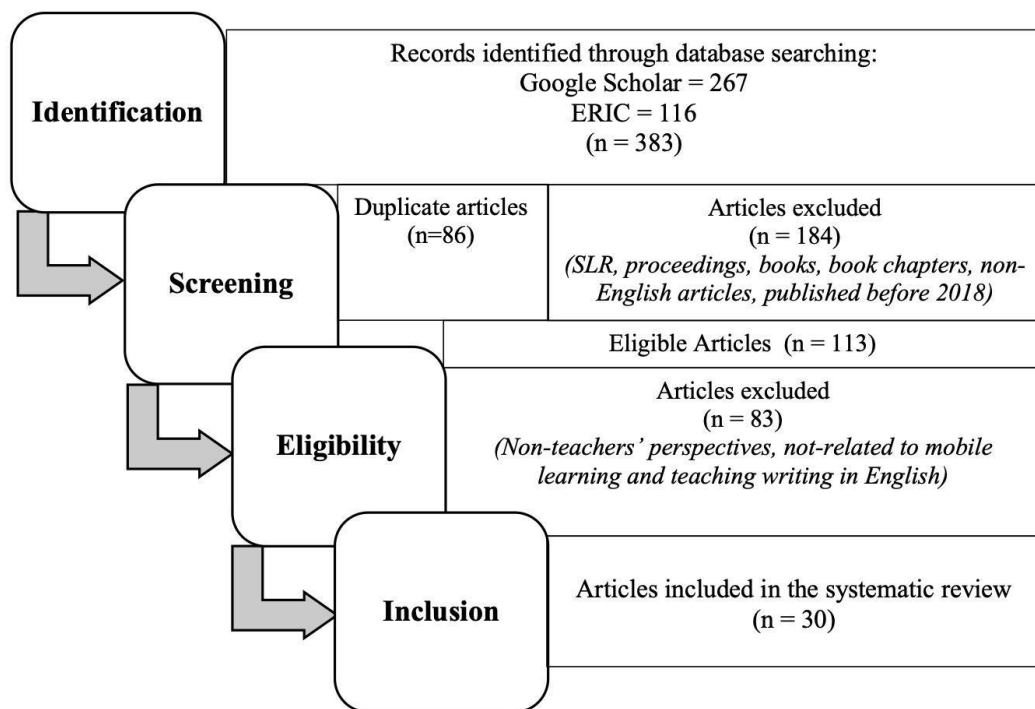


Figure 1. Steps of the systematic review based on PRISMA

**Identification**

In this systematic literature review, Google Scholar and ERIC were used as the main and only databases. The articles collected were from 2018 to 2022, which is the recent 5 years. Google Scholar is a database that stores the metadata of scholarly articles across various publications worldwide. On the other hand, the Education

Resources Information Centre (ERIC) is more like an online digital library that allows researchers to access different journals from different study fields. A total of 383 articles have been found from the two databases. The keywords used when browsing and collecting the relevant articles are as listed in Table 1 below.

Table 1. The keywords used in this review

Databases	Keywords
ERIC	Mobile Assisted Language Learning AND teaching writing, Mobile Assisted Language Learning AND teachers' perspective, Mobile Assisted Language Learning AND teachers' view, Mobile Assisted Language Learning AND teachers' motivation, Mobile Assisted Language Learning AND teachers' readiness, Mobile Assisted Language Learning AND effectiveness
Google Scholar	Mobile Assisted Language Learning AND teaching writing, Mobile Assisted Language Learning AND teachers' perspective, Mobile Assisted Language Learning AND teachers' view, Mobile Assisted Language Learning AND teachers' motivation, Mobile Assisted Language Learning AND teachers' readiness, Mobile Assisted Language Learning AND effectiveness

### Screening

The articles found from both databases, ERIC and Google Scholar had included duplicates. Hence, 86 articles were filtered according to the criteria. All these filtered articles were then screened based on the criteria as shown in Table 2. There were 184 articles eliminated in this screening process.

Table 2. Criteria for screening phase

Criterion	Inclusion	Exclusion
Type of article	Research article	SLR, proceedings, books, book chapters
Language	English	Non-English
Year	2018-2022	<2018

### Eligibility

In this stage, the remaining articles were reviewed for eligibility, and they had to achieve the criteria outlined in the inclusion part. The purpose is to verify that the result acquired in this review was of high reliability and quality. A total of 83 articles were then removed from this review.

Table 3. Criteria for eligibility phase

Criterion	Inclusion	Exclusion
Type of article	Research article	SLR, proceedings, books, book chapters
Language	English	Non-English
Year	2018-2022	<2018

## Inclusion

The articles for this study encompassed mobile learning and teaching writing in English. There were 22 articles selected from Google Scholar and 8 more were chosen from ERIC. These journals were chosen based on the features and aims of the articles, especially in the education industry. The objectives of the journals chosen were all connected to mobile learning and teaching writing in English.

## Results

The results of the research articles found in the previous process will be analysed in detail in this section. Due to the objectives of the respective study, 30 articles were selected to be used in this review after the selection of relevant articles for this study. From the articles, teachers' perspectives and teachers' readiness on the integration of mobile learning to teach writing could be seen, mainly, ease of use, effectiveness, challenges, and motivation. The results were tabulated as seen in Table 4.

Table 4. Aspects of teachers' perspectives and readiness on mobile learning in teaching writing

Authors/ Articles	Teachers' Perspectives		Teachers' Readiness	
	Ease of Use	Effectiveness	Challenges	Motivation
Abd Karim et al. (2015)	✓	✓		✓
Aghajani & Adloo (2018)		✓	✓	✓
Al-Hamad et al. (2019)	✓	✓		
Al-Shehab (2020)		✓		✓
Azar & Tan (2020)	✓		✓	
Betancourt-Odio et al. (2021)	✓		✓	
Bozorgian (2018)	✓	✓	✓	
Cahyono & Astuti (2018)		✓		
Cakmak (2019)	✓			
Chung et al. (2019)	✓	✓	✓	



Dewi et al. (2020)	✓			✓
Fučeková & Metruk (2018)	✓		✓	
Gharehblagh & Nasri (2020)		✓		✓
Hosseinpour et al. (2019)	✓	✓		
Imelda et al. (2019)	✓		✓	
Kee et al. (2021)	✓			✓
Khan et al. (2018)			✓	
Khlaif (2017)	✓			
Krisbiantoro & Pujiani (2021)	✓	✓	✓	
Metruk (2020)	✓	✓		
Nikopoulou et al. (2021)			✓	✓
Nuraeni (2021)		✓	✓	✓
Qarkaxhja et al. (2021)			✓	
Ristić & Mandić (2018)		✓		
Rusli et al. (2019)		✓	✓	
Saragih & Jaelani (2020)	✓			
Sari & Sulistyono (2022)			✓	✓
Solihin (2021)			✓	
Vo & Vo (2020)	✓	✓	✓	
Woon & Yunus (2018)	✓			✓

Table 5 and Figure 2 below depicts the analysis on the number of journal articles discovered on Google Scholar and ERIC in accordance with this systematic review.

Table 5. Number of journal articles based on different perspectives and readiness

Perspectives and Readiness		Number of Journal Articles
Teachers' Perspectives	Ease of Use	18
	Effectiveness	15
Teachers' Readiness	Challenges	16
	Motivation	10

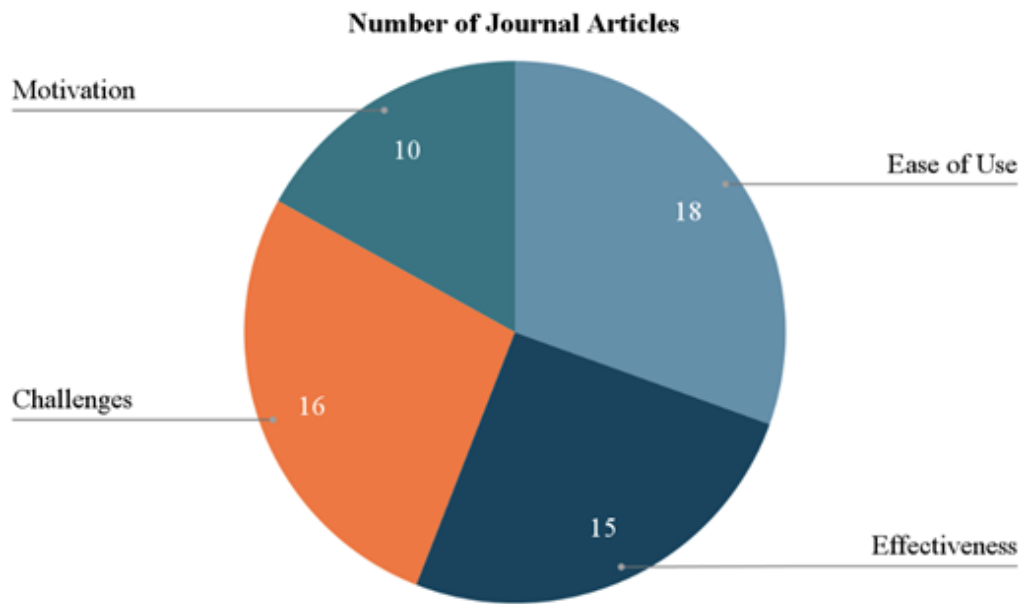


Figure 2. Number of Journal Articles

## Discussion

This section will further discuss teachers' perspectives and readiness to use MALL in teaching writing in four main areas: ease of use, effectiveness, challenges, and motivation. These discussions are based on the two research questions.

### Teachers' Perspectives on the Integration of MALL in Teaching Writing

Teachers' perspectives towards the application of MALL in teaching writing were viewed in two major aspects which are ease of use and the effectiveness. 18 of the 30 papers found in the final phase of this systematic literature review (SLR) examined the MALL's feasibility to teach writing from teachers' perceptions. This accounted for 55.9 percent of teachers' considerations in deciding the use of mobile-assisted digital tools in their writing classes. Sari & Sulisty (Sari & Sulisty, 2022) said that teachers think MALL is quite user-friendly as it is appropriate for all users (Abd Karim et al., 2020; Nuraeni, 2021; Vo & Vo, 2020). Kee et al. (2021) has also supported the stance on teaching writing using digital applications, underpinning MALL, which can be accessible by both teachers and students at anywhere and anytime. They further asserted that MALL made it easier for teachers to create suitable writing materials and provide continuous guidance towards students' writing practices. Rusli et al. (2019) posited that teachers agreed on the fact that with the use of social media could help them to ease their burden in preparing hardcopy materials for writing since most students are able to get direct access to digital writing materials and only at their fingertips using their mobile devices. However, Bozorgian (2018) and Saragih & Jaelani (2020) stated the teachers' concern regarding the internet connectivity as the students still need to have a good internet connection in order to swiftly access the digital materials as

well as to participate in the writing lesson. Therefore, it is vital for teachers to look into all aspects of the use of MALL including the hindrances that might make teaching writing not accessible to all their students. This eventually will impede students' learning potentials and opportunities.

Furthermore, a total of 15 out of 30 articles discussed the effectiveness of using MALL for teaching writing. There were many articles on the effectiveness of MALL from the students' perspectives compared to the teachers' view. However, after reading through all the articles, there are a few studies that have embedded teachers' view in their discussion even though it wasn't emphasised as a whole. Hence that summed up to the findings of 15 articles on the effectiveness of MALL in writing. Teachers from different countries agreed that MALL is very useful in enhancing teaching writing since it is more student-centred, meaningful, authentic and interactive (Abd Karim et al., 2020; Aghajani & Adloo, 2018; Al-Shehab, 2020; Azar & Tan, 2020; Purwaningrum, 2019; Woon & Yunus, 2018). Aghajani & Adloo (2018) has proven that their students showed significant improvement in their overall writing performances as well as in their acceptance in cooperative learning through using Telegram. With the use of MALL teachers and peers are able to provide instant feedback to their written work (Aghajani & Adloo, 2018; Al-Hamad et al., 2019; Al-Shehab, 2020; Chung et al., 2019; Khan et al., 2018). Meanwhile, Hosseinpour et al. (2019) has evidently proved that Edmodo mobile application has a tremendous influence on the higher education learners' writing proficiency where it has impacted positively in terms of students' active participation and boosting their confidence in writing.

Overall, it can be concluded that most teachers share the same opinion that MALL is definitely efficient and rather effective for English language teaching (ELT) especially in writing skills, since the current generation, GenZ, has grown more tech-savvy. Besides, the booming advancements of smartphones has increased the need to move our teaching writing strategies in line with the latest trend.

### **Teachers' Readiness on the Use of MALL in Teaching Writing**

On the other hand, teachers' readiness on the use of MALL in teaching writing were determined through two main aspects which are challenges and motivations.

There were a total of 16 out of 30 studies reviewed on the challenges that the teachers had encountered while using MALL for teaching writing. Metruk (2020) claimed that teachers viewed the use of MALL as a distraction for students. This is due to the interactive and social features that can influence students to be less attentive as well as engaged in social networking and ping-pong instead of devoting their time mobile phone usage time for writing practices and learning purposes in general. Khan et al. (2018) and Solihin (2021) through their study has revealed that teachers' incompetencies of utilising mobile devices in ELT is a drawback of MALL. There are still some teachers using age and time constraints as the reasons for their incompetency in technology skills. These issues mentioned hinders teachers' readiness in maximising the use of MALL for teaching writing. However, teachers ought to perceive these issues as a challenge for their professional development and increase self-efficacy towards using MALL (Rusli et al., 2019; Sari & Sulisty, 2022). Besides, teachers should be

determined to find long-term solutions in order to solve the issues they encounter while using MALL since it is strongly beneficial towards students' writing competence and language proficiency.

Apart from that, a total of 10 articles have mentioned the aspects of motivation that contribute to teachers' readiness. Teachers with lesser years of experience in education have higher preference of using m-learning in the classroom compared to the senior teachers. New teachers are highly motivated in moving their pedagogical approaches according to the latest advancements specifically in using mobile devices for ELT. However, teachers as the agent of change ought to be ready for constant transformation in education as well as actively involved in providing the best learning environment for the students. MALL is seen as a convenient tool in preparing materials for teaching writing (Dewi et al., 2020; Kee et al., 2021; Saragih & Jaelani, 2020), providing instant feedback (Cakmak, 2019); Sari & Sulisty, 2022) as well as in facilitating students' writing competence especially in sentence constructions (Chung et al., 2019; Miin et al., 2019; Morthy & Aziz, 2020), grammatical components (Dewi et al., 2020) and stimulating their writing ideas (Abd Karim et al., 2020; Al-Hamad et al., 2019; Krisbiantoro & Pujiani, 2021; Purwaningrum, 2019; Rusli et al., 2019). Since MALL is seen as a convenient and practical tool, therefore teachers' motivation on the use of MALL to teach writing is elevated. Kee et al. (2021) posited teachers' preferences of using social media like WhatsApp, Facebook, Google Doc and WordPress to teach writing. Vo & Vo (2020) claimed that most teachers are ready in terms of learning to use MALL in ELT as well as to implement it in classroom activities. This exhibits the motivation among teachers in upscaling their ELT especially in teaching writing so that every student is given the opportunity to excel in their writing performance.

In short, most teachers are willing and ready to use MALL in their ELT including teaching writing as they believe that teachers are the agent of change to promote better learning opportunities for their students. Teachers' readiness also depends on the level of their students' readiness. In the study conducted by Qarkaxhja et al. (2021), they clearly stated that as long as students are well equipped with both mobile devices and good connectivity to the internet, teachers will be more prepared to fully utilise the m-learning approach in the classroom. Besides, teachers are convinced with the effectiveness of MALL in ELT and how it has impacted positively in students' language performances.

## Conclusion

This systematic literature review has analysed papers connected to teachers' perspectives and readiness towards the use of MALL for teaching writing. Two databases, namely Google Scholar and ERIC, were used in determining the 30 articles after the inclusion and exclusion criteria above. Teachers' perspectives were analysed from two different perspectives which are ease of use and effectiveness. There were 18 articles dwelled on the aspect of ease of use, while 15 articles discussed on the aspects of effectiveness of MALL in teaching writing. Meanwhile for the aspect of teachers' readiness, it was analysed based on their motivation and challenges that they encountered in using MALL for teaching writing. 16 papers reviewed on the challenges that

the teachers had encountered while using MALL for teaching writing, while 10 papers touched on the aspect of teachers' motivation towards using MALL.

The findings show that teachers have high strong positive opinions upon MALL and its application in ELT because it is viewed as beneficial for the students in all aspects of writing including writing competency and proficiency as well as boosting their interest and confidence in writing. Moreover, this review has posited teachers' belief on the efficiency and feasibility of using MALL in ELT especially in teaching writing. The results of this review also have identified that most teachers were also keen to learn and ready to MALL in ELT. In a nutshell, based on the deep analysis of each of the articles, MALL is widely viewed as an approach by the teachers as an easy-to-use and effective tool, thus making them ready and motivated to brace any challenges in utilising MALL for teaching writing. This is because most teachers view the challenges of using MALL as a source of motivation to fuel their professional development, allowing them to serve their students with the best yet current strategies and approaches in teaching writing. In short, this strongly proves that MALL has given a positive impact on English teachers from various countries, and they are willing to accept the MALL approach.

It is crucial for all stakeholders in the education field to realise and acknowledge the high possibility of utilising mobile devices in enhancing the learners' education in various levels, typically in the current 21st century. They ought to acknowledge the significance of MALL, under the bigger umbrella term of M-learning, for enhancing students' language competency and performance level. Hence, the two research questions of this systematic review are answered. Furthermore, it can be concluded that based on the teachers' perspectives, MALL is considered an effective and convenient to use for teaching writing. This subsequently impacted positively towards their readiness in using MALL for not only teaching writing but also for other language skills.

### **Limitations & Challenges**

There were a few limitations of this study that needed to be addressed in the future in case any other researchers want to do deeper research on this study. Since this study has only reviewed 30 articles from Google Scholar and ERIC, due to time constraints, there might be many more journals that can be found in other databases such as SCOPUS and WoS. By expanding the search from various databases and collecting additional views and opinions from other scholars, it would be more interesting to exhibit the different schools of thoughts and results.

The second limitation of this study is that there was not much research done on teachers' perspectives because researches related to MALL for teaching writing are geared more towards students' perspectives. Based on the findings, student's perspectives on using MALL for improving writing skills were given much priority but undeniably the fact that teachers' voice and views are equally important to be heard off. Hence, this makes the findings from this review reliable and notable.

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## Integrating The Values of Leadership in Public Educational Policies For Training Nurses

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**Abstract:** Nurses are a vital resource of health care systems, a resource that must be valued, bearing in mind that their work has a role in social indicators of health, and also determines topics such as equality and equity, fairness and justice, which support the kind of societies we all want to live in. In the training process, they learn, in the middle of a team, to plan, to put into practice and evaluate general medical care based on acquired knowledge and skills. Future nurses must not only be prepared to meet the needs of the individual, the family, the community, but also to have confidence in their own intellectual and clinical abilities so that they can work responsibly and autonomously, facing at the same time with increasingly complex requirements of healthcare. The refinement of medical training is subsequently achieved by developing the ability to solve problems, to make decisions, to practice leadership in medical care. The acquisition of leadership skills has been identified as a need in training nurses, both from the researches of internal and international professional bodies and from those of clinical units. By harmonizing this need with public educational policies, the unit of learning outcomes *"Leadership and professional communication"* was implemented in the professional training standard. This paper aims to gain insight into the relationship between the values of leadership and the development of a good educational policy in training nurses, with a fundamental impact on the provision of health care in an efficient, integrated and safe manner for the patient.

**Keywords:** Nurses, Leadership, Educational policies

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### Introduction by short descriptions of used terms Nursing

The concept of *nursing* is one of the philosophies that has evolved with the evolution of human society, starting, historically speaking, with Florence Nightingale (1860), who paves the way for public health as the founder of modern nursing, continuing with Virginia Henderson's need theory (1960), and followed by Marjory Gordon's

functional health models (1982). By definition, nursing means caring. It is a profession within the health care sector focused on the care of individuals, families and communities so they may attain, maintain or recover optimal health and quality of life. Nursing and caring are grounded in a relational understanding, unity, and connection between the professional nurse and the patient.

Task-oriented approaches challenge nurses in keeping care in nursing. This challenge is on-going as professional nurses strive to maintain the concept, art, and act of caring as the moral centre of the nursing profession. Keeping the care in nursing involves the application of art and science through theoretical concepts, scientific research, conscious commitment to the art of caring as an identity of nursing, and purposeful efforts to include caring behaviours during each nurse-patient interaction. Thus, in the *training process*, nurses need not only be prepared to meet the needs of the individual, the family, the community, but also to trust their own intellectual and clinical capabilities so that they can work responsibly and autonomously, while at the same time facing the increasingly complex requirements of healthcare.

Educational results should enable the student, the future nurse, to select information in order to assess, plan, implement and evaluate nursing care. Such a result can be achieved by developing a proper professional training standard that creates a relevant and useful teaching and learning environment for both students and teachers.

### **Educational policy**

*Educational policy* represents a set of programs, activities, measures aimed to address some basic human needs for education, among others, as social protection, health, housing and - generally – the increase of social wellbeing by (re)distribution of resources considered to be relevant (money, services, time, etc.).

There is a growing recognition that a sufficient, adequately trained and well-motivated nursing workforce is essential for the health of the world's population. Equitable access to good quality health services cannot be obtained without having an adequate number of properly trained nurses. As a result, a solid functional relationship between the educational and medical sectors is vital.

The ability of professional training programs to prepare clinically competent nursing graduates is a permanent challenge for all actors involved: students, teachers, schools, clinical units, local authorities, line ministries, national and international professional organizations. The simple increase in the number of personnel in the field is not enough to improve the safety of patients and the quality of care provided to them.

### **Leadership**

*Leadership*, which must be considered as a means and not an end, has effects on all organizational, social and personal processes in an organization. Leadership in an organization means, among many others, vision, encouragement, enthusiasm, energy, passion, but also adequate communication with organizational members from different cultural backgrounds, an understanding and correct use of language and cultural symbols, respect

for diverse cultural customs and traditions. A good leader today is the one who has the necessary knowledge and skills to communicate with people from all corners of the world, using appropriately all possible communication means and channels and all technological innovations.

So, this paper will discuss how these values were translated at the level of specific educational programmes for the training and professional evaluation of nurses, as well as in specific programmes dedicated to internalizing the values.

### **Discussion: Is it necessary and is it relevant for future nurses to be trained about leadership?**

In Romania, the nurse's training program has gone through several stages closely related to demographic, medical, social and economic factors. During the period of 1978 - 1994, there was the Sanitary High School, with a duration of 4 years, after a previous 8-year basic training, obtaining the title of "Medical Sister". Later, considering, in particular, the emotional impact generated by pupils' early contact with the suffering of patients, with their image in situations of weakness, helplessness, inability, morbidity and mortality, since 1998, the educational system has moved to a new stage: Post-High Sanitary School, with a duration of 3 years, after a previous 12-year basic training, obtaining the title of "General Medical Assistant" or "General Nurse". From 1998 to 2007, the training program was adapted to the European principles through the EU PHARE VET program RO 9405 and the strategic objectives of the reform program in vocational and technical education in Romania.

Consequently, the accession of Romania to the European Union and following the specific stages of European recognition of the General Medical Assistant qualification, qualification obtained in Romania, there were significant changes in the structure of the training program. As a result, the educational policies in Romania were aligned with those of the European Union through a new training program for nurses in the following period 2007-2018, in compliance with the provisions of 2005/36/EC Directive.

Starting with 2018, taking into account the changes brought by the 2013/55/EU Directive regarding the recognition of professional qualifications, the training program went through a new qualitative and quantitative transformation. The main improvement in building the training format was the more accurate definition of the Professional Training Standard. This is the document that describe the results that a participant in a training program carried out in vocational and technical education, has to hold at the end of it.

Briefly, the picture of the changes made by the Romanian Nurses Training Program starting from 1978 and up to now, shows an adaptive evolution both to the needs of the health system and to the requirements of the labor market, regarding the following aspects: type of school, duration of the program, number of hours, objectives, structure and descriptors of the curriculum.

In present time, by pursuing an active and continuous training program that includes 4600 hours of theoretical and practical training, the graduate of the post-secondary sanitary school, will have the following basic professional competences, covered by the EU/55/2013 Directive:

- *The competence to independently diagnose necessary medical care, based on existing theoretical and clinical knowledge, and to plan, organize and implement healthcare in treating patients based on acquired knowledge and skills to improve professional practice ) (a)*
- *The competence to collaborate effectively with other actors in the health sector, including through participation in the training of health personnel on the basis of acquired knowledge and skills; (b)*
- *The ability to provide individuals, families and groups of people with information enabling them to have a healthy lifestyle and self-management on the basis of knowledge and skills acquired; (c)*
- *The power to independently initiate immediate measures for the maintenance of life and to apply measures in crisis or catastrophe situations; (d)*
- *The power to provide independent counseling, guidance and support to carers and close persons (e)*
- *The competence to independently ensure the quality of health care and its assessment (f)*
- *The competence to ensure exhaustive professional communication and to cooperate with members of other health professions (g)*
- *The competence to analyze the quality of the assistance provided to improve their general nurse medical practice (h)*

All these goals have been generated through the development of the nursing process, which has gained new dimensions: the role of the nurse has become more complex, one of the tasks being to diagnose and determine the proper therapeutic attitude. The individual is appreciated holistically as a person with physical, emotional, psychological, intellectual, social and spiritual needs. All these needs are interdependent, equally important and represent the basis of the nurse's interventions according to the nursing diagnosis.

Taking into account these prerequisites, the curriculum development involves thinking and structuring the actual learning situations in which students will be involved, acting as requiring prefiguration of the learning experiences that they will undertake. The educational results must allow the student, the future nurse, to select the information, to make possible the appreciation, planning, implementation and evaluation of the nursing care. But, first of all, a future nurse must learn to communicate!

The communication process is very important because the following actions can be carried out: coaching, counseling, coordination, guidance, evaluation and supervision. The chain of understanding is the one that integrates the members of an organization, from the top to the bottom, from the base to the top, from one end to the other. Table 1 presents a comparison by analogy, between the hierarchy of needs of Maslow's pyramid (A. H. Maslow, 1943) - as a theory of motivation - and the hierarchy of communication levels in training nurses.

Table 1. Correlations between 5 needs and 5 levels of communication

Needs of Maslow's pyramid	Level	Levels of communication development	Correlations
<i>Physiological</i>	1	<i>Communication</i> (definitions, types, process, purpose, role)	<i>Learn to communicate</i> (primary need)
<i>Safety</i>	2	<i>Professional communication</i> (sources of information, specific terminology, selection of information, dysfunctions in communication, expression of opinions and listening strategies)	<i>Can communicate</i> (feeling safe)
<i>Belonging</i>	3	<i>Communication in the medical team</i> (the concept of group/belonging, norms of behavior, status, objectives, principles, coordination and communication networks)	<i>Know how to communicate</i> (feeling understood, having a common language and belonging to a group)
<i>Self-esteem</i>	4	<i>Therapeutic communication</i> (information analysis, confidentiality, respect for boundaries, active listening and observation, counseling people)	<i>Adapt communication to different contexts</i> (having self-esteem, receiving respect and recognition, building reputation)
<i>Self-fulfilling</i>	5	<i>Leadership in the medical team</i> (data management and evaluation, problem solving, decision making, autonomy)	<i>Giving direction, through communication, by using my own influence, authority and expertise, to achieve the pursued objectives</i> (active participation in increasing own performance, communication and organizational culture)

Similarly, Figure 1 shows the correlations between the needs in Maslow's pyramid and the levels of communication. Therefore, the premise of training a leader is the ability to communicate. A good communication plan is an essential part of any management. It is essential that all participants in the activities of the organization are informed about the aspects of interest of their work. Most of the problems that appear within organizations are the direct result of failure in communication, which creates a state of confusion and can lead a good plan to failure. And, as usually, a good plan is the platform for developing the vision of a leader, who will lead his team towards the achievement of well-defined objectives and goals. The team, of which the nurse will undoubtedly be a part, is open to communication. Team members feel that they can express their

opinions and feelings, without fear. Listening is as important as speaking. Thus, differences of opinion are appreciated and conflict resolution methods are understood. Through honest and thoughtful feedback, people learn their strengths and weaknesses, as members of a team. In this way, an atmosphere of trust and acceptance is created, and a sense of community is built, so each member of the team can reach their potential.

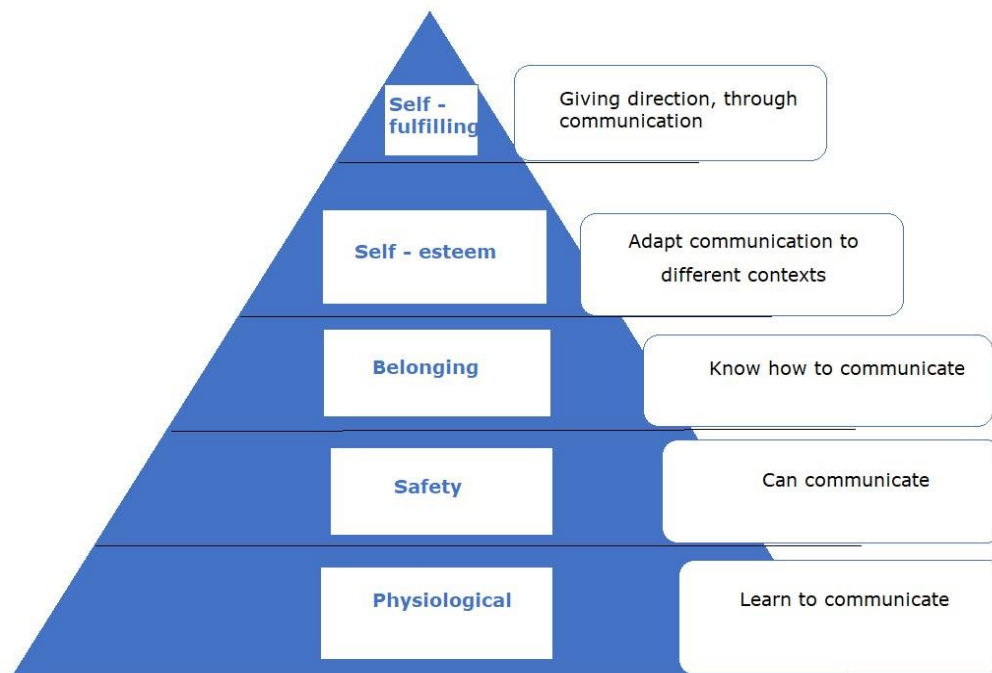


Figure 1. Transposition of the communication levels in Maslow's pyramid

## Method

Finding the need to implement the values and principles of leadership in training of nurses, was initially carried out by the graduates, who accessed career promotion by obtaining the professional degree immediately superior to the beginner degree. Most of them, after that, were appointed to management positions (head assistant, medical care manager) and consider that learning leadership skills during schooling, would have been very useful both in completing tasks and in solving problems from every day, as well as in the context of management positions obtained.

Following the collected observations, questionnaire-based research was initiated at the school level to determine more precisely the degree in which leadership brings added value to a future nurse. The questionnaire contained the question: *"How useful would it be to introduce a learning unit about leadership into the training program?"* and was applied to a number of 968 graduates registered for the main degree exam in September 2017 (group A) and to a number of 320 students of the school in the final year of study (group B), between September 2017 and January 2018. Analysis of the data obtained will be presented below as percentage values, according to the way the original scale was used (Yes/No/I don't know).

The results are contained in Figure 2 and Figure 3.

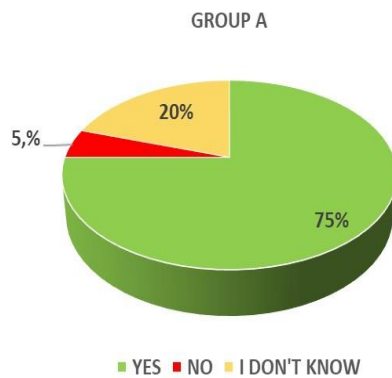


Figure 2. Results in group A

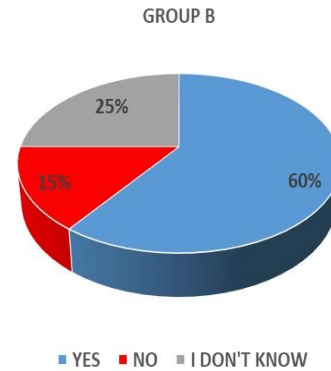


Figure 3. Results in group B

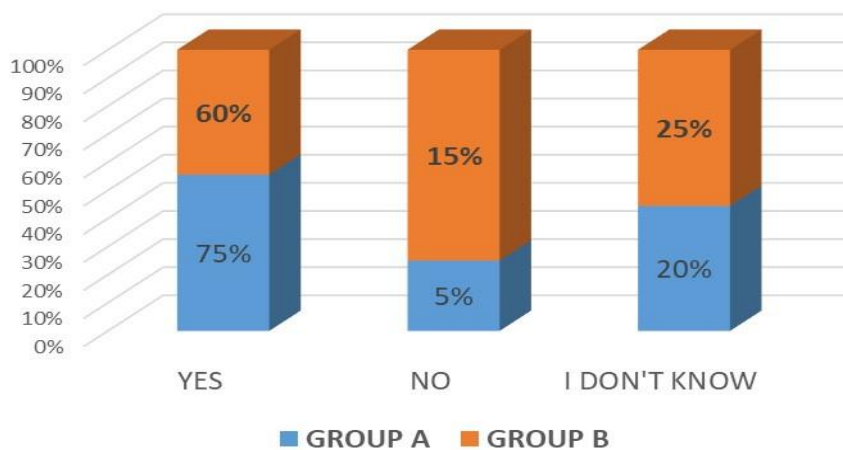


Figure 4. Comparison of the results in group A and group B

As a result, through consultation with similar schools in the country, national curriculum commission, sectoral committees, professional associations, profile organizations and other regulatory bodies and in conjunction with the provisions of directive 2013/55/EU, a new Professional Training Standard (PTS) and a new Curriculum (CRR) for training of nurses were developed, which applies starting with September 2018 (OMEN 3499/2018).

Professional competencies or competency units, generically called "Competencies", which underlie the design of the Professional Training Standard (PTS) in the general nurse's profession, are included in the PTS content by correlating with learning outcomes units to highlight the link between learning outcomes and skills required at work. A learning outcomes unit is a component of a PTS that describes a professional qualification corresponding to a complex of competencies and consists of a coherent set of knowledge, skills and attitudes that can be evaluated.



In the new training program, the learning outcomes unit "*Leadership and professional communication*" was introduced, through which leadership values were implemented. The contents about leadership were oriented, organized and structured at a *standard (basic) level* - theories, definitions, classifications and subclassifications, typologies, styles, with general applicability in the personal, organizational and professional sphere.

The leadership style is defined by the way in which a leader, regardless of his field, offers a direction, a strategy, managing to implement his plans and to motivate, direct and guide the people he coordinates. There are big differences between leadership styles, but also particularities that allow the identification of each approach, through its advantages and disadvantages.

The first major study of leadership styles was conducted by Lewin, Lippitt and White (1939), developed in the following decades and cited in most works on this topic. Each of them made an important contribution, and together they described the characteristics of three great leadership styles: authoritarian (autocratic), participative (democratic) and delegative (*laissez-faire*) leadership. Each of these styles has dominant characteristics and are useful in the nursing profession.

*Autocratic* leaders dictated terms and people had to obey them blindly. *Democratic* leaders discussed all probabilities and also made followers to take their own decisions. *Laissez – faire* is the extreme opposite to autocratic leadership style. They completely parted with all responsibilities to the followers. Later, other ways of leading were added, adapted to the evolution of society, to trends and to the real needs of the moment, but the principles of their definition respected the strategy of the three authors.

Leadership manifests itself differently, being influenced by the social, economic, sometimes even the political context, it depends on the culture and interests of the organization, on its purpose, but also on the characteristics and personality of the leader. The interaction between all these elements has given birth, over time, to several classifications of leadership, but regardless of the size or field of activity of the company, the leadership style is an important aspect that influences the productivity of the organization.

## Results

The Order of Nurses and Midwives of Romania which is a professional and regulatory organization with the role of developing norms and rules for practicing the profession of generalist nurse, midwife and nurse, so that professionals can provide quality services to patients, in safety and security conditions, consider that the ability of medical personnel to meet the citizen's need to have quality health system is directly linked first and foremost to the reform of the educational system of professional training.

The professional organization took the training leaders of the medical teams, to *another (higher) level*. Starting from 2020, it organizes and conducts leadership courses for nurses who occupy management positions in

clinical units. Entitled „*Leadership program in medical care, for care directors and chief assistants in Romania*”, the contents of these trainings took into account several aspects, such as:

- *Organizational culture and ethics*
- *Human resources management*
- *Time management*
- *Performance management*
- *Professional ethics and deontology*
- *Change management*
- *Global leadership*
- *Current and future directions for the nursing and midwifery profession in Romania: priorities from the perspective of politics, leadership and education*

These aspects are defining for the development of an integrated multitask operating system, with minimum response times and with the involvement of all members of the organization, being intended to be internalized by all actors in the health system.

The leadership style adopted by nursing managers depends on the climate of the group. The manager needs to find out whether the needs of the group are meted out and whether the group is so formed in order to handle group goals. In this case, the nurse leader needs to first make a retrospect of his or her behavioral traits. Accordingly, the current situation in the organization should be taken into consideration and the nurse manager should change leadership style as per the situation.

A nurse's personality may not suit the particular role assigned. Hence, the nurse manager needs to find out the differences in his or her personality and change them according to the role focus. Secondly, nursing managers must be capable of directing and planning the group effectively and efficiently. Nurse Managers must positively motivate the team to perform tasks efficiently. In this case, democratic nurse managers are considered to be more efficient and task-oriented than those who adopt an authoritative or a laissez-faire style of leadership. The group task also determines the appropriate leader and at times the style of leadership needed to be followed by the leader.

Consequently, the qualities of a responsible nurse are based on morality, values, moral principles, respect, personal integrity, courage, tenacity, self-esteem and expertise. It empowers others by facilitating, investing, sharing, authorizing, enabling. These are extremely important characteristics that the nurse must have and that we need in patient care. To evolve, leadership potential needs skills, confidence, and must consider a leader's ability, evidence of knowledge and skills, including transversal skills, as we sometimes call them: trust, integrity, as well as a moral compass. The leader must share a vision of the future, be able to work in a team and reach a consensus together, and also be able to make unilateral decisions when necessary.

Nurses and midwives can develop the empowerment of others by respecting their views, their opinions and by soliciting these opinions, through their managerial skills that demonstrate empathy and empowerment towards others. They enable participation, invite others to get involved, and have the authority and responsibility they accept.

## Conclusion

Initiative, determination, cohesion, brevity, patience and argumentation are among the skills needed in changing educational policies. Thus, it has been proven that the *necessary change* required following the identification of a need and for satisfying it, goes through several stages: identifying the type of *need*; the *will* to produce change to satisfy the need; the *power* to achieve change; *implementing* the change; *satisfying* the need. The key words needed on the path to change educational policies are presented in the Figure 5, below:

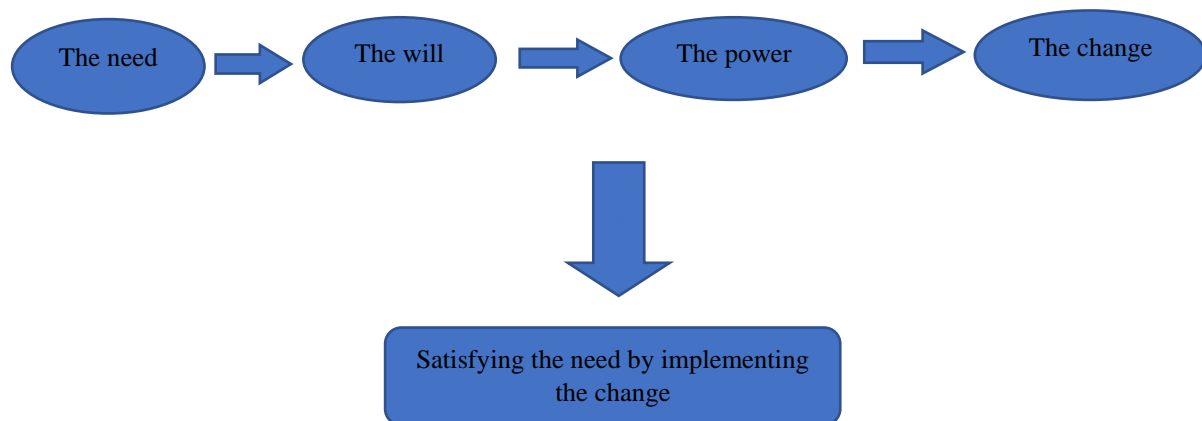


Figure 5. The key words in changing process

Along this approach, from individuals, schools, clinical facilities, hospitals, to professional organizations, government institutions and the community, each with its own contribution, the driving force behind the main goal, has been to achieve and maintain better care and a healthier society.

Interdependence and interconnectivity are characteristics of the current age in which we live. Obviously, we also encounter this new reality within organizations that now operate in heterogeneous environments, with employees from different corners of the world, of various ages, ethnicities, religious or political orientations, with a *mélange* of customs, traditions, beliefs, with different ways of perception of time or space, with different ways of communicating and relating to success or failure, with different degrees of digital literacy. Operating within the parameters of today's global world, organizations need to adapt quickly and efficiently to this reality. They implicitly need leadership that is attentive and responsible towards issues of diversity and inclusion, capable of creating an appropriate organizational culture/climate for intercultural work groups while being at the same time customized to the type of organization.

The biggest issue is finding proper ways, which will ensure the building and the perpetuation of a leader structure, which is professional, autonomous, flexible, efficient, capable of development and adaptation in new contexts.

So, leadership in nursing is required in order to efficiently manage the challenges and obstacles which result due to healthcare workforce and workplace problems.

## Recommendations

Overall, boosting and improving the training of nurses, must be the permanent target of educational policies in the field of health, by establishing the framework of needs and difficulties and by coordinating and facilitating the implementation of discovered solutions.

## Acknowledgements

The successful completion of both this work and the change described within, it would not have been possible without the support and help received from many individuals and organizations. We would like to sincerely thank all of them and, in particular, the following: Ministry of Education - National Curriculum Commission; Order of Nurses and Midwives of Romania; International Council of Nurses.

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*education, jobs and leadership.*


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[https://www.edu.ro/sites/default/files/SPP\\_asistent%20medical%20generalist\\_2018.pdf](https://www.edu.ro/sites/default/files/SPP_asistent%20medical%20generalist_2018.pdf) Anexele nr. 1-3 la Ordinul ministrului educației naționale nr. 3.499/2018 privind aprobarea standardului de pregătire profesională, a planului de învățământ și a programelor școlare pentru calificarea profesională Asistent medical generalist, nivel 5, al Cadrului național al calificărilor pentru care se asigură pregătirea prin învățământul preuniversitar postliceal, din 29.03.2018

## Factors Promoting Student Agency and Community Engagement: Case of a Lebanese Public High School


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**Abstract:** OECD (2019) defined student agency as the ability to set goals, reflect, and act responsibly to endorse change. It is the quality of students' engagement and interaction with peers, teachers, parents and the wider community. The purpose of this research is to investigate and track the factors of promoting student agency and community engagement leading the change. Thirty nine students at a public high school in Lebanon were trained on STEAM activities such as: coding, robotics, electronics, crafts and 3D printing. Students took the initiative with continuous encouragement and facilitation from the principal and teachers to enrol and lead a community- based STEAM laboratory. A self-reflection questionnaire for students was administered in order to measure the characteristics and processes of the student agency. This case study used interviews, and focus groups in order to track the factors promoting this agency. The results of this study will inspire policy makers and school principals to promote student agencies and community involvement.

**Keywords:** Student agency, Community, STEAM laboratory, Public high school

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### Introduction

Student agency has gained more attention among education researchers, policymakers, and practitioners in recent years (Lehtonen, 2015). It refers to the capacity of students to take ownership of their own learning, make decisions, and act upon them in ways that support their personal growth and academic achievement. In the 21st century, the skills of self-regulation, self-efficacy, and self-determination have become essential for students to succeed and thrive in various learning environments (Reeve & Tseng, 2011). Moreover, research has shown that

fostering student agency can lead to positive educational outcomes, such as increased motivation, engagement, persistence, and academic performance (Völkl et al., 2023). In addition, promoting student agency can also contribute to the development of students' social-emotional competencies, such as resilience, social awareness, and empathy (Blair et al., 2018).

### **Theoretical Framework**

There is no consensus on a specific definition of student agency. In the context of the OECD Learning Compass 2030, student agency denotes a sense of responsibility as students engage in society and aim to affect people, events, and circumstances for the better (OECD, 2019). The OECD Learning Framework 2030 offers a vision and some underpinning principles for the future of education systems. According to OECD, student agency is the ability to frame a guiding purpose and identify actions to achieve a goal rather than “student autonomy”, “student voice” and “student choice”. Agency is at the heart of the OECD Learning Compass 2030 and is defined as the competency to think, initiate and act intentionally and responsibly to shape the world towards individual and collective well-being, it necessitates the capacity to articulate a driving goal and specify actions to realize a vision (OECD, 2018). However, the development and prerequisites for agency have received little explicit attention in education (Jääskelä et al., 2020). When students are agents in their learning, that is, when they play an active role in deciding what and how they will learn, they tend to show greater motivation to learn and are more likely to define objectives for their learning (OECD, 2019).

Two factors, in particular, assist students in gaining agency. The first is an individualized learning environment that encourages and supports each student to pursue their interests, connect various learning opportunities and experiences, and design their own learning projects and processes in collaboration with others. The second is building a solid foundation of literacy and numeracy. In the era of digital transformation and with the advent of big data, digital literacy and data literacy are becoming increasingly essential, as are physical health and mental well-being (OECD, 2018).

Agency can be developed as students learn, receive feedback and reflect on their work, this is referred to as the “Anticipation-Action-Reflection (AAR) cycle” according to the OECD learning compass 2030. Anticipation, action and reflection are competencies in their own, however, when combined in a cycle, they can assist and accelerate the development of student agency (see Figure 1).

The Anticipation-Action-Reflection (AAR) cycle is an iterative learning process whereby learners continuously improve their thinking and act intentionally and responsibly, moving over time towards long-term goals that contribute to collective well-being. Through planning, experience and reflection, learners deepen their understanding and widen their perspective. As learners engage actively in iterative cycles of anticipation, action and reflection, they can gain a sense of accountability because they feel more connected to the issues and problems being examined. In this sense comes the belief that they can make a difference in society. The AAR cycle enables learners to express and develop their agency both in classroom contexts and in life more generally.



Figure 1. Anticipation-Action-Reflection (AAR) Cycle

The AAR cycle consists of three phases: In the first phase, learners use their abilities to anticipate the short and long term consequences of actions, understand their own intentions and the intentions of others, and widen their own and others' perspectives. The second phase is where learners take action towards well-being. In the third phase, learners reflect on their thinking, which leads to deeper understanding and better actions towards well-being.

This study implemented the AAR cycle as a conceptual framework for tracking student agency. Students in the STEAM lab anticipated, planned, executed, and reflected on their community-based projects. During this process students attended many workshops to enhance their digital skills, data literacy, communication, problem solving and critical thinking skills.

On the other hand, according to Salmela-Aro (2009), student agency is influenced by parents, peers, teachers and the wider community, this led to the development of the term "Co-agency", often referred to as "collaborative agency", which implies the influence of a person's environment on his or her sense of agency. The concept of co-agency recognises that students, teachers, parents and communities work together to help students progress towards their shared goals. Co-agency is important for students' agency in terms of goal construction and reconstruction.

As a result of a project done by OECD in 2018, Hart's ladder of student participation in activities and decision making was used to develop the "Sun Model of co-agency" which illustrated the level of interaction of adults in each level of student agency (OECD, 2019), as presented in Figure 2.



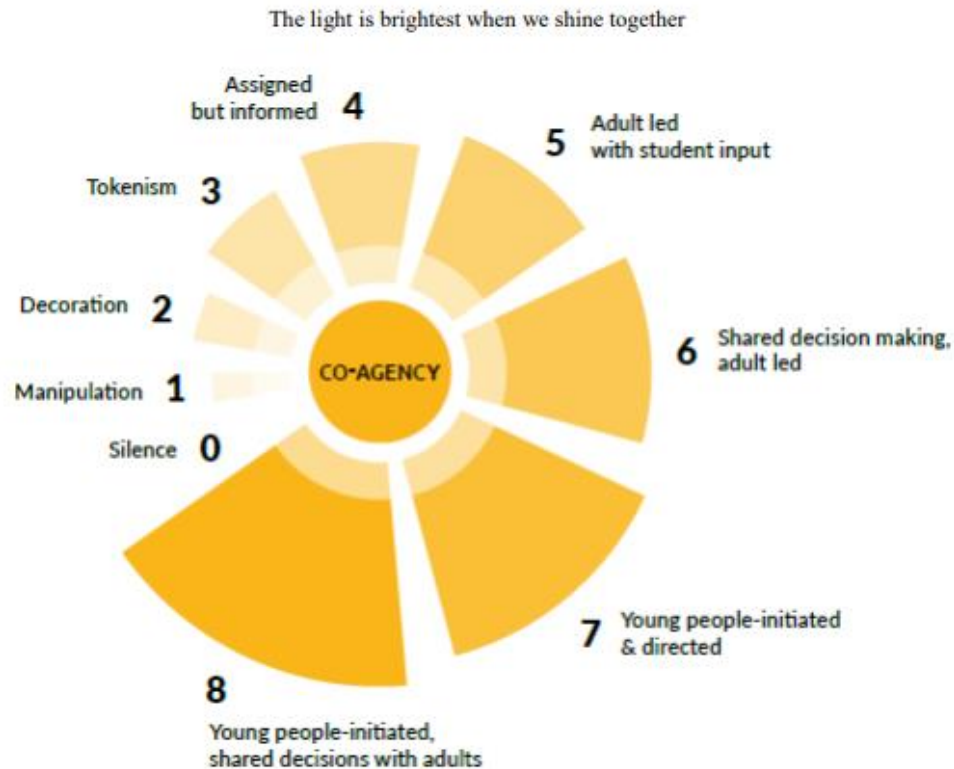


Figure 2. Sun Model of Co-agency (OECD, 2019)

To explain this model, the table below developed by OECD (OECD, 2019), describes, operationally, each level explaining the role of the student and that of the adult (see Table 1). The Sun model in this study was used to evaluate the level of interaction of adults, principal, teachers, and community members in the student agency.

Table 1. The Role of Young People/Students and Adults in each Level of Student Agency

Level of Student Agency	Level of interaction with adults
0.Silence	Young people remain silent and adults take and lead all initiatives and make decisions
1.Manipulation	Adults use young people to support causes, pretending the initiatives is from them
2.Decoration	Adults use young people to help a cause
3.Tokenism	Adults appear to give young people a choice, but there is little or no choice about the substance and way of participation
4.Assigned but informed	Young people are assigned a specific role and informed about how and why they are involved, but do not take part in leading or taking decisions for projects
5.Adult led with student input	Young people are consulted on the projects designed, and informed about outcomes, while adults them and make the

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	decisions
6. Shared decision making, adult led	Young people are part of the decision making process of a project led and initiated by adults
7. Young people-initiated and directed	Young people initiate and direct a project with support of adults. Adults are consulted and may guide/advise in decision making, but all decisions are ultimately taken by young people.
8. Young people-initiated, shared decisions with adults	Young people initiate a project and the decision making is shared between young people and adults, leading and running the project is an equal partnership between young people and adults.

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## Literature Review

### *Role of the Principal*

The role of a principal in promoting student agency is critical in today's educational landscape. A principal who prioritizes student agency can create an environment that fosters self-motivation and curiosity, leading to improved academic outcomes, social-emotional skills, and overall well-being. A principal can encourage student voice by allowing students to have input into their curriculum choices, and school activities. Teachers can also be encouraged to give students opportunities to think critically, collaborate, and solve problems on their own. Furthermore, research has shown that student agency promotes long-term success in both academic settings and the workforce (Henderson & Mapp, 2002). A principal who recognizes this can greatly impact the success of their students. According to a study by Zimmerman and Schunk (2011), when students have agency, they take ownership of their learning and are more motivated to succeed. A principal can promote student agency by creating opportunities for student voice, choice, and leadership (O'Neill, 2017). This can include involving students in decision-making processes, allowing them to design and lead projects, and providing choice in classroom assignments. When students feel empowered and in control of their learning, they are more likely to be engaged and invested in their education. Therefore, the role of a principal in promoting student agency cannot be overstated, as it can have a significant impact on student success both academically and personally.

### *Role of the Teachers*

Teachers play a crucial role in promoting student agency, which is defined as "the power to take meaningful actions and solve problems" (Reeve & Shin, 2020). Teachers can support student agency by creating a learning environment that enables students to set their own goals, make decisions, and take ownership of their learning. This can be achieved by providing opportunities for student choice and autonomy in activities, encouraging risk-taking, and facilitating reflection and self-assessment. Research has found that teachers who implement a student-centered approach to instruction, where students' interests, experiences and perspectives are valued, are more likely to promote student agency (Zeiser et al., 2018). Ultimately, when teachers prioritize student agency, they foster a sense of empowerment and engagement in their students, which can enhance their motivation and achievement both in and out of the classroom.

## Rationale

Promoting student agency, students can develop important skills such as self-regulation, critical thinking, and self-efficacy (Zimmerman, 2000). Research has shown that when students have agency in their learning, they are more engaged, motivated, and achieve higher academic outcomes (Gao & Liu, 2020). However, despite the potential benefits of student agency, many students still struggle to engage in self-directed learning. This highlights the need for further research to understand the factors that contribute to students' agency and how it affects their academic achievement. By having agency, students are able to set goals, monitor their progress, and regulate their motivation and emotions. Moreover, agency is linked to the development of higher-order cognitive skills such as critical thinking and problem-solving (Zimmerman, 2000). In recent years, researchers have emphasized the importance of promoting student agency in educational settings, particularly in the context of online learning. For instance, Wang et al. (2020) examined the relationship between student agency and academic performance in online courses. Their findings suggested that students who have higher levels of agency are more likely to actively participate in online discussions and achieve higher grades. However, little attention has been given to the role of agency in traditional face-to-face classroom settings, particularly in K-12 education.

Research shows that student agency increases civic engagement because students with more voice build stronger learning communities with teachers, they grow important academic characteristics and attitudes such as efficacy, engagement and motivation, and they welcome opportunities for experiential learning during their civic engagement (Hoefnegals, 2015).

## Purpose of the study

The study was conducted in a Lebanese public high school implementing a community based STEAM lab. The purpose of this research is to assess the characteristics of the students agency, and to investigate and track the factors of promoting student agency and community engagement leading the change. The research addressed the following questions:

Main question: How can a student agency be developed in a school ?

- 1- What constructs characterize a student agency in the case under study ?
- 2- What are the factors leading to the development of the student agency ?

## Method

### Research Design and Sample

This study is a descriptive case study that assessed student agency and uncovered the factors behind that agency. The study applied a mixed method approach where quantitative and qualitative data were collected. The sample of this study included high school students, teachers, school principal, community members, and experts who

were involved in a community-based STEAM project in a Lebanese public high school. This project was funded and supported by *nafda* which is a Lebanese nongovernmental organization and principal led movement that aims to reform the education system to become more reinforcing of active citizenship, social justice, and good governance.

### **Data Collection Tools**

Several data collection tools were implemented for triangulation purposes. Students' survey was used to measure the characteristics of the student agency. The survey's items were categorized into seven constructs: 1) self- efficacy, 2) perseverance of interest, 3) perseverance of effort, 4) locus of control, 5) mastery orientation, 6) metacognitive and self regulation, and 7) future orientation. Each construct was measured with between four and nine survey items, and responses to survey items ranged from 1 (disagree) to 4 (strongly agree) . For each survey construct, we calculated a scale score by averaging responses to relevant survey items. In addition, the survey included students' demographic information: Gender; grade level; learning language; time they joined the lab, the department joined, their effective role, and why they joined the lab.

To infer the factors that favored the development of student agency , semi-structured interviews were performed with the school principal, involved teachers, community members and experts. Moreover, a focus group with five active students in the STEAM lab was conducted to study the effect of the content and process of the STEAM-based projects, and the role of each of the principal, involved teachers, community members, and experts in promoting their agency. Students were asked to provide feedback on the following: opportunities they have been provided in the STEAM lab; their role as active members; the practices of the principal, teachers, experts, and community members; the skills they developed and the factors that favored the development of these skills; the projects accomplished; ideas for improvement.

### *Validity and Reliability*

The survey is a validated instrument adopted from a study done by the American Institute For Research (AIR):" Maximizing Student Agency Implementing and Measuring Student-Centered Learning Practices" (Zeiser et al., 2018). The survey was piloted on five students that were not involved in the research. For reliability cronbach alpha was calculated to be 0.894 which shows high reliability and greater internal consistency of the items in the survey. The data from interviews and the focus group were transcribed, coded and analyzed by the three researchers collaboratively. The themes generated from the interviews were validated by the researchers through inter- rater reliability.

### **Results and Discussion**

Thirty nine students from the STEAM lab completed the survey adopted from the American Research Institute (Zeiser et al., 2018). 65 % of the participants are females, and 80 % learn mathematics and science in English.

The students are distributed over four departments: Coding and web development, 3D printing, sewing, and Mechatronics (see Figure 3).

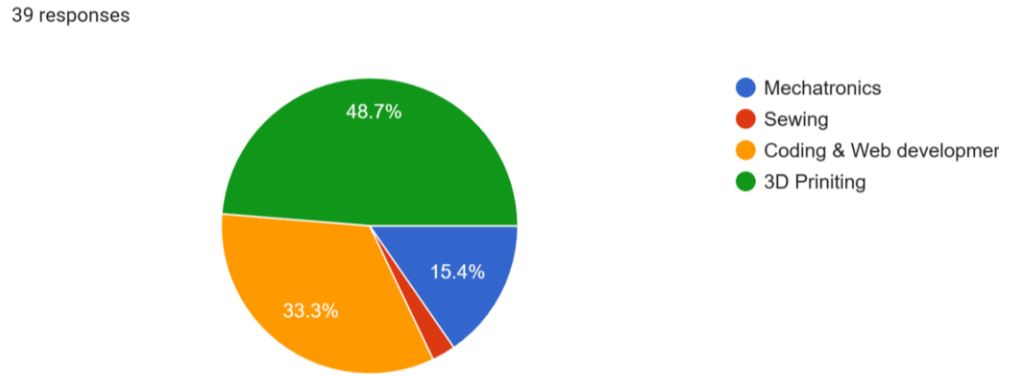


Figure 3. Distribution of Participant Students according to Departments

According to a scale from 1 to 5 ( 1 least effective and 5 most effective) the majority of students more than 80 % declared that they play an effective role in developing and sustaining the STEAM lab as illustrated in Figure 4.

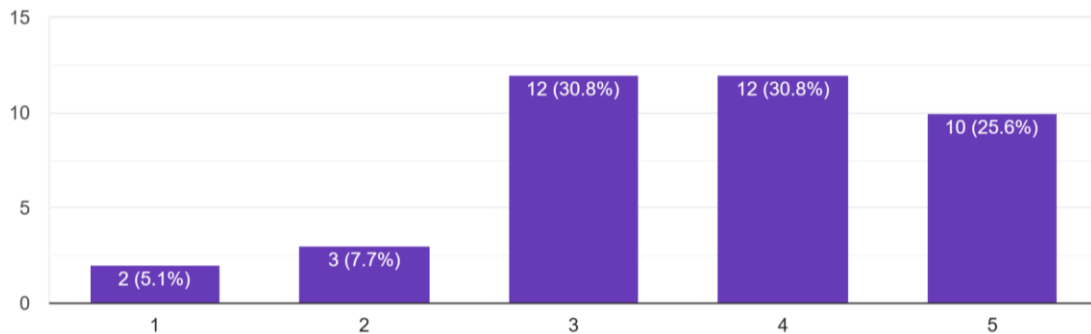


Figure 4. Effectiveness of the role of students in STEAM lab

To answer the first question of research about the characteristics of student agency, the survey constructs were measured based on specific constructs, the mean, minimum, maximum and standard deviations were calculated for each construct (see Table 2).

Table 2. Means and Standard Deviations of Students Agency Constructs

Constructs	N	Minimum	Maximum	Mean	Std. Deviation
Self-efficacy	39	1.88	4.00	3.13	.463

www.icres.net	May 18-21, 2023	Cappadocia, Turkiye	www.istes.org		
Perseverance of Interest	39	.00	3.50	1.67	.988
Perseverance of effort	39	2.00	4.00	3.0	.537
Locus of control	39	1.57	4.00	3.00	.548
Mastery Orientation	39	2.25	4.00	3.41	.504
Metacognitive and Self-regulation	39	2.00	3.36	2.61	.35
Self-regulated learning	39	1.67	4.00	2.99	.62
Future Orientation	39	1.80	4.00	3.31	.54

The items in the survey were coded on a scale from 0 for strongly disagree to 4 for strongly agree and 2 for neutral. The analysis of the results indicates that the mean for all constructs is greater than 2 except for the construct “perseverance of interest” which was calculated to be 1.67. The highest mean was for the self-efficacy construct. The results demonstrate that the participant students satisfy the agentic characteristics.

To infer the factors leading to the development of student agency in the case studied, interviews were conducted with the school principal, two of the teachers that followed the students in the Steam lab, a community member, and an expert from *nafda* who evaluated students’ projects.

### Principal’s Perception

According to the principal, the main factors for the student agency were: The principal belief in the students’ capacities and the trust in their potentials; the students’ commitment to use the STEAM Lab and to learn coding and other skills. Moreover, in line with practicing good governance, students developed a code of behaviour and a management structure for the lab, they created the lab curriculum, rules and policies, and they made their direct connections with the students. They were given the chance to explore the community’s needs through visits to their workplace. For instance, a website for a flower shop was designed by the students.

### Teachers’ Perception

Based on the teachers’ perceptions the factors that enhanced the development of student agency were: Students’ interest in the projects they worked on, they were not afraid to do mistakes, they were motivated and enjoyed what they were doing; The STEAM lab environment which allowed students to practise teamwork, acquire communication, problem solving, and critical thinking skills; the training that the students followed; the opportunity provided to students by the school principal and the involved teachers to have voice and choice, to

learn from their own mistakes, to practise leadership, to design their own projects, and to take decisions; providing the appropriate environment for creativity (STEAM lab) in terms of technologies that simulate their aspiration; their close ages and their ability to understand each other, think collectively, and the spirit of cooperation among them; the trust, encouragement and responsibility given to them; the moral support and positive feedback from teachers; the freedom to make the appropriate decision and find solutions.

### **Community Member Perception**

According to the community member who accompanied the students from the moment of STEAM lab creation, the main factors that allowed students to be agentic were: The fact that students were given the opportunity to be active community members; to address community needs and take the initiative to solve problems; the workshops provided for students who were ready to explore their highest potential; the future vision of the principal who provided them with full control of the lab; the skills gained by students by sharing the lab responsibility; the shared experience, help and guidance provided by the community members when necessary.

### **Expert's Perception**

The expert interviewed stated that promoting students agency was the result of different factors: First, the governance system that was demonstrated by the principal where students voice and agency were respected and reinforced throughout the extracurricular practices including the community- based STEAM lab. Seond, the leadership style of the principal who modelled the transformative leadership style where the vision of community engagement and social justice was reinforced. Third, the training approach adopted in the STEAM lab where students interest, voice, and leadership were reinforced with clear and informative resources allowing students' autonomy. Fourth, students' personal traits who were intrinsically able to work collaboratively in STEAM lab. Fifth, community appreciation for students' initiatives. Moreover, the project management approach that reinforces student centeredness, distributed leadership and connection to values of active citizenship, social justice and good governance and community support through community visioning process, enhanced the development of student agency.

### **Students' Perception**

A focus group was performed with four students from the STEAM lab who are committee members that participated in creating the lab, and that satisfy the agentic characteristics. According to them, the motivation and support of the principal that always listens and shed light on specific issues enabled them to acquire these characteristics. The bonding between the team members that are now able to communicate very well, and to help each other in problem solving and decision making is one of the main factors that led to development of student agency. They declared that they were able to access the STEAM lab at any time, even after school and on weekends. Moreover, they thought that the agentic characteristics were enhanced due to the self-confidence, commitment, responsibility, critical thinking and pride acquired by the members after training and practising

teamwork during their projects. The projects designed were based on solving problems in the community.

Cross analysis of the data collected from interviews led to the emergence of specific themes related to student agency: the self-directed learning created in the STEAM lab; the training provided to students which allowed them to acquire skills of communication, collaboration, problem solving, critical thinking, decision making...; students' goal setting and responsibility during the initiation, planning, and execution of the projects; the project management approach; creativity and innovation; leadership and advocacy. The emerged themes along with evidence extracted from the data collected from the interviews are summarized in Table 3.

Table 3. Themes Emerged from Interviews and Focus Group

Theme	Principal	Teachers	Students	Community
Self- directed Learning	The principal believes in the students' capacities and trust their potentials	The self-learning opportunity provided to students by the principal and teachers	Self-commitment and responsibility	Students suggest solutions to problems they face and try to prove its validity
Collaboration & Team work	The principal encourages students to work together on projects and share their ideas	Communication, problem solving and critical thinking skills of students	Students communicate very well, and help each other in problem solving and decision making	Students were active community members who work in collaboration to solve real life problems
Goal Setting & Reflection	Principal listens to students and shed light on specific issues, this enabled them to acquire these characteristics	Students set their goals and monitor their progress	Students signed a social contract	Sharing responsibility and reflecting on their progress
Choice and voice	Students developed a code of behaviour and a management structure for the lab	Students choose their own projects and modes of presentation	Students have access to the lab all the time	Students' voice and choice was respected
Creativity and innovation	Trust in students' capacities boosts their creativity	Technologies that simulate their aspiration	Being able to learn from their errors and try again	The training followed by students had



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				uncovered their highest potential
Leadership and advocacy	the vision of community engagement and social justice was reinforced.	Response of students to the community needs through design thinking	Solving problems in the community	Leadership and connection to values of active citizenship, social justice and good governance

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Moreover, based on the sun model developed by OECD the analysis of the data showed that the students engaged in the STEAM lab projects are at the last level of the student agency where they initiate projects based on community needs and problems faced. The decision making related to projects were shared with adults: principal, teachers, and community members. who supported and guided the students during this process.

### Conclusion and Future Recommendation

This study aimed to investigate the factors that lead to the development of student agency in a public high school who implemented a student led community-based STEAM lab. The students acquired agentic characteristics through planning, experience and reflection on their own projects. Students were given the responsibility to make decisions and own their own learning. Students were able to create the lab committee, curriculum, policy and rules. They designed Makerspace projects, teaching materials to be used in explaining science concepts in class using the 3D printer, three websites, and many robotic models. Moreover, the committee students are now in the process of training other students in three different schools.

Finally, based on our study the main factors that enhanced the development of student agency in our case are: The principal leadership style; teachers' guidance and follow up when requested by student; students' interest in the projects; the training approach which leads to students' self- efficacy; community support and appreciation to students' work; the project management approach; connection to values; and the personalised environment of STEAM lab as well as . This is in congruence with the study of Crowhurst and Cornish (2020), who identified five key factors to support students to have more agency in their learning: independence and ownership, scaffolding, students as teachers, joyfulness, and reflection. Similar factors were also identified by Wenmoth et al. (2021): students' engagement in active self directed learning experience; students' leadership; time management, and collaboration skills; students' reflections and teachers' feedback.

Similar projects can be implemented in schools to enhance agentic characteristics that allow students to acquire skills such as leadership, critical thinking, communication, collaboration, decision making, and problem solving. The factors that promote student agency inferred from this study can be implemented in regular classes giving

chance for students to set their learning goals and hold the responsibility to fulfil these goals.

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## Entrepreneurial Decisions and Problem-Solving: a Discussion for a New Perspective Based on Complex Thinking

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**Abstract:** This work addresses the importance of innovation in entrepreneurial and business education to ensure that students develop the ability to make complex decisions and solve complex challenges. The intention was to incorporate the complexity theory in decision-making and problem-solving in business and entrepreneurship. To achieve this, we present the results of the first phase of our project, aiming to scale the levels of complex thinking in university students, discuss the need for business and entrepreneurship students to develop complex thinking competency (including its sub-competencies of critical, systemic, scientific, and innovative thinking) in the complexity of the business environment, analyze the relevance of system elements, apply their inductive and deductive reasoning, and create appropriate and relevant solutions. Our findings suggest that an educational model focused on developing complex thinking and its four sub-competencies can enable entrepreneurs to integrate sustainable development, increase their social engagement and critical thinking, develop their imaginative intelligence and discursive and reflective skills, and thus improve their decision-making and problem-solving processes. In the future, we plan to extend this analysis to the behavior of real-life entrepreneurs.

**Keywords:** Educational Innovation, Higher Education, Professional Education, Complex Thinking, Entrepreneurial Decisions

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### Introduction

Society currently faces complex challenges, such as sustainability, characterized by an undefined nature,

multiple potential solutions, and unique characteristics with competing objectives and open deadlines. To effectively address these challenges, educational institutions like business schools must equip students with the competencies and skills necessary to understand and solve these issues. Literature on entrepreneurial and business education highlights the importance of critical thinking, reflective thinking, and multiple intelligences. These skills are crucial for students to make informed decisions and solve problems effectively.

In the literature on the competencies and skills relevant to entrepreneurial and business education, most authors emphasize the importance of critical thinking (Amblee et al., 2022; McDonald et al., 2022). The AACSB (2018) refers to reflective thinking, and Carreira et al. (2022) to imaginative, aesthetic, multiple intelligences, and discursive and reflective reasoning skills. The AACSB (2018:35) recommends integrating technology into decision-making and problem-solving. This includes evidence-based decision-making integrating current and emerging technologies across the curriculum, including statistical tools, data management, data analytics, and information technology. Additionally, it is recommended that students demonstrate higher-order cognitive skills to analyze an unstructured problem, formulate and develop a solution using appropriate technology, and effectively communicate the results to stakeholders. Several universities have started to innovate how they design and teach business courses to ensure students develop the ability to make complex decisions. This approach emphasizes equipping students with the skills necessary to understand and solve complex challenges such as sustainability.

## Literature Review

### Entrepreneurial decisions, problem-solving, and rational frameworks

Several studies have explored various methods for understanding entrepreneurs' thought processes and actions. One such method is the concept of effectuation, proposed by Sarasvathy, which stems from the understanding that entrepreneurial processes are characterized by uncertainty and risk; it postulates that opportunities are created by the actions of entrepreneurs with available resources and not from the logic of prediction or causality (Sarasvathy, 1998; Sarasvathy, 2001). Effectuation and other prescriptive methods for entrepreneurship have faced criticism. For example, Mansoori and Lackéus (2020) compared effectuation with five other methods: discovery-based planning, prescriptive entrepreneurship, entrepreneurial planning, lean startup methodology, and design thinking. The authors use a three-step methodology to perform the comparison at three hierarchical levels (logic, model, and tactics) and in nine different dimensions (uncertainty management, resource management, knowledge extension, redirection power, continuous learning, iterative process, stakeholder interaction, team collaboration, and value creation) to illustrate their strengths, weaknesses, and complementarities. One of the authors' conclusions is that entrepreneurial methods should be articulated and taught as the result of collaboration between academicians and practitioners, which could deepen students' complex thinking as they grasp that the decisions they make to solve problems must consider what works, when, for whom, and in what context.

Several scholars consider that entrepreneurial actions are based on a rational, logical framework or are preceded by impulse (Lerner et al., 2018a, 2018b; Wiklund et al., 2016, 2018). We propose incorporating the complexity theory in the discussion to support entrepreneurs in creating value. While there is debate about the rationality of entrepreneurial actions, we must understand the impulse behind such actions. Kurdoglu et al. (2022) proposed a new framework combining rational and irrational logic based on the decision-makers' motivations. They argued that a decision is deemed motivationally rational when the truth is sought and motivationally irrational when interest is sought without empirical grounding.

Furthermore, they posit that motivationally rational decisions are based on reality and aim to find solutions that align with it, while motivationally irrational decisions are detached from reality and driven by impulses. The authors' argument about the adaptive potential of irrational decisions from a motivational standpoint is innovative and noteworthy. However, their reasoning raises questions about differentiating between impulsive decision-making and a lack of knowledge organization, whether decision-making in extreme uncertainty is always wholly irrational, and whether the observer can distinguish different rational and impulsive decision-makers. Additionally, it raises the question of whether the decision-maker characterized as rational is always aware of the knowledge he possesses and reality and whether the decision-maker characterized as impulsive does not also seek to understand the facts from his particular logic.

### **Complex thinking as a coherent framework**

Although the proposal is highly sophisticated and goes beyond the simple dichotomy between rational and irrational actions, it is also limiting because what is defined as irrational could only be a lack of conscience. From the perspective of complexity theory, the problem in decision-making is not the factual error (false perception) or the logical error (incoherence) but the way we organize our knowledge into systems of ideas (Morin 2001). Therefore, rational actions and decisions are not devoid of errors, ignorance, and blindness. Every decision results from selecting significant data and rejecting non-significant data, i.e., operations that separate, unite, hierarchize, and centralize. These operations are based on principles of thought organization that permeate our vision of things and the world, even though we are unaware of it. Thus, qualifying the selection or rejection of significant or non-significant data as rational or irrational results in a one-dimensional view.

Classifying and explaining business decision-making as rational or irrational leads to simplistic thinking. One must develop complex thinking to get away from this mutilating and one-dimensional vision. Complex thinking makes it possible to clarify the opposition between rationalization (a logical system of explanation but deprived of empirical foundations) and rationality that strives to unite coherence with experience and to grasp the need for a rationality that is both critical and self-critical (Morin, 2020:52-53). In this sense, business and entrepreneurial careers should promote the development of complex thinking for decision-making and problem-solving.

It is crucial to teach entrepreneurs to observe the information, representations, concepts, ideas, and myths in

their minds to be clear that they are mediators between their ideas and reality. Complex thinking aspires to a non-partitioned, non-divided, non-reductionist, and non-unidimensional knowledge, i.e., it leads to multidimensional thinking that seeks all that is interrelated, interacting, and interfering. At the same time, it recognizes the unfinished and incomplete nature of all knowledge (Morin, 2001). It is necessary to become aware and sensitized to the enormous shortcomings of our thinking and to grasp that a mutilating thought necessarily leads to mutilating actions. This requires a reforming of thinking that seven complementary and interdependent principles can guide: the systemic or organizational, the hologram, the retroactive circle, the recursive circle, the autonomy/dependence, the dialogic, and the reintroduction of the knower in all knowledge (Morin, 2020). To the extent that entrepreneurs develop their complex thinking, they have within their reach other strategies, another starting point to make decisions and solve problems in a less mutilating way.

Concerning complex thinking and its sub-competencies, recent research has found a significant link with developing skills among business students. For example, Kuzina et al. (2022) identified critical thinking as essential in developing skills among business students, such as reading comprehension. Thus, they concluded that strengthening critical thinking in business areas reinforces knowledge acquisition and enables individuals to work more efficiently.

## Results

### A methodology for complex thinking development

Our interdisciplinary research group, Reasoning for Complexity (R4C), aims to scale higher education students' mastery of complex thinking skills by implementing training systems supported by Open Science and Technology 4.0 strategies. These strategies include connectivity, digitalization, virtualization, artificial intelligence, and data science, among others, linked to projects undertaken by the quadruple helix (university-industry-government-civil sector) for sustainable development solutions (Figure 1). Our paper shows the results of the first phase of a project that aims to scale the levels of complex thinking in university students in Mexico through case study models and personalized learning, open science, and artificial intelligence, using mixed-method measurements and supporting sustainable development goals.

One of the project's first-phase results was the systematization of the principles of the theory of complex thinking by authors such as Edgar Morin to conceptualize what we define as the macro competency of complex thinking that is integrated by four sub-competencies (critical, systemic, scientific, and innovative thinking) (Baena-Rojas et al., 2022; Ramírez-Montoya et al., 2022). The macro competency of complex thinking is a cognitive tool that can expand the thinking capacity of people facing challenging situations or problems. It can also help people develop competencies that allow them to think comprehensively about reality with a broad vision of the world (Vázquez-Parra et al., 2022) (Table 1). Table 1 shows that complex thinking perceptions for university students in Mexico are more developed in Schools of Medicine and Social Sciences than in Business (Vázquez-Parra et al., 2022).

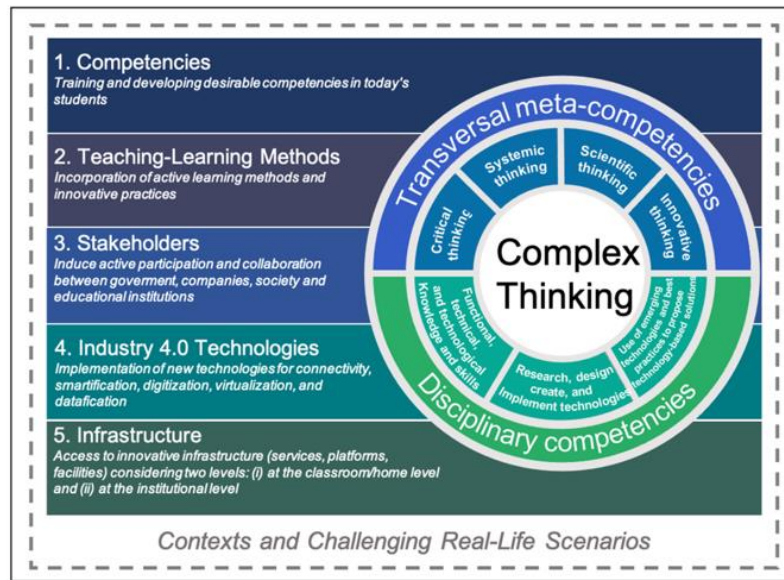


Figure 1. Complex Thinking in Education 4.0

	Medicine	Architecture	Humanities	Social Sciences	Engineering	Business
X	4.13	3.86	3.97	4.11	3.90	3.84
$\sigma$	0.83	0.93	0.89	0.75	0.84	0.87

Source: Vázquez-Parra et al., 2022

Table 1. Disciplinary areas in Higher Education and Complex Thinking

Regarding the sub-competencies, *critical thinking* evaluates the soundness of one's own and others' reasoning to form a judgment in a situation or problem and identify false arguments; *systemic thinking* analyzes the relevance of the system elements and is determined by analyzing the existing set; *scientific thinking* encompasses a set of reasoning strategies or cognitive processes, like inductive and deductive reasoning, problem-solving, and formulating and testing hypotheses; and *innovative thinking* allows problem-solving and designing and creating solutions for social progress (Rodríguez-Abitia et al., 2022). Developing the macro competency of complex thinking and its sub-competencies has unlimited scope in any field, including business and entrepreneurship.

### Validated tools and instruments (eComplexity)

Another significant result of the research group was the design of the eComplexity instrument to measure the students' perceived mastery of complex thinking and its sub-competencies. This instrument was validated theoretically and statistically by a team of experts in the field (Castillo-Martínez et al., 2022). It comprises twenty-five items (each answered on a 5-level Likert scale), grouped into the four sub-competencies. In turn, each sub-competency is divided into the areas of knowledge, skills, and attitudes or values (Vázquez-Parra et al., 2022).



So far, we have used the instrument in various university institutions in 19 different countries: Argentina, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Finland, France, Germany, Guatemala, Holland, Italy, Mexico, Nicaragua, Paraguay, Peru, Spain, United States, Dominican Republic, and Venezuela. In addition to the eComplexity instrument, our research group also generated the Profile of the Social Entrepreneur instrument to evaluate the students' perceived mastery of social entrepreneurship and relevant skills through 28 items integrating five dimensions (personal, leadership for social change, social innovation, social value, and management for social change). The latter instrument was applied during entrepreneurship and used a 5-level Likert scale (García-González et al., 2020).

For example, this instrument was applied to a sample of 328 students in a private Mexican university in Guadalajara. The results showed that students perceived themselves as competent in sub-competencies related to personal values through indicators such as communication, knowledge of others, motivation, perseverance, and persuasion. They perceived themselves with limited practical, administrative, and implementation skills (Cruz-Sandoval et al., 2022). So, these students had a high index of personal values and a low index of competencies related to their environment's economic and administrative reality.

## Discussion and Conclusion

Our research group obtained several significant results, including the systematization of the principles of the theory of complex thinking, the conceptualization of macro and sub-competencies of complex thinking, and the use of instruments to measure both the perceived mastery of complex thinking and social entrepreneurship competency. These results provide a solid methodological foundation for discussing topics such as the gender gap, contents, and formative processes in higher education, the strengthening of the competency of complex thinking, its use in the labor market, its use in the hegemonic patriarchal culture in Latin America, its ability to face professional challenges, and its effects on decision making and problem-solving.

The teaching of business process methods in business schools must include collaboration between academicians and practitioners for students to deepen their understanding of complexity to analyze situations to make proper decision-making. Entrepreneurs operate in uncertainty and risk, have limited resources, need to update their knowledge constantly, draw up plans but are ready to redirect them at any time, refine and improve their projects and products, and look for actors who can add more value. Therefore, students need to develop their complex thinking competency to think critically, systemically, scientifically, and innovatively to understand the complexity of the entrepreneurial environment, analyze the relevance of system elements, apply their inductive and deductive reasoning, and create appropriate and relevant solutions.

Beyond thinking that learning of this nature requires identifying reality and committing to learning to make rational decisions or decisions guided by impulses, we consider it more beneficial to teach students to grasp how they organize their ideas, to question rational decisions and actions, and become aware of the process of selecting meaningful data and rejecting those that are not meaningful. In this way, students can develop an

awareness of their vision of things and the world, which can help them make decisions about their projects and products that generate more value for their customers.

Conveying the message that understanding the operations that separate, unite, hierarchize, and centralize is crucial for a future entrepreneur because these determine the vision of things and the world. This understanding facilitates decisions based on the entrepreneur's vision of the world and what generates value for those purchasing their products or investing in their projects. In this realm, we propose incorporating complexity theory into discussing how entrepreneurs think and act to generate more value. Our methodology can be leveraged to assess complex thinking competencies in university business students at the beginning and end of their careers. In the future, we plan to extend this analysis to the behavior of real-life entrepreneurs.

Our findings suggest that an educational model focused on developing complex thinking and its four sub-competencies (critical, systemic, scientific, and innovative thinking) can enable entrepreneurs to integrate a sustainable development perspective, increase their social engagement and critical thinking, develop their imaginative intelligence and discursive and reflective skills, and improve their decision-making and problem-solving processes.

## Acknowledgments

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## George Town Festival 2022: The Promotions of Arts and Multi-Cultural Heritage in UNESCO George Town, Penang, Malaysia

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**Abstract:** George Town, the cultural heritage city of the Straits of Malacca was gazetted as a UNESCO World Heritage Site (WHS) in 2008. George Town Festival (GTF) is one of the significant annual events that commemorates the inscription of George Town. The Festival was first organised in 2010. However, due to the unforeseen Covid-19 pandemic in 2020 and 2021, the Festival has been organised virtually. Now in its thirteenth year, the Festival is once again set to gather on a physical stage. The main aims of GTF 2022 are two-fold: (1) to promote the arts and multi-cultural heritage at an international level and (2) to feature at least 40% of local programmes and artists. However, there are claims that the cultural promotions of GTF in regard to the multi-ethnic community is biased, where: (1) the Malay Muslim community are under-represented (2) the representations of GTF is said to be a bit ‘too Chinese’ and (3) GTF cultural promotions from 2010-2020 have greatly benefitted the Chinese community, leaving other multi-ethnic community under-represented at the Festival. Hence, this quasi-statistical qualitative study seeks to examine the patterns of arts and cultural heritage promotions in regard to the multi-ethnic community at GTF 2022. The findings revealed that the Chinese’s arts and cultural promotions at GTF 2022 is highly promoted compared to other multi-ethnic community in Penang.

**Keywords:** Ethnicity, George Town Festival, Penang, UNESCO.

**Citation:** Suhaimi, D. M., Bustami, M. R. & Nasruddin, E. (2023). George Town Festival 2022: The Promotions of Arts and Multi-Cultural Heritage in UNESCO George Town, Penang, Malaysia. In M. Koc, O. T. Ozturk & M. L. Ciddi (Eds.), *Proceedings of ICRES 2023-- International Conference on Research in Education and Science* (pp. 831-845), Cappadocia, Turkiye. ISTES Organization.

## Introduction

On July 7, 2008, Melaka and George Town, the historic cities of the Straits of Malacca were jointly declared as a UNESCO Cultural World Heritage Site (Law et al., 2022). The size of UNESCO George Town Cultural World Heritage Site (hereafter the heritage Site) is doubled that of Malacca, measuring at 109 hectares for the core zone, and 150 hectares for the buffer zone. Thus, UNESCO George Town should allow for greater spatial, capitalistic and socio-cultural changes that deserve scholarly attention (Foo & Krishnapillai, 2019). The prestigious status of George Town was based on the Outstanding Universal Values (OUVs) (Amat, 2018) inscribed by UNESCO, 2023; Nasution, 2012):

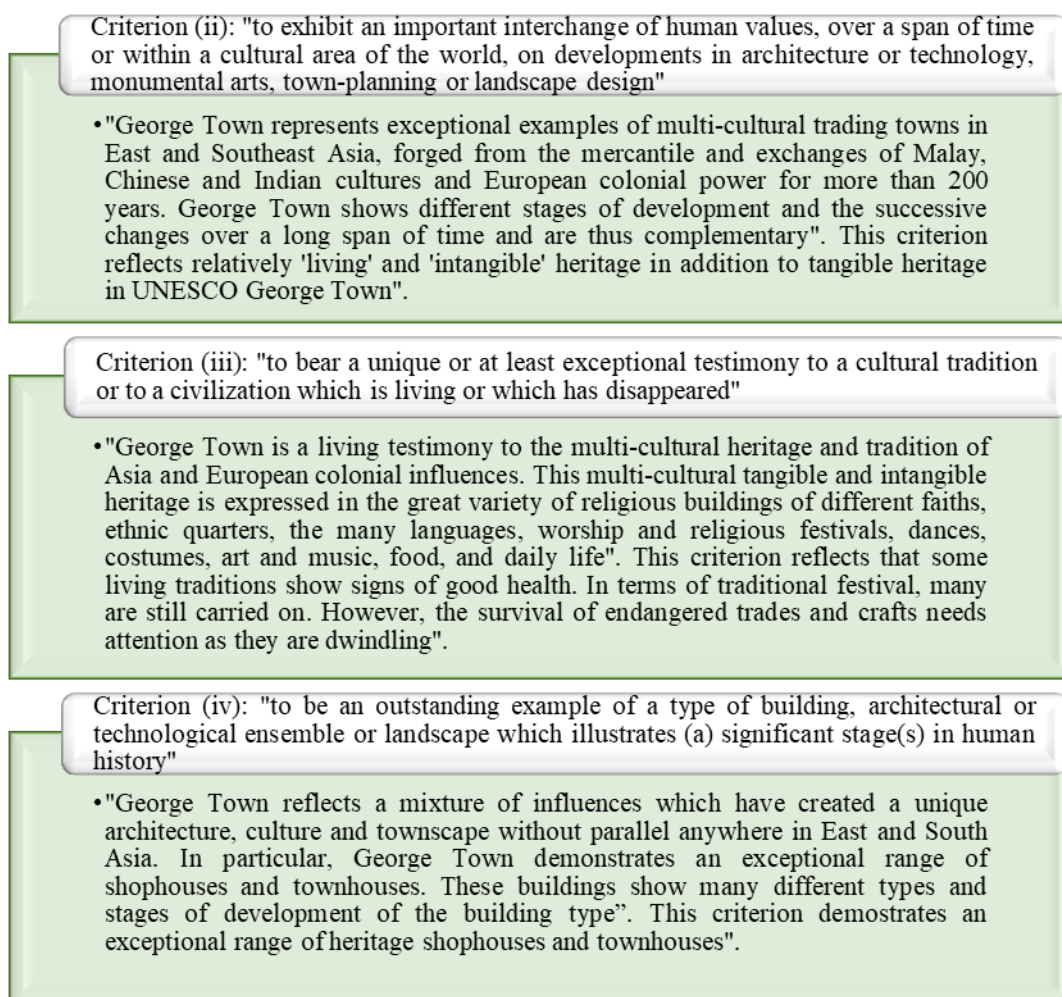


Diagram 1. UNESCO George Town's OUV criteria

In 2010, George Town World Heritage Incorporated (GTWHI) was established by the Penang State Government to manage, safeguard and promote UNESCO George Town. Since then, many projects and events have been held to commemorate the heritage site, such as the George Town Festival, George Town Literary Festival, George Town Heritage Celebrations; George Town Discovery Walk, to name just a few (GTWHI, 2023).

**Problem Statement**

Over the years, the initiative and purpose of organising the Festival has always been a subject of debate. There are claims that the cultural promotions of GTF in regard to the multi-ethnic community are biased, where:

1. the Malay Muslim community are under-represented at the Festival (Merican et al., 2018),
2. the representations of GTF are said to be a bit ‘too Chinese’ (Suhaimi & Bustami, 2020), and
3. GTF cultural promotions from 2010-2020 have greatly benefitted the Chinese community, leaving other multi-ethnic community under-represented at the Festival (Suhaimi, 2022). Specifically, the findings revealed that the GTF cultural promotions have benefitted the Chinese community with 48%, followed by Malay (26.3%), Indian (8%), Straits Chinese (7%), Indian Muslim (6%), Eurasian (4%), Japanese (0.4%) and Siamese with 0.3% (Diagram 2).

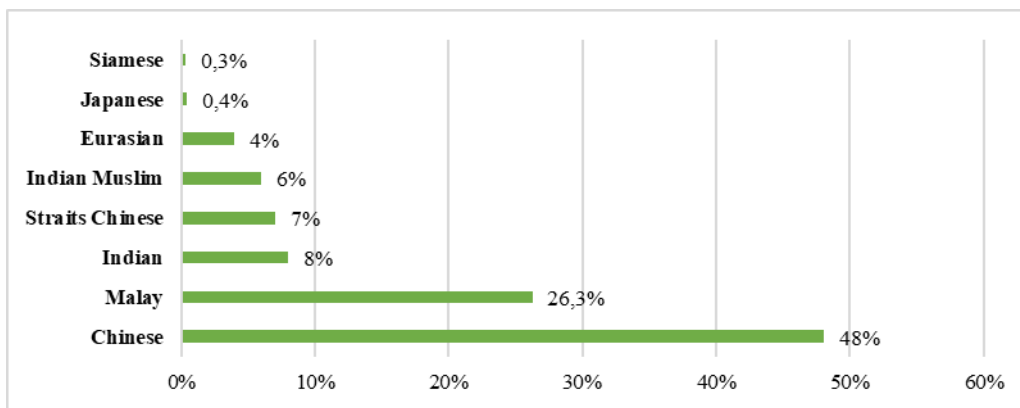


Diagram 2: GTF cultural promotions in regard to the multi-ethnic community from 2010-2020

Therefore, in problematising these issues, this study seeks to investigate the patterns of arts and cultural heritage promotions in regard to the multi-ethnic community representations at GTF 2022. This study will be based on the document analysis of GTF 2022 e-booklet (GTF, 2023).

**Literature Review**

The traditional style of literature review (LR) is established to locate a study within the existing knowledge. Nevertheless, the systematic literature review (SLR), has the objective of comprehensively locating and synthesising related study using organised, transparent and replicable processes. Compared to LR, the SLR offers several benefits, that include: the reviews can be reinforced through a transparent article retrieval process, a broader study area, and more significant objectives for controlling study bias. Additionally, SLR also has the benefit of motivating the scholars to come out with more significant results using quality evidence (Shaffril et al., 2021).

The review is based on a SLR, particularly with reference to the UNESCO George Town and George Town

Festival (GTF). This study applied an online search to navigate available sources from Scopus database. Since UNESCO George Town was gazetted as a Cultural World Heritage status in 2008 and GTF was established in 2010, articles included in this study consist of those published from 2008-2022.

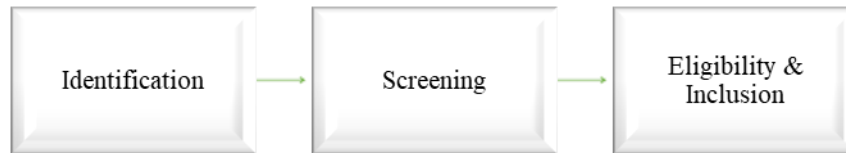


Diagram 3. SLR methodology

The analysis of SLR is a replicable, scientific and transparent methodology and minimises bias as it provides comprehensive decisions, procedures and conclusions from scholars (Shaffril et al., 2019). The methodology for a SLR in selecting articles includes identification, screening, eligibility and inclusion (Diagram 3).

Identification: The first phase is keyword identification, followed by a search for similar and related terms based on the keywords of previous studies. The Scopus advanced search string successfully retrieved 195 articles in the first phase of the SLR process (Table 1).

Table 1. Scopus advanced search string

Databases	Search string
Scopus	TITLE-ABS-KEY("george town" OR "unesco penang" OR "unesco george town" OR "george town festival") AND ( LIMIT-TO ( PUBSTAGE,"final" ) ) AND ( LIMIT-TO ( OA,"all" ) OR LIMIT-TO ( OA,"publisherfullgold" ) ) AND ( LIMIT-TO ( AFFILCOUNTRY,"Malaysia" ) ) AND ( LIMIT-TO ( PUBYEAR,2022) OR LIMIT-TO ( PUBYEAR,2021) OR LIMIT-TO ( PUBYEAR,2020) OR LIMIT-TO ( PUBYEAR,2019) OR LIMIT-TO ( PUBYEAR,2018) OR LIMIT-TO ( PUBYEAR,2017) OR LIMIT-TO ( PUBYEAR,2016) OR LIMIT-TO ( PUBYEAR,2015) OR LIMIT-TO ( PUBYEAR,2014) OR LIMIT-TO ( PUBYEAR,2013) OR LIMIT-TO ( PUBYEAR,2012) OR LIMIT-TO ( PUBYEAR,2011) OR LIMIT-TO ( PUBYEAR,2010) OR LIMIT-TO ( PUBYEAR,2009) OR LIMIT-TO ( PUBYEAR,2008) ) AND ( LIMIT-TO ( DOCTYPE,"ar" ) OR LIMIT-TO ( DOCTYPE,"cp" ) ) AND ( LIMIT-TO ( SUBJAREA,"SOCI" ) OR LIMIT-TO ( SUBJAREA,"ARTS" ) OR LIMIT-TO ( SUBJAREA,"MULT" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) ) AND ( LIMIT-TO ( SRCTYPE,"j" ) OR LIMIT-TO ( SRCTYPE,"p" ) )

Screening: The aim screening phase is to screen the 195 articles based on the inclusion and exclusion criteria specified by the scholars. The first criterion was the open access documents, followed by year of documents, where only documents published from 2008 to 2022 were selected because UNESCO George Town was gazetted as a Cultural World Heritage status in 2008.



Table 2. Scopus' inclusion and exclusion criterion

Criterion	Inclusion	Exclusion
<b>Open access</b>	All open access, Gold open	Hybrid Gold, Bronze, Green
<b>Year</b>	2008 - 2022	1965 - 2007
<b>Document type</b>	Article, conference paper	Erratum, Review
<b>Country</b>	Malaysia	Other than Malaysia
<b>Subject area</b>	Social sciences, Arts and humanities, Multidisciplinary	Other than Social sciences, Arts and humanities, Multidisciplinary
<b>Source type</b>	Journal, conference proceeding	Other than journal, conference proceeding
<b>Language</b>	English	Other than English

The third criterion is the document type – only article and conference paper were selected. Next criterion included is studies that were conducted in Malaysia only. The fifth criterion is subject areas of social sciences, arts and humanities as well as one multidisciplinary document. The sixth criterion is source of documents where only journals and conference proceedings type were selected. The final criterion was language selection. Only those in the English language were included. Other non-English language documents were excluded to avoid translation errors. After screening, out of 195 Scopus-indexed articles, 171 articles were removed (Table 2).

Eligibility and Inclusion: Eligibility includes or excludes articles manually according to criteria specified by the scholars. The retrieved articles were thoroughly reviewed, and any articles that did not meet the particular criteria were excluded. Six articles were excluded as they did not specifically focus on GTF and/or UNESCO George Town in Penang, Malaysia. Finally, 18 articles are included and ready to be analysed (Diagram 4).

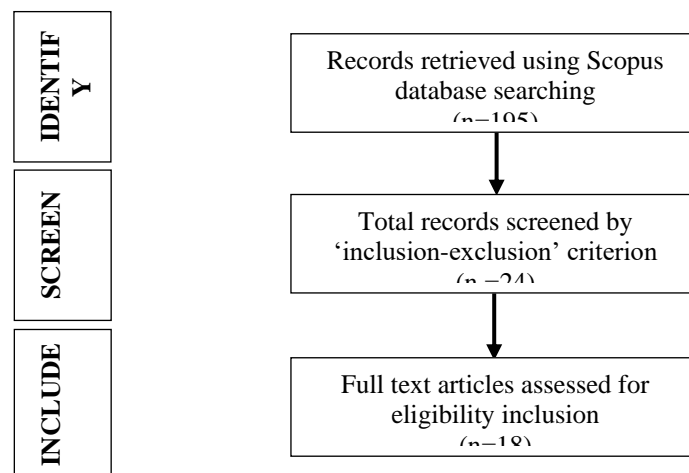


Diagram 4. SLR flowchart on GTF and UNESCO George Town

Table 3 lists 18 selected articles that are ready to be analysed. Majority of the articles are not based on ethnic preferences, that include: Tilaki et al. (2014), Goh (2015), Musa and Feng (2016), Farhad and Gelareh (2017), Wahab et al. (2018), Rahman (2018), Zhao et al. (2019), Mohd, Abdul Latiff & Senadjki (2019), Chan et al. (2020), Rahman and Velayuthan (2020), Abdul Aziz (2020), Chan et al. (2021), Halim and Tambi (2021), Ng

and Rahman (2021), Zwain (2021) and Abdul Aziz (2021). Bahauddin and Soon (2019) analysed the Chinese's Feng Shui approach of landscapes and building placements of Cheong Fatt Tze Mansion. Merican, Abdulra'uf & Sulam (2018) examined the historical consciousness and the representation of multi-ethnic community based on George Town Festival 2015 (GTF 2015). The findings of Merican, et al., (2018) showed that:

1. GTF 2015 depicts a wrong settler version of Penang history, where GTF 2015 featured that the Eurasians as the founding community of Penang. Truth is, the Malays are the natives and also the founding community of Penang.
2. GTF 2015 highlights the importance of British occupation of Penang in 1786, via the arrival of Light. The listing of Fort Cornwallis as a historical site of Penang suggests a Eurocentric representation of history commencing in 1786. Whereas, the existence of Malay communities prior to the 1786 occupation has been subverted by the dominant discourse.

In addition to the issues pertaining GTF, Suhaimi & Bustami (2020) claimed that GTF is said to be a bit 'too Chinese' and Suhaimi (2022) suggested that the GTF cultural promotions from 2010-2020 have greatly benefitted the Chinese community, leaving other multi-ethnic community under-represented at the Festival. Thus, this study seeks to investigate the patterns of arts and cultural promotions in regard to the multi-ethnic community representations at GTF 2022. This study will be based on the analysis of GTF 2022 e-booklet.

Table 3. The inclusion of 18 eligible articles

No.	Author	Objective	Ethnic preferences
1	Tilaki et al. (2014)	To address the role of liveability to improve the built environment, safety, public participation, cultural identity and tourist satisfaction in different communities	General
2	Goh (2015)	To investigate the determinants of customers' revisit intention for boutique hotels. The findings indicate that attitude, subjective norm and customer satisfaction influence customers' revisit intention.	General
3	Musa and Feng (2016)	To illustrate the role of an oral history project in creating public awareness, appreciation for heritage and encourage community engagement in the heritage discourse.	General
4	Farhad and Gelareh (2017)	To investigate the role of a cultural festival in creating a sense of attachment among local visitors in George Town World Heritage Site.	General
5	Wahab et al. (2018)	To assess the adaptive reuse works that have been implemented on the heritage buildings as hotels.	General
6	Rahman (2018)	To investigate the process of the built heritage commodification of boutique hotels in George Town	General

No.	Author	Objective	Ethnic preferences
7	Merican et al. (2018)	To examine the historical consciousness and the representation of multi-ethnic community based on George Town Festival 2015 (GTF 2015).	Malay
8	Bahauddin and Soon (2019)	To analyse the Feng Shui approach of landscapes and building placements Cheong Fatt Tze Mansion	Chinese
9	Zhao et al. (2019)	To examine the evolution of urban morphology in George Town within geography, politics, economy and culture in a horizontal dimension and layer upon layer in a vertical dimension.	General
10	Mohd et al. (2019)	To investigate the travel behaviour and analyse the factors influencing the mobility of the elderly in UNESCO George Town and Malacca	General
11	Chan, et al. (2020)	To examine how 'innovation culture' is inculcated and embedded within two local organisations with distinct approaches to innovation.	General
12	Rahman and Velayuthan (2020)	To investigate the transformation of functions and typology of museums on the basis of the top 20 museums in Penang listed in TripAdvisor.	General
13	Abdul Aziz (2020)	To investigate the financial performance of adaptive reuse private museums in George Town	General
14	Chan et al. (2021)	To examine the potential roles and challenges faced by innovative social enterprises in the cultural and creative sector in George Town, Malaysia.	General
15	Halim and Tambi (2021)	To investigate the level of awareness among the local community towards heritage conservation in George Town, Penang.	General
16	Ng and Rahman (2021)	To examine the participation and collaboration processes in conducting George Town Festival.	General
17	Zwain (2021)	To investigate the hindrances facing the observation of precautionary measures on tourists (that are residents) in George Town Heritage City traditional shophouses.	General
18	Abdul Aziz (2021)	To determine the authenticity condition of historic buildings on their post-conservation phase, after adaptive reuse implementation.	General

## Research Methodology

This study employed case study qualitative research method. According to Merriam (1998), Stake (2005), a case

study is the selection of the case to be studied – regardless any kind methods the scholars select to study the case. In this study, the GTF 2022’s arts and cultural promotions in regard to the multi-ethnic community in UNESCO George Town WHS is selected as a case study. Document analysis is used in this study. Document analysis is the review by the scholars based on of written materials, for examples: journals, annual reports, booklets, newspapers, and so on. According to Bowen (2009), document analysis can be used as a stand-alone method. Hence, in this study, the e-booklet analysis of GTF 2022 is employed as a stand-alone method. Moreover, document analysis is very much applicable to qualitative case studies – the intensive studies produce rich descriptions of a single event (Stake, 1995; Yin, 1994).

The quasi-statistical qualitative methodology is employed to analyse the document (Miller & Crabtree, 1992). The number of programmes included in the GTF 2022 will be analysed and categorised based on diverse ethnic background / preferences. For quasi-statistical qualitative methodology, numerical data is used in qualitative research, in order to make simple counts of things to support terms such as usually, most, some, and so forth. As mentioned by Maxwell (2010), numbers in the sense of simple counts of things are a legitimate and important sort of data for qualitative scholars.

“Qualitative researchers often make quantitative claims in verbal form, using terms such as many, often, typically, sometimes, and so on. Numbers have the value of making such claims more precise and coined the term quasi-statistics for simple counts of things to support terms such as some, usually and most. One of the greatest faults in most observational case studies has been their failure to make explicit the quasi-statistical basis of their conclusions” Becker (1970).

## Findings

### GTF 2022

George Town Festival (GTF) is one of the significant annual events to commemorate the inscription of George Town. In particular, GTF is a project by George Town World Heritage Incorporated (GTWHI), endorsed by the Penang State Government and fully supported by the Penang State EXCO for Tourism and Creative Economy (PETACE), City Council of Penang Island and Penang Global Tourism (PGT). GTF was first held in 2010. The first GTF Director was Mr. Joe Sidek of Joe Sidek Productions. He was the Director of GTF from 2010 to 2018. From 2019 to 2022, GTF was organised by Mr. Jack Wong of TLM Event. The Festival aims (George Town Festival 2023; Suhaimi, 2021):

- i. to promote the arts and multicultural heritage on an international platform,
- ii. to progress the format of arts and heritage education and foster an appreciation of the role of arts and heritage in George Town,
- iii. to ensure that a minimum of 70% of the events are free to attend, and
- iv. to feature a minimum of 40% of local programmes and artists.

GTF 2022 was held from 9<sup>th</sup> to 24<sup>th</sup> July 2022. Under the theme ‘A Festival for Everyone’, GTF 2022’s edition features around 70 programmes covering dance, theatre, music, film, visual arts and design throughout the 16 days of festival.

### GTF 2022 programmes in numbers

Table 4. GTF 2022 programmes

No	GTF 2022 programmes	LOCAL										INTERNATIONAL			
		General	Multi-ethnic	Malay	Chinese	Eurasian	Italy	China	Japan	Paris	Taiwan	Spain	USA	UK	
1	A Night at Hin - Reset		✓												
2	G-Short: Finalists’ films screening	✓													
3	A concert to “浪 (lang4) x lepak”				✓										
4	The Shang Sisters: Pesta irama bersama-sama				✓										
5	Down memory lane featuring Kathleen Rodrigues					✓									
6	Ciné France at Cheah Kongsı									✓					
7	A concert to “浪 (lang4) x lepak”				✓										
8	The Shang Sisters: Pesta irama bersama-sama				✓										
9	From Zero to Ten Talk & Dialogue	✓													
10	Tin Pan Alley, Shanghai Jazz and Malayan Music	✓						✓					✓		
11	An introduction to Jazz drumming												✓		
12	Come play with me: A piano concert for families													✓	
13	Tiltbrush competition: Create your own artwork in tiltbrush	✓													
14	The Image and the Word	✓													
15	Macallum rooftop concert		✓												
16	Tiltbrush competition: Create your own artwork in tiltbrush	✓													
17	Meet the Artists in Residence!	✓													
18	The acoustic rebel: The singer and the song	✓													
19	ANGIN OMBULAN			✓											
20	Tiltbrush competition: Create your own artwork in tiltbrush	✓													
21	Community and social impact in XR storytelling and the metaverse	✓													
22	Viva Voce: Exploring the voiceover	✓													
23	Isle to Isle: The architectural aesthetic and image design of Taipei										✓				
24	Kids AR mask workshop!	✓													
25	TU7OH: Artists sharing session pt. 1	✓													
26	Le Corbusier’ Maquettes: The representation of modern architecture - Talk									✓					
27	Isle to Isle: Comprising urban branding events into public spaces										✓				
28	Tiltbrush competition: Create your own artwork in tiltbrush	✓													
29	Oops! Belle the witch is gone!				✓										
30	Explore your digital identity through AR mask making	✓													

No	GTF 2022 programmes	LOCAL										INTERNATIONAL																
		General	Multi-ethnic	Malay	Chinese	Eurasian	Italy	China	Japan	Paris	Taiwan	Spain	USA	UK	General	Multi-ethnic	Malay	Chinese	Eurasian	Italy	China	Japan	Paris	Taiwan	Spain	USA	UK	
31	A night at Hin - Refine		✓																									
32	Spotlight on Malaysian XR creators: An online dialogue between Malaysian XR industry professionals	✓																										
33	A notional history		✓																									
34	Isle to Isle: Integrating arts and design onto the land: Matsu Biennial as an example																								✓			
35	Isle to Isle: Aesthetic design revolution for public institutions																								✓			
36	Tiltbrush competition: Create your own artwork in tiltbrush	✓																										
37	Down memory lane featuring Colleen Read	✓																										
38	Oops! Belle the witch is gone!	✓																										
39	The senses	✓																										
40	A notional history		✓																									
41	Performance to screen arts film festival Ryuichi Sakamoto: Coda																											
42	Let's talk about Tanjong life: A sharing session by Azmi Hussin		✓																									
43	Handbuilt pottery workshop	✓																										
44	Performance to screen arts film festival West Side Story																											✓
45	SERENITY: A glimpse through the traditional lenses																											✓
46	Jom! Pi Holland!																											
47	Performance to screen arts film festival Yuli: The Carlos Acosta story																										✓	
48	SERENITY: A glimpse through the traditional lenses																											✓
49	ANGIN OMBULAN																											✓
50	Performance to screen arts film festival Cinema Paradiso																											✓
51	Ibu 伊母																											✓
52	Teater tradisional Makyung 'Dewa Indera Indera Dewa'																											✓
53	Performance to screen arts film festival Clouds of Sils Maria																											✓
54	Ibu 伊母																											✓
55	TU7OH: Artists sharing session pt. 2	✓																										
56	Isle to Isle: What can designers do?																											✓
57	Mozart at The Mansion																											✓
58	Ibu 伊母																											✓
59	A night at Hin - Retro		✓																									
60	Performance to screen arts film festival Drive My Car																											✓
61	Potehi Puteri Hang Li Po																											✓
62	VISION, a new wave dance creations by Emerging Choreographers																											✓
63	Teater tradisional Makyung 'Dewa Indera Indera Dewa'																											✓
64	Isle to Isle: Converse with community using designs																											✓
65	Songs at the Dawn of a Nation (Part 2)		✓																									
66	Mozart at The Mansion																											✓
67	VISION, a new wave dance creations by Emerging Choreographers																											✓

No	GTF 2022 programmes	LOCAL		INTERNATIONAL																				
		General	Multi-ethnic	Malay	Chinese	Eurasian	Italy	China	Japan	Paris	Taiwan	Spain	USA	UK										
68	Potehi Puteri Hang Li Po																							✓

Table 4 shows the list of 68 programmes at the GTF 2022. Based on Table 4, there are two general categories of representatives at the GTF 2022, namely the local and international. There are 72% local-based programmes and 28% international-based programmes (Diagram 5). Local-based representatives promote the arts and culture of Chinese, Malay, Eurasian as well as a mix of multi-culture ethnic groups and also general programmes (regardless ethnicity). International representatives are from countries such as Taiwan, Japan, USA, Paris, United Kingdom, Spain, Italy and China.

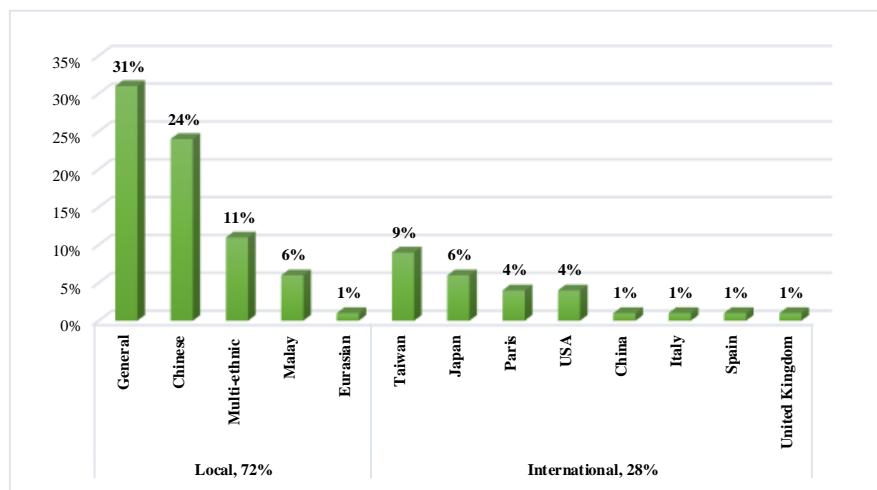


Diagram 5. GTF 2022 programmes by percentage

This study began by inquiring into the patterns of arts and multi-cultural promotions of GTF 2022. The findings offer two patterns, that are: (1) GTF 2022 featured 72% of local programmes and artists, and (2) the Chinese arts and culture is highly promoted at the GTF 2022.

### Conclusion

The aim of GTF 2022 is to feature a minimum of 40% of local programmes and artists. The first findings showed that GTF 2022 has achieved its objective by featuring 72% of local programmes and artists. The second findings showed that out of 72% of local programmes and artists featured at GTF 2022, general programmes turned out to be the most showcased programmes, by 31%, followed by Chinese (24%), multi ethnic community (11%), Malay (6%) and Eurasian (1%).

In specific, the findings showed that the Chinese's arts and cultural promotions at GTF 2022 is highly promoted compared to Malay and Eurasian's as well as other multi-ethnic community in Penang (under multi-ethnic community category). The findings is parallel with Merican et al. (2018) findings, where the Malay Muslim community are under-represented at the Festival. Additionally, it also parallels with other findings, where the representations of GTF are said to be a bit 'too Chinese' (Suhaimi & Bustami, 2020), and GTF cultural promotions from 2010-2020 have greatly benefitted the Chinese community, leaving other multi-ethnic community under-represented at the Festival (Suhaimi, 2022).

Social exclusion, social marginalisation or marginalisation is the social disadvantage to the fringe of society (Silver, 1994). In this context, social exclusion occurs in arts and multi-cultural promotions at the GTF 2022. Perhaps also, social exclusion occurs in terms of tokenism. The Festival does promote the arts and culture of other multi-ethnic community in Penang, but only in small percentage. By referring to the findings, it is evidently showed that the GTF 2022 is highly promoting the arts and cultural of the Chinese community in Penang, marginalising other multi-ethnic local community's arts and culture in Penang less and un-promoted. This is a type of social exclusion occurring at GTF 2022, and also the previous GTF since 2010.

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## Heritage Celebrations 2022: Intangible Cultural Heritage Promotions Vis- À-Vis Community In UNESCO Penang


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**Abstract:** George Town has developed over 200 years. In 2008, George Town was successfully listed as a UNESCO Cultural World Heritage Site (WHS). Since then, many events had been celebrated to commemorate the prestigious inscription of the heritage city. One of them is the George Town Heritage Celebrations (GTHC). GTHC focuses on promoting the intangible cultural heritage (ICH) of the local community in the heritage enclave. While fragile, it is very important to preserve and transmit both knowledge and skills of ICH from one generation to the next. Consequently, numerous researches about UNESCO George Town are focusing on tangible heritage, and the ICH is given less attention. Based on the GTHC 2022's e-brochure, this quasi-statistical qualitative research aims to investigate the promotions of the ICH vis-à-vis multi-ethnic local community in UNESCO George Town WHS, Penang, Malaysia. The findings showed that GTHC 2022 is most likely to promote the Chinese community's ICH.

**Keywords:** George Town Heritage Celebrations, Intangible Cultural Heritage, Multiculturalism, Promotion, UNESCO.

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### Introduction

#### An overview of UNESCO

Established in 1945, the United Nations Educational, Scientific and Cultural Organization (UNESCO) promotes international cooperation in education, sciences, culture, communication and information. Since then, many UNESCO programmes were introduced, among them is the UNESCO lists and designations. Under this listings are the World Heritage, Memory of the World Register, Creative Cities, Intangible Cultural Heritage, to name just a few (UNESCO, 2022a).

UNESCO cultural heritage scopes: What is ICH?

Generally, cultural heritage can be defined as the legacy that we receive from the past, experience in the present and transmit to future generations (Pelegri, 2008). There are two scopes of cultural heritage, namely: tangible cultural heritage and ICH (Isa et al., 2018; Salleh et al., 2021).

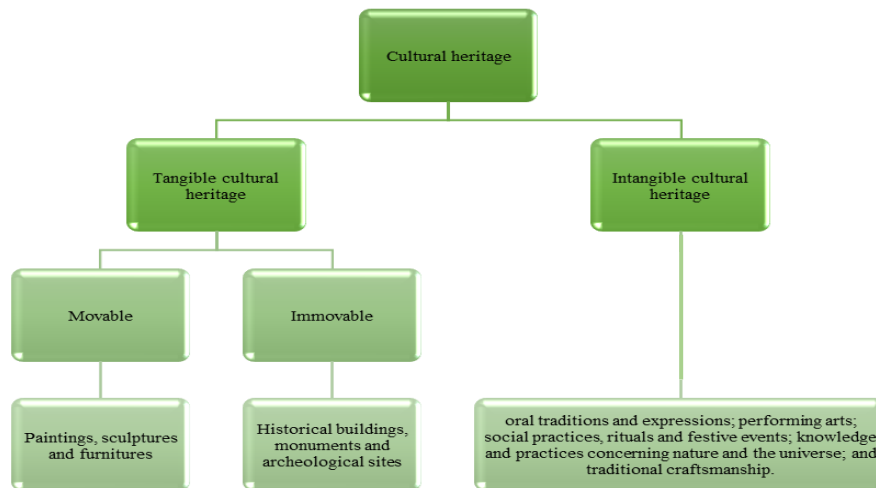


Diagram 1. Cultural heritage scopes by UNESCO

The tangible cultural heritage scope is divided into movable and immovable categories. The movable cultural heritage category includes paintings, sculptures, furniture and wall paintings; while the immovable cultural heritage category includes heritage buildings, monuments and archaeological sites. The ICH scope includes oral and traditions, traditional skills as well as science and habits related to nature and world (Hasibuan, 2011). Specifically, ICH is (UNESCO, 2022b):

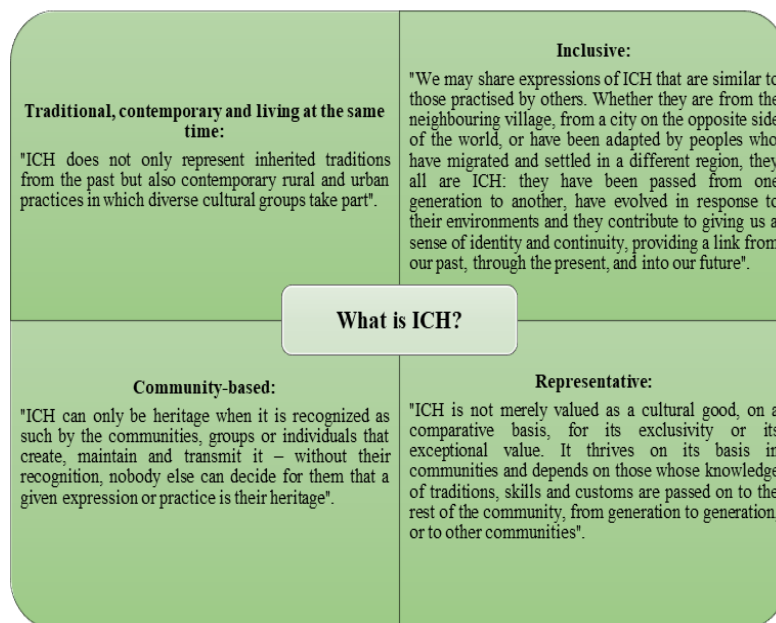


Diagram 2. ICH definitions

*Five domains of ICH (UNESCO, 2022c)*

So, what is ICH? The ICH means the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage. This ICH is transmitted from one generation to generation. UNESCO manifests five domains of ICH, viz (a) oral traditions and expressions, including language as a vehicle of the ICH; (b) performing arts; (c) social practices, rituals and festive events; (d) knowledge and practices concerning nature and the universe; and (e) traditional craftsmanship. The instances of ICH are not restricted to a one manifestation, many include elements from multiple domains.

*List of ICH in Malaysia*

The proposed nomination of ICH must demonstrate at least one of the following criteria (UNESCO, 2022 d):

“**Criterion U.1:** the element is based on UNESCO’s five ICH domains: (a) oral traditions and expressions, including language as a vehicle of the ICH; (b) performing arts; (c) social practices, rituals and festive events; (d) knowledge and practices concerning nature and the universe; and (e) traditional craftsmanship.

**Criterion U.2:** The element is in urgent need of safeguarding because:

- a. its viability is at risk despite the efforts of the community, group or, if applicable, individuals and State(s) Party(ies) concerned; or
- b. it is facing grave threats as a result of which it cannot be expected to survive without immediate safeguarding.

**Criterion U.3:** Safeguarding measures are elaborated that may enable the community, group or, if applicable, individuals concerned to continue the practice and transmission of the element.

**Criterion U.4:** The element has been nominated following the widest possible participation of the community, group or, if applicable, individuals concerned and with their free, prior and informed consent.

**Criterion U.5:** The element is included in an inventory of the intangible cultural heritage present in the territory(ies) of the submitting State(s) Party(ies),

**Criterion U.6:** In cases of extreme urgency, the State(s) Party(ies) concerned has (have) been duly consulted regarding inscription of the element in conformity”.

Beginning 2008, 90 elements of ICH were listed, followed by 2009 (86), 2010 (47), 2011 (33), 2012 (32), 2013 (30), 2014 (38), 2015 (28), 2016 (41), 2017 (42), 2018 (39), 2019 (41), 2020 (35), 2021 (47) and 2022 (48). To date, there are 677 elements of ICH, consistent of 140 state parties (countries) (UNESCO, 2022e).

Thus far, there are six ICH elements in Malaysia, namely: Mak Yong theatre (2008), Dondang Sayang (2018), Silat (2019), Pantun (2020 - shared with Indonesia), Ong Chun ceremony (2020 - shared with China) and Songket (2021) (UNESCO, 2022 f).

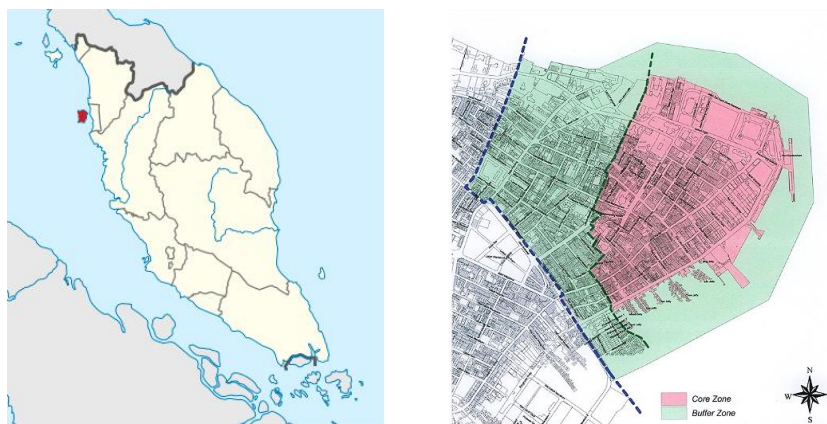
Table 1. Six elements of ICH in Malaysia

Elements	Year of inscription	Domain
Songket	2021	<ul style="list-style-type: none"> <li>• Traditional craftsmanship</li> </ul>
Ong Chun / Wangchuan / Wangkang (shared with China)	2020	<ul style="list-style-type: none"> <li>• Social practices, rituals and festive events</li> </ul>
Pantun (shared with Indonesia)	2020	<ul style="list-style-type: none"> <li>• Knowledge and practices concerning nature and the universe</li> <li>• Oral traditions and expressions</li> <li>• Performing arts</li> <li>• Social practices, rituals and festive events</li> </ul>
Silat	2019	<ul style="list-style-type: none"> <li>• Knowledge and practices concerning nature and the universe</li> <li>• Performing arts</li> </ul>
Dondang sayang	2018	<ul style="list-style-type: none"> <li>• Oral traditions and expressions</li> <li>• Performing arts</li> <li>• Social practices, rituals and festive events</li> </ul>
Mak Yong theatre	2008	<ul style="list-style-type: none"> <li>• Oral traditions and expressions</li> <li>• Performing arts</li> <li>• Social practices, rituals and festive events</li> </ul>

**An overview of UNESCO GTWHS, Penang, Malaysia**

*UNESCO George Town World Heritage Site, Penang, Malaysia*

In 2008, George Town was successfully declared as a World Heritage Site (WHS), by UNESCO (Halim & Tambi, 2021; Latiff et al., 2020). George Town is the capital of Penang (Wazani, 2021). There are two separate zones identified in this heritage Site, namely the core and buffer zones. The buffer zone is measured at 150.04 hectares and the core zone is measured at 109.38 hectares (Noraffendi & Rahman, 2020).



Map 1. The location maps of George Town

To be listed as a UNESCO Cultural WHS, sites must be of outstanding universal value (OUV) and meet at least

one out of six cultural selection criteria. The declaration of George Town as a UNESCO Cultural WHS was based on these 3 particular OUVs (UNESCO, 2022g):

- i. “to exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;  
George Town represents exceptional examples of multi-cultural trading towns in Southeast Asia, forged from the mercantile and exchanges of Malay, Chinese, Indian and European cultures for more than 200 years, each with its imprints on the architecture and urban form, technology and monumental art. George Town demonstrates different stages of development and the successive changes over a long span of time and are thus complementary.
- ii. to bear a unique and exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;  
George Town is a living testimony to the multi-cultural heritage and tradition of Asia and European colonial influences. This multi-cultural tangible and intangible heritage is expressed in the great variety of religious buildings of different faiths, ethnic quarters, the many languages, worship and religious festivals, dances, costumes, art and music, food, and daily life.
- iii. to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;  
George Town demonstrates a mixture of influences which have created a unique architecture, culture and townscape without parallel anywhere in Southeast Asia. In particular, George Town reflects an exceptional range of shophouses and townhouses. These buildings show many different types and stages of development of the building type”.

Evidently, the listing of George Town as a UNESCO Cultural WHS was based on the value of multiculturalism and traditions that are still alive!

Such a unique blend of cultural diversity and traditions existing within the George Town inner city caught the world’s attention when George Town’s was inscribed into the UNESCO World Heritage listing in 2008 (Leng & Badarulzaman, 2014).

#### *The George Town Heritage Celebrations (GTHC)*

Since the declaration as a UNESCO WHS, apart from the traditional events and festivals of the multi-ethnic community in Penang, there have been numerous new events organised to specifically commemorate the heritage Site, such as the GT Heritage Day, George Town Festival (GTF), George Town Heritage Celebrations (GTHC), to name just a few. George Town Heritage Day is held on 7<sup>th</sup> July each year, since 2008. It is a public holiday in Penang. GTF is an annual festival that inaugurated in 2010. The festival presents a mix of arts and cultural programmes and held within the heritage Site. It provides a platform for domestic and international



creative talents to showcase their works.

GTHC have been taking place in the streets of the UNESCO George Town, every year since 2010. It specifically focuses on the celebrations of UNESCO George Town's ICH. Particularly, this Celebrations gives participants to showcase and experience first-hand UNESCO George Town's living traditions. GTHC builds on the multi-cultural and diverse character of the heritage Site, whose inhabitants continue to live in harmonious coexistence through the understanding of multi-cultural traditions that have been passed down through generations despite cultural and ethnic differences (UNESCO, 2022h). Most importantly, the Celebrations highlights the endangered ICH of UNESCO George Town (GTHC, 2022).

### **Problem statement**

After being listed as a UNESCO Cultural WHS in 2008 and before the Covid-19 pandemic, Penang has been receiving increasing number of local and international tourists (Swan, 2020). Unfortunately, in 2000, the repeal of the Rent Control Act in George Town and the listing of George Town as a UNESCO Cultural WHS in 2008 have devastated many forms of ICH within the heritage enclave. The development has displaced the residents, most of whom are tenants who have lived in George Town since birth, and the traditional businesses that have served them (Looi, 2015; Sekaran & Ong, 2015).

Furthermore, in 2020, Malaysia was restricted to a four-phase of Movement Control Order (MCO) to prevent the widespread of Covid-19 in the country. The MCO has affected many sectors, including the tourism industry in UNESCO George Town. Zwain (2021) found that the Covid-19 had the worst hit on traditional businesses in the heritage enclave of George Town. Majority of the traditional businesses are struggling to survive. The old trades and livelihoods in the heritage Site have gradually declined (Swan, 2020). The heritage shophouses that are located in the heritage Site are among the few that have retained their authenticity artifacts, cultural and identities of George Town, also affected by the MCO (Tan, 2019; Tye, 2016).

After the UNESCO listing in 2008, the tangible heritage was well maintained through regular monitoring and improvement by the authority. However, the same cannot be said for the ICH that involves humans in and around structures, buildings, and spaces within the heritage enclave (Musa & Feng, 2016). Consequently, after Covid-19, there have been many studies that gave attention to the sustainability of heritage buildings (Swan, 2020).

Furthermore, numerous researches conducted about UNESCO George Town are focusing on tangible heritage instead of ICH (Rashid et al., 2020). In addition, the trend shows that the nomination of a WHS generally focuses on the tangible heritage properties, and the ICH is given less attention (Bakri et al., 2022). While fragile, it is very important to preserve and transmit both knowledge and skills of ICH from one generation to the next (UNESCO, 2022b).

**Research objective**

In problematising these issues, based on GTHC’s 2022 e-brochure, the researchers seek to explore the promotions of GTHC’s ICH vis-à-vis multi-ethnic local community in UNESCO George Town Cultural WHS, Penang, Malaysia.

**1. SLR: ICH in UNESCO GTWHS, Penang, Malaysia**

This section presents the systematic literature review (SLR) in selecting articles with special reference to the ICH in UNESCO GTWHS, Penang, Malaysia. The articles are retrieved from Scopus and Google Scholar databases. The methodology for a SLR in selecting articles includes identification, screening, eligibility and inclusion. Identification is a phase in selecting the most relevant articles. The first point is keywords identification, followed by a search for related and similar terms based on the keywords of past research. The Scopus search strings retrieved 13 articles, while the Google Scholar retrieved 2 articles (Table 2).

Table 2. Scopus advanced search string

Database	Search string
Scopus	TITLE-ABS-KEY ((ich OR “intangible cultural heritage” OR “intangible heritage”) AND (penang OR georgetown OR “george town”))
Google scholar	(with exact phrase:) "george town heritage celebration"

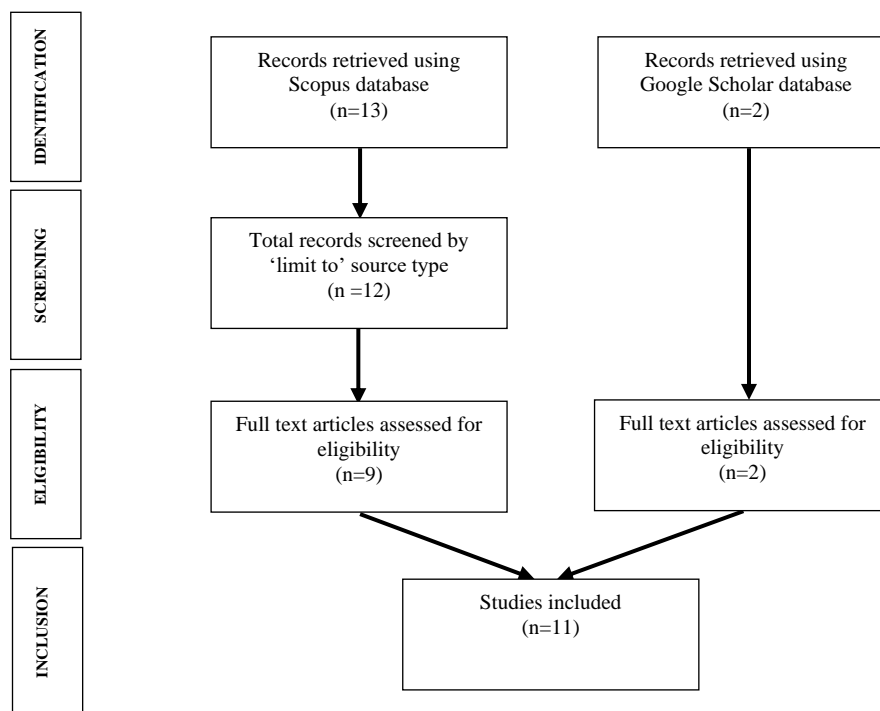


Diagram 3. SLR flowchart

The aim of the screening phase is to screen the 13 (Scopus) articles and 2 (Google Scholar) articles based on the inclusion and exclusion criteria specified by the researchers. For Scopus, the only criterion was source type. Only ‘journal and conference proceeding’ were included. After screening, 1 article was removed.

Eligibility includes or excludes articles manually according to the criteria specified by the researchers. The retrieved articles were thoroughly reviewed and any articles that did not meet the criteria, were excluded. Three articles were removed from Scopus database as (1) it was written in Chinese language and (2) two articles did not specifically focus on UNESCO GTWHS, Penang, Malaysia. As a final point, a total of 11 articles from Scopus and Google scholar databases were included and ready to be analysed (Diagram 3: SLR flowchart).

Table 3. SLR Matrix

No.	Author	Findings	
		Sustainability of ICH	Branding of UNESCO GTWHS through ICH
1	Bideau and Kilani (2012)	relocations of local inhabitants	
2	Leng and Badarulzaman (2014)		Gastronomy
3	Musa and Feng (2016)	oral history documentation	
4	Cheng (2017)		Penang hawker food
5	Mei (2017)	Chinese architectural feng shui	
6	Tan et al. (2018)	people-place bonding	
7	Rashid et al. (2020)		tourists’ perception on ICH as brand image of UNESCO George Town
8	Suhaimi and Bustami (2020)	George Town Festival cultural promotions of multi-ethnic community	
9	Lim et al. (2021)	garment preservation	
10	Law et al. (2022)	the role of stakeholders in safeguarding the ICH	
11	Bakri et al. (2022)	relationship between GTWHS and its local communities	

Table 3 shows the SLR table matrix outlining 11 articles. These articles are focusing on ICH in UNESCO GTWHS, Penang, Malaysia. There are two categories of SLR focus area: (1) the sustainability of ICH and (2) branding of UNESCO GTWHS. Researches that focus on the sustainability of ICH in UNESCO GTWHS are Bideau and Kilani (2012), that focuses on the relocations of local inhabitants; followed by Musa & Feng (2016) - through oral history documentation; Mei (2017) – Chinese architectural feng shui; Tan et al. (2018) – people-

place bonding; Suhaimi and Bustami (2020) – George Town Festival cultural promotions of multi-ethnic community; Lim, et al. (2021) – garment preservation; Law et al. (2022) – the role of stakeholders in safeguarding the ICH; and Bakri et al. (2022) - relationship between GTWHS and its local communities.

Researches about branding of UNESCO GTWHS are Leng and Badarulzaman (2014) – gastronomy; Cheng (2017) – Penang hawker food; and Rashid et al. (2020) - tourists' perception on ICH as brand image of UNESCO George Town. None of these researches focus on the cultural heritage promotions of George Town Heritage Celebrations (GTHC) vis-à-vis multi-ethnic community in the heritage enclave. GTHC is one of the significant festivals in commemorating George Town as a UNESCO Cultural WHS. GTHC focuses on the ICH of UNESCO GTWHS. GTHC have been organised for more 10 years. Thus, this research is vital to be carried out.

### **Research Methodology**

This research employed case study qualitative research method. A case study is the selection of the case to be studied – by whatever methods the researchers choose to study the case (Merriam, 1998; Stake, 2005). In this research, the GTHC 2022's cultural promotions vis-à-vis multi-ethnic community in UNESCO GTWHS is selected as a case study.

The data collection used in this research is document analysis. Document analysis refers to the review by the researcher of written materials, such as journals, newspapers, annual reports, brochures, to name just a few. Document analysis can be employed as a stand-alone method (Bowen, 2009). Thus, in this research, the document analysis of GTHC 2022's e-brochure is used as a stand-alone method. As a research method, document analysis is particularly applicable to qualitative case studies - intensive studies producing rich descriptions of a single event (Stake, 1995; Yin, 1994).

The quasi-statistical qualitative methodology is used to analyse the document (Miller & Crabtree, 1992). The number of programmes included in the GTHC 2022 will be analysed and categorised into multi-ethnic community preferences. In quasi-statistics, numerical data is used in qualitative research to make simple counts of things to support terms such as some, usually and most. Specifically, numbers in the sense of simple counts of things are a legitimate and important sort of data for qualitative researchers (Maxwell, 2010).

“Qualitative researchers often make quantitative claims in verbal form, using terms such as many, often, typically, sometimes, and so on. Numbers have the value of making such claims more precise and coined the term quasi-statistics for simple counts of things to support terms such as some, usually and most. One of the greatest faults in most observational case studies has been their failure to make explicit the quasi-statistical basis of their conclusions” Becker (1970).

## Findings

### GTHC 2022

The George Town Heritage Celebrations (GTHC) is an annual celebration to commemorate the prestigious declaration of George Town as a UNESCO Cultural World Heritage Site (WHS) on 7<sup>th</sup> July 2008. It celebrates the living heritage of George Town's ICH that takes place within the historic streets of George Town. GTHC 2022 marks the year that the Celebrations is able to be organised physically after a two-year long overdue because of Covid-19 pandemic. This year, the Celebrations is held for three-day long – that are on July 2, 3 and 7, 2022.

## Analysis

Table 4. GTHC 2022 programmes

No.	Programme name	Malay	Muslim	Chinese	Indian	Straits Chinese	Eurasian
1	<i>Persembahan Boria: Warisan George Town - Kumpulan Boria Omara Pulau Pinang</i>	✓					
2	Odissi Dance: Arabhi Pallavi - The Temple of Fine Arts Penang				✓		
3	Chinese Orchestra Medley - Chong Yee Chinese Music Centre and Academy			✓			
4	Sitar Recital - The Temple of Fine Arts Penang				✓		
5	Lion Dance: The Awake of The Lions - Penang Grocers' Association			✓			
6	Cultural Folk Dance: Journey - The Temple of Fine Arts Penang				✓		
7	Gamelan Ensemble - Wak Long Music and Art Centre	✓					
8	Chinese Drums: Reborn - Louds Percussion			✓			
9	<i>Persembahan Dikir Barat: Let's Suka Ria - Dikir Barat Suara Mutiara</i>	✓					
10	Glove Puppet Theatre: The Monkey King's Havoc in Heaven - Beng Geok Hong Glove Puppet Show			✓			
11	<i>Persembahan Dikir Barat: Let's Suka Ria - Dikir Barat Suara Mutiara</i>	✓					
12	Carnatic Vocal Performance - The Temple of Fine Arts Penang				✓		
13	<i>Silat Kapi - Pertubuhan Seni Silat Kapi 997 Pulau Pinang</i>	✓					
14	Nillaikalakki Silambam - <i>Persatuan Nillaikalakki Silambam Pulau Pinang</i>				✓		
15	Wushu - CMF Wushu Academy			✓			
16	Lion Dance: The Awake of The Lions - Penang Grocers' Association			✓			
17	Rhythmic Kathak Dance - The Temple of Fine Arts Penang				✓		
18	<i>Persembahan Ghazal Parti: Mai Berpesta - Kumpulan Boria Omara Pulau Pinang</i>	✓					
19	Chinese Drums: Reborn - Louds Percussion			✓			
20	Teochew Opera: A Drizzling Rain - Lau Geok Thng Dramatic Troupe			✓			
21	<i>Persembahan Wayang Kulit: Wak Long Menjadi Raja - Wak Long Music and Art Centre</i>	✓					
22	Art of Khat: Learn to write your name in the traditional Jawi script - <i>Yayasan Islam Pulau Pinang</i>		✓				
23	The Way of The Brush: Learn to write your name in Chinese, using only brushes and ink - Van Hin Book Co.			✓			
24	<i>Eh Wau Bulan! Make your own Malaysian Moon Kite - Wak Long</i>	✓					

No.	Programme name	Malay	Muslim	Chinese	Indian	Straits Chinese	Eurasian
	Music and Art Centre						
25	Henna: The Body Art for Celebrations - Free Henna hand art as you join our celebration - <i>Persatuan Hindu Pulau Pinang</i>				✓		
26	'Jian-Zhi' Learn the ancient Chinese folk art of paper cutting - <i>Gabungan Belia Persatuan Klan Cina Pulau Pinang</i>			✓			
27	'Wood' You Print This? - Make your own Woodblock Prints - <i>Gabungan Belia Persatuan Klan Cina Pulau Pinang</i>			✓			
28	<i>Wayang Kulit</i> : Rise of the Shadow Puppets - Wak Long Music and Art Centre	✓					
29	Kolam: Symbol of Well-being and Welcoming - <i>Persatuan Hindu Pulau Pinang</i>				✓		
30	Thoranam: The Mark of Occasions - Learn to weave this traditional hanging decorations - <i>Persatuan Hindu Pulau Pinang</i>				✓		
31	Film #1 Penang Eurasian Cultural Adaptation						✓
32	Film #2 Boria in the New Normal	✓					
33	Film #3 The Celebration of Mue Guek in New Normal			✓			
34	Film #4 Penang Teochew Puppet and Opera House in the New Normal			✓			
35	Film #5 Dondang Sayang Chap Goh Meh					✓	
36	Film #6 Perseverance: Moh Teng Pheow Nyonya Koay					✓	
37	Film #7 Phor Thor in a Pandemic (Hungry Ghost)			✓			
38	Film #8 Eye Dotting Ceremony: Crisis and Opportunity			✓			

Table 4 shows the list of 38 programmes at the GTHC 2022. Based on the ethnic preferences, GTHC 2022 is most likely to promote the Chinese community's ICH with 39%, followed by Malay (26%), Indian (24%), Straits Chinese (5%) as well as Muslim and Eurasian-ethnic with one (3%) programme each (Diagram 4).

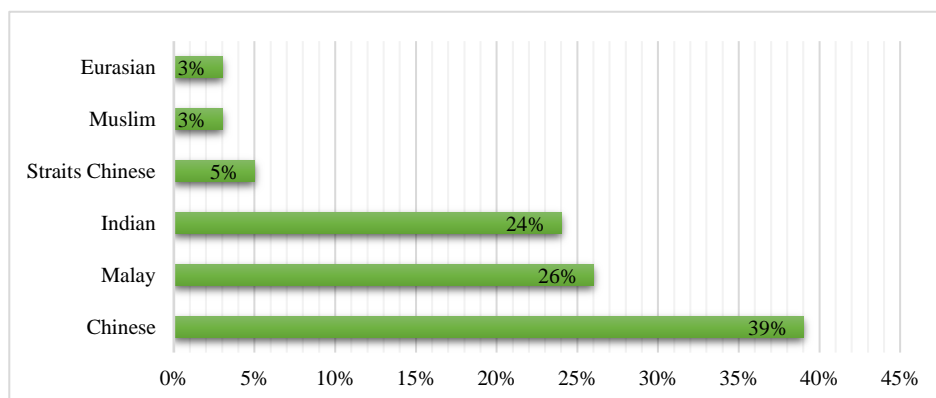


Diagram 4. ICH promotions at GTHC 2022 vis-à-vis multi-ethnic community in UNESCO GTWHS, Penang

**Conclusion**

UNESCO George Town Cultural World Heritage Site is a good example of multiculturalism. Derived from its 200-year history, the heritage enclave has more than Chinese-, Malay-, Indian-, Straits Chinese-, Muslim- and

Eurasian-influence have to offer. Other minor ethnic groups like *Jawi Peranakan*, Arab, Indonesian descent, Siamese, to name just a few - are also part of the UNESCO's cultural OUVs. Every ethnic group has their part in contributing to the multiculturalism that leads to the listing of George Town as a UNESCO Cultural WHS. Thus, more ICH promotions that represent all the multi-ethnic community in the heritage enclave deserves to be highlighted. Like other elements and essences of the Site's multiculturalism, other festivals and ICH promotions of multi-ethnic community in UNESCO GTWHS, Penang, needs more attention.

## Appendix

GTHC 2022 e-brochure.

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## Appendix. GTHC 2022 e-brochure

George Town  
**Heritage**  
Celebrations 2022

**Persembaan**  
Gelanggang Bola Keranjang

**2 Julai**  
2022

Sabtu  
06.30pm — 10.00pm

- 06.30pm **Persembahan Boria: Warisan George Town**  
*Kumpulan Boria Omara Pulau Pinang*
- 06.50pm **Tarian Odissi: Arabhi Pallavi**  
*The Temple of Fine Arts Penang*
- 07.00pm **Rangkaian Lagu Orkestra Cina**  
*Chong Yee Chinese Music Centre and Academy*
- 07.20pm **Resital Sitar**  
*The Temple of Fine Arts Penang*
- 07.45pm **Tarian Singa: Terjaga dari Tidur**  
*Penang Grocers' Association*
- 08.00pm **Tarian Rakyat: Perjalanan**  
*The Temple of Fine Arts Penang*
- 08.15pm **Ensembel Gamelan**  
*Wak Long Music and Art Centre*
- 08.40pm **Gendang Cina: Lahir Semula**  
*Louds Percussion*
- 09.00pm **Persembahan Dikir Barat: Let's Suka Ria**  
*Dikir Barat Suara Mutiara*
- 09.20pm **Teater Boneka Tangan: Raja Monyet Mengamuk di Istana Langit**  
*Beng Geok Hong Glove Puppet Show*

George Town  
**Heritage**  
Celebrations 2022

**Persembaan**  
Gelanggang Bola Keranjang

**3 Julai**  
2022

06.30pm — 10.00pm

- 06.30pm **Persembaan Let's Sul**  
*Dikir Barat Su*
- 06.50pm **Persembaan The Temple of**
- 07.10pm **Pertunjukan Silat**  
*Pertubuh*
- Nillail**  
*Persatuan*
- Wushu**  
*CMF Wushu*
- 07.45pm **Tarian Silat**  
*Penang Grace*
- 08.00pm **Tarian K**  
*The Temple of*
- 08.13pm **Persembaan**  
*Kumpulan Bo*
- 08.42pm **Gendang**  
*Louds Percuss*
- 09.00pm **Opera T**  
*Lau Geok Thn*
- 09.20pm **Persembaan "Wak Lo"**  
*Wak Long Mu*

George Town  
**Heritage**  
Celebrations 2022

**7 July**  
2022

05.30pm — 09.30pm

**Cultural Workshops In The Garden**  
Armenian Park, George Town

- Art of Khat**  
Learn to write your name in the traditional Jawi script  
*Yayasan Islam Pulau Pinang*
- The Way of The Brush**  
Learn to write your name in Chinese, using only brushes and ink  
*Van Hin Book Co.*
- Eh Wau Bulan!**  
Make your own Malaysian Moon Kite  
*Wak Long Music and Art Centre*
- Henna: The Body Art for Celebrations**  
Free Henna hand art as you join our celebration  
*Persatuan Hindu Pulau Pinang*
- "Jian-Zhi" for Luck & Happiness**  
Learn the ancient Chinese folk art of paper cutting  
*Gabungan Belia Persatuan Kian Cina Pulau Pinang*
- Wood You Print This?**  
Make your own Woodblock Prints and bring it home  
*Gabungan Belia Persatuan Kian Cina Pulau Pinang*
- Wayang Kulit: Rise of the Shadow Puppets**  
A DIY workshop on engraving Wayang puppet figures  
*Wak Long Music and Art Centre*
- Kolam: Symbol of Well-being and Welcoming**  
Hand-on experience in creating the magical Kolam  
*Persatuan Hindu Pulau Pinang*
- Thoranam: The Mark of Occasions**  
Learn to weave this traditional hanging decorations  
*Persatuan Hindu Pulau Pinang*

**Mini-Documentary Films Screening**  
Dewan Belia Lebuah Acheh, George Town

- 07.00pm **Penang Eurasian Cultural Adventure**  
*Film #1*
- 07.15pm **Boria in the New Normal**  
*Film #2*
- 07.30pm **The Celebration of Mue Guek in the New Normal**  
*Film #3*
- 07.45pm **Penang Teochew Puppet and Opera House in the New Normal**  
*Film #4*
- 08.05pm **Dondang Sayang Chap Goh Meh**  
*Film #5*
- 08.30pm **Perseverance: Moh Teng Pheow Nyonya Koay**  
*Film #6*
- 08.50pm **Phor Thor in a Pandemic**  
*Film #7*
- 09.10pm **Eye Dotting Ceremony: Crisis and Opportunity**  
*Film #8*

## Ensuring Intercultural Diversity Through the VNC104 Student Exchange Program

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**Abstract:** Target 4.7 in Sustainable Development Goal 4 (SDG4) aims to ensure that education is equally accessible to all genders who are taught to appreciate human rights and cultural diversity as global citizens. Understanding and sympathy for intercultural differences become important in higher education. With a focus on the foundations and dimensions of Vietnamese culture, the course VNC104 (Vietnamese Culture) allows lecturers to meet Target 4 in SDG4 in some ways. Advancing students' understanding and sympathy for intercultural diversity requires lecturers to involve them in activities that are socially constructed. It is argued in this paper that socially constructed knowledge can be absorbed through the body and mind. Bodily engagement, environment, task integration, and use of objects play a vital role in this process. The world is not simply understood by the working mechanism in our brains. Nevertheless, it must be felt and sensed. In this paper, the authors combine embodiment with Bloom's taxonomy to increase students' cognitive development through the connection between the mind and body. The combination of these theories has the potential to link social constructivism to students' bodily engagement in the world through cognitive processes. It also develops an innovative approach to establishing an organic rapport with students of diverse backgrounds and ensuring education quality for global citizenship.

**Keywords:** intercultural diversity, Vietnamese culture, Bloom's taxonomy, global citizenship, embodied cognition

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### Introduction

Bloom's taxonomy is widely applied in education. Bloom and his associates came up with six levels of thinking that are arranged from a low-order to a high-order sequence. Nonetheless, recent research has pointed out that Bloom's taxonomy is flawed. This taxonomy's hierarchical structure has been critiqued for being excessively rigid and failing to adequately capture the complexity of learning (Krathwohl, 2002). It is crucial to modify the

taxonomy to fit local circumstances. In addition, Nguyen and Phung (2018) contended that Bloom's taxonomy falls short in meeting the demands of 21st-century learners, who tend to require a more varied collection of abilities and competencies is typically covered by the framework. They criticized Bloom's taxonomy for its exclusive concentration on cognitive functions and its omission of significant non-cognitive areas including social and emotional development, cultural competency, and digital literacy. Nguyen and Phung (2021) were in incongruence with Bloom's taxonomy by stating that students may not always go through the hierarchical levels of cognition. They may use a certain level of cognition for a particular task and then another for either the next sequence of the same task or for another task.

This article is not intended to criticize Bloom's taxonomy. Instead, the authors of this article would like to specify the process of the integrated model. The authors argue that we are perceivers, and at the same time, we are being perceived, allowing our knowledge to evolve and develop. This argument is based on the integration of embodiment into Bloom's taxonomy. The incorporated model is illustrated in a Vietnamese culture course at a private university in Vietnam. This course is only the first testing phase of this model, which only presents the implementation and initial student feedback. More empirical research is needed to test the validity of this model.

The introduction of this original model is important in higher education. The authors acknowledge that many other theoretical frameworks or Bloom's taxonomy itself perform a fundamental role in the design of instructional activities. However, we believe that our body is the vehicle for us to enter the world. What the teacher teaches is what the teacher thinks is right. Yet, it is the students with their bodies and minds that enable them to enter what the teacher teaches. Perception, therefore, is a combination of the mind and body.

The article is structured in several sections. The first section discusses education as a means for sustainable development. Increasing students' understanding of intercultural diversity is essential for global citizenship, and this is outlined in the second section. The Vietnamese Culture course (internal code VNC104) is introduced in the section that follows to illustrate the expected course outcomes that include students' understanding of cultural diversity. Bloom's taxonomy and embodiment are introduced later to facilitate the argument about the nexus of the body and the mind. The rest of the paper shows the authors' experiences in conducting the VNC104 course by using the integrated model between Bloom's taxonomy and embodied learning and teaching approaches.

### **Education for sustainable development**

The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2015) developed Sustainable Development Goal 4 (SDG4) with 10 targets that promote education for all so that everyone can achieve an education that can be suited for their global citizenship. Target 4.7 in SDG4 emphasizes that every learner is able to learn the knowledge and skills for them to develop sustainably. These sets of knowledge and skills allow them to lead a healthy lifestyle, respect human rights and gender equality, and value the culture of peace. They

should also learn how to appreciate cultural diversity as cultural understanding and sympathy can significantly contribute to sustainable development for society and individuals. It is the ability to live together with others peacefully and sustainably. UNESCO also proposes three means to implement these targets one of which is to create effective learning environments with adequate facilities for learning. The authors of this paper further argue that such effective learning environments should allow for an understanding and appreciation of culture diversity to happen.

An effective learning environment should encompass spaces for students to learn how to understand and value intercultural diversity (see Murray, 2016). It is sometimes considered an added value to lessons that do not necessarily cover cultural issues. In culture courses, of course, this value should be highlighted through foreign student exchange programs, overseas learning experiences, or a course per se. What matters to education for sustainable development is students' ability to comprehend similarities, differences, and meanings of culture rituals and practices among cultures. Respect for those differences, as such, can be maintained (Guo & Jamal, 2007). The authors of this paper keep arguing further that respect for differences among multiple cultures is important, but it is similarly important to understand, appreciate, and even embed in these cultural differences. The meaning of this cultural embeddedness is not to change oneself, but to enable one to act like one of the cultural groups with proper understanding and appreciation of the similarities and differences. We are our culture. We don't simply have a culture in us. This is the primary argument we would like to formulate in this section so that we can advance an understanding of education as a means for sustainable growth. Only when students are able to culturally act like others (as such a culture is embedded in them). This is why intercultural diversity and understanding of this issue matters.

The body as the means to appreciate intercultural diversity

O'Reilly, Williams, and Barsade (1998) described diversity as a characteristic of being multiple, different and possibly similar at the same time, and divergent. This feature is reflected and embedded in us, our actions and behavior, thoughts, objects that we use, and even instructional activities. Human beings are never the same. Cultures are never the same either. As a result, interactions that happen across cultures may result in intercultural diversity.

From several perspectives, culture is defined differently from diverse perspectives. Leininger (1995) described cultures as transmitted values, beliefs, and customs that guide thinking, decisions, and actions in patterned ways. According to Pauwels et al. (1997), culture is an integral component of how individuals interact socially and live in groups. Culture is shared by members of a social group and is transmitted among various generations. In other words, culture is the preservation and dissemination of knowledge about a nation's past and accomplishments (Papademetre & Scarino, 2000, p. 33). It is vital to understand that cultures evolve when living conditions alter due to two dynamic components of culture including knowledge and behavior. The interaction of one culture with those of other groups, and the nature and applications of a language are the other two variables that contribute to the dynamism of cultures.

According to Brick (1991), learning a language encompasses acquiring a culture, and vice versa. Hence, understanding cultures is of paramount significance in the teaching and learning processes. Corbett (2003) stated that the intercultural approach is suggested for culture education since it facilitates learners to be diplomatic and are able to view different cultures from a perspective of informed comprehension. In the same vein, English language learners are characterized as intercultural speakers who love learning about and establishing relationships with people from different cultural backgrounds, while not having received formal training for that reason (Soler & Jorda, 2007). Similarly, Baker (2012) stated that people become more conscious of the multi-voiced nature of cultural categorization as a result of the diversity and complexity of many local and national cultural groupings.

From these points, the authors of this paper argue that culture is reflected in how we live our lives in accordance with norms that others follow. We do as what others do. Therefore, our body becomes the means for us to enter a culture.

#### **Vietnamese culture course (VNC104): A move towards intercultural diversity within the understanding of one culture**

Intercultural education has won immense popularity in the process of teaching and learning English. Thus, an English course named Vietnamese Culture (VNC104), which is integrated with intercultural topics, is offered to English-majored students at a private university. This course is designed to give students a thorough comprehension of the roots, dimensions, origins, and characteristics of Vietnamese culture. It focuses on how Vietnamese culture is connected to the lives of Vietnamese citizens in the digital age as well as the numerous cultural components that are found in social structures namely belief systems, literature, arts, and customs. By taking this course, students are able to comprehend the foundations and dimensions of Vietnamese culture. Additionally, learners are capable of explaining Vietnam's history and the change of Vietnamese culture over the different historical periods. Besides, they can analyze cultural phenomena. Also, this course helps students evaluate cultural differences from a cultural perspective, aesthetic creation, and thriving for success in the globalization context. Furthermore, those who get involved in this course tend to develop essential skills in building or constructing a typical product reflecting cultural aspects. Last but not least, students can have a professional attitude, critical thinking, and teamwork.

Embodied cognition is applied in the lesson about cuisine. The lecturer taught students how to use their sensory perceptions to understand their embeddedness in the world by using objects and their relations to the surrounding environment, colors, sounds, flavors, and tastes. The lecturer chaired group discussions that generated new knowledge. Meanwhile, students used their bodies as the vehicle to make sense of the world by participating in team-building activities that nurtured their team working spirit, collaboration, and discipline. These activities were aimed to bring about fun and excitement in learning.

### **When the mind learns: Bloom's taxonomy**

Bloom's taxonomy was revised by Krathwohl in 2002. Three overlapping categories of knowledge, abilities, and attitudes (KSA) are included in Bloom's taxonomy: cognitive, psychomotor, and emotional. The taxonomy reflects various types of intellectual skills and abilities qualitatively. It is divided into low-order thinking and high-order thinking. At the low-order level, remembering is the broad and fundamental cognitive aspect that allows learners to begin their cognitive processes at a higher level. Understanding is the next level that implies one's capability to comprehend and utilize the information when receiving the information. The next level is applying. It requires students to demonstrate their ability to use newly learned skills to address problems. Aviles (1999) said that applying allows information to be used in new circumstances. At the high-order thinking level, analysis is supposed to divide a whole into its component pieces and detect relationships between them, whereas synthesis brings the component parts to create a pattern or structure that did not exist before. According to Aviles (1999), the prior levels of understanding, application, analysis, and application of information will be required for a task that includes synthesis. Bloom's taxonomy also entails making decisions about the worth of a subject.

The development and activation of the mind allows them to remember, understand, apply, analyze, evaluate, and create knowledge for application and use in real life. In other words, Bloom's taxonomy speaks about the mind that puts down the stepping stone for students to learn. However, students are supposed to learn through their cognitive mechanism, which can be developed through teaching approaches, lesson contents, and their interactions with others in the classroom (see Metlevskiene, 2011; Murray, 2016; Nguyen, 2010; Nguyen & Phung, 2021). The engagement of the whole body and mind in the lesson and learning spaces with others ignites their cognition. In this sense, the body plays an equally important role in learning.

### **When the body acts to learn: Embodied learning**

According to Metlevskiene (2011) and Dall'Alba and Barnacle (2015), curricula and courses that focus on what and how students learn theoretical knowledge and skills without relating them to specific contexts in real life can cause trouble to students when they later enter professional environments. This problem is caused by several reasons. First, what students learn from textbooks that have been published before they actually enter the working environment. The world keeps changing. A very good textbook can depict time ahead with changes, but most remain theoretical and fundamental and are unable to provide descriptions and instructions on exact situations for students to deal with (Nguyen & Thach, 2022). Decontextualized knowledge cannot be easily absorbed or become useful for students' future careers. Second, what students learn should be embodied as it is their own knowledge for use. The way they can absorb the knowledge which is embodied is through the embeddedness of their bodies in the world.

Their bodies allow them to cognitively perform functional roles in processing information, thus enabling their mental operations to be formed under the mutual exercise of neurological/mental/cognitive processes, body



reactions, and environments (Clark, 2008). In this sense, students can only learn and understand knowledge by embodying it in their embeddedness in a real environment. Third, we can always experience an extension of our bodies through the interconnection between our bodies and the world. As Heidegger (1962) pointed out in an example of pointing out our finger, we do not simply stop our action of the finger pointing at our fingertip but rather, it stretches to a particular action we mean with someone. Perception, action, and the body are interconnected in this sense. Fourth, Merleau-Ponty (1968) went on by discussing double belongingness when we are connected to other people and the world. When we touch something, he described, we perceive that our hand touches an object. The object is perceived by our perception of our hand touching, giving us some meanings about the object. As such, our perception, which is shaped and influenced by cultural norms, is connected to the world.

Our bodies allow us to embody our perception, forming specific relationships between us and the world and between us and our culture. Without the body, we couldn't have any place to perceive the world. We are our lived bodies that are already enmeshed in the world and cultural practices on the one hand, but that are able to interact and communicate with the world with our intentions on the other. As perceivers with lived bodies, we know the world, perceiving it as it is in our perception. At the same time, we know what we have known. We become the object of our perception as well. We can touch, see, feel, and perceive and at the same time, we are also touched, seen, felt, and perceived (Merleau-Ponty, 1968).

The discussion on embodied knowledge enables the authors to conclude that any lesson must not be decontextualized. It must be able to replicate real-life situations that abide by cultural norms as much as possible. Teaching activities must allow for students' embodied engagement in learning. Their senses of hearing, touching, sight, taste, and smell must be exercised through the use of diverse and interesting activities so that their perception can be increased and improved. There must be teaching aids that are referred to in the textbook and lesson that can encourage students to experience their learning through the extension of their bodies to these objects. As we are both perceivers and objects of our perceptions, there should be activities that motivate them to reflect on their learning processes with their friends. Interacting with others, therefore, becomes essential. Such issues as bodily engagement, task integration, use of objects and teaching aids, and a learning environment that accords with cultural practices are important in allowing for embodied learning to happen.

Then some questions arise. How do students perceive? What processes are involved in forming their perception of a lesson? Here, Bloom's taxonomy can be well combined with embodied learning.

#### **Embodied cognitive processes in the culture course VNC104**

Bloom et al. (2001) described the 6 levels of cognition that are divided into low-order and high-order thinking skills. When this taxonomy is integrated with embodied learning, we arrived at the following steps to facilitate embodied cognition. Preparation includes some cultural norms, lesson material, teaching aids that can create

chances for students to activate their senses and bodily movements, classroom environment, types of students, and their personal traits and levels of knowledge. Let's take an example from the lesson about Vietnamese cuisine in the Mekong Delta. Teaching aids should include ingredients for cooking particular dishes, spices, herbs, and utensils.

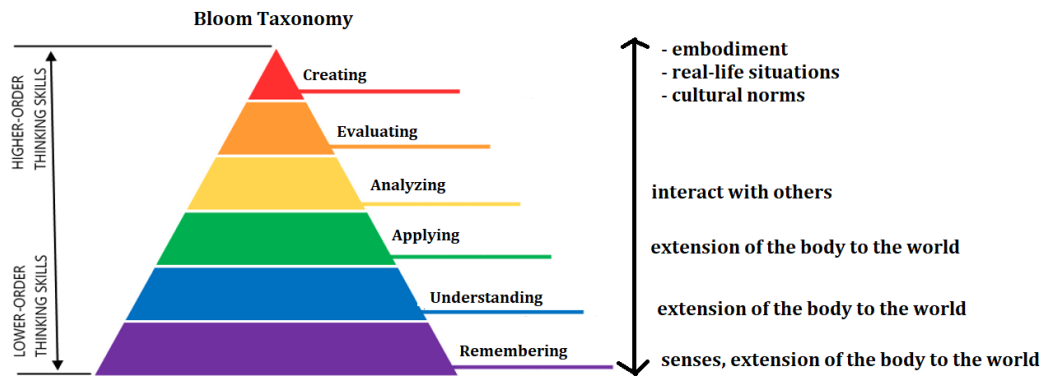


Figure 1: Embodied cognition

### Implementation of the embodied cognitive framework

This proposed framework can be used in a traditional classroom in any subject. In this paper, the authors present an example that took place in a student exchange program on a Vietnamese culture course. This program offered students between two universities to share their knowledge about cultural issues. This program was designed to meet 5 program learning outcomes (PLO):

- PLO1: Show national pride,
- PLO2: Work in groups effectively
- PLO3: Demonstrate professional behaviors
- PLO4: Be mentally and physically strong
- PLO5: Understand cultural literacy

These PLOs were interpreted through the deployment of the lesson objectives (LOs) as follows:

- Introduce some beautiful parts of Vietnamese culture for students to be proud of the nation (PLO1, PLO5)
- Create conditions for students of the two universities to get to know each other, learn from and with each other, and construct knowledge (PLO2, PLO3, PLO5)
- Enable students to participate in an embodied social constructivist class, breaking the traditional classroom model (PLO2, PLO3, PLO5)
- Enhance students' communicative and team-working skills in an intercultural environment (PLO3, PLO4, PLO5)
- Develop students' and lecturers' professional knowledge and relationships (PLO4, PLO5s)
- Promote cooperation, friendship, and mutual understanding between the two universities (PLO5, PLO6)

The topic of the lesson was food and cuisine in the Mekong Delta. It was extracted from a chapter in the

textbook of the course on Vietnamese culture. There were three main parts of the program: welcoming, lesson, and teambuilding activities. The lesson plan is described below.

### Lesson Plan: The Power Of The Senses

#### Lesson Objectives:

*At the end of the lesson, students will be able to:*

- use their prior knowledge to construct new knowledge of a specific theme relating to Vietnamese cuisine and typical traditional dishes, particularly in the Mekong Delta
- gain valuable experience of working with new people,
- develop their confidence in using their English to communicate with new people.

Table 1: The Lesson Plan

Time	Lesson details	Lecturer's activities	Students' activities	Embodied cognitive approach
9:30-9:40	<b>Warm-up</b>			
9:40-10:00	<p><b>Activity 1: Powerful senses (guess names of the food and spices)</b></p> <p>Instructions: One member of each team is asked to smell/taste/touch the food while their eyes are covered with a blindfold, then write the name of the ingredients that local people in the Mekong Delta often use in their daily dishes. The students write their answers in a sheet of paper. There are 10 turns for 10 different members.</p> <p><b>Points: 02 correct answers = 01 point</b></p> <p>List of food and ingredients:</p> <ol style="list-style-type: none"> <li>1. fish sauce</li> <li>2. curry powder</li> <li>3. salted bean curd</li> <li>4. palm sugar</li> <li>5. salt</li> <li>6. cooked rice</li> <li>7. salted lime</li> <li>8. coconut milk</li> <li>9. vinegar</li> <li>10. rice wine for cooking</li> <li>11. chicken curry</li> <li>12. lime leaves</li> </ol> <p>At the end of the game, the lecturer provides students with more knowledge about the main types of spices and asks the students to explore the origins of these spices by looking up the information on the internet and in the textbook. Two groups will be chosen to present the information.</p>	<p>Give instructions</p> <p>Ask two teachers/student s to come on stage to help with the demonstration</p> <p>Demonstrate the game</p> <p>Manage the game</p> <p>Check correct answers and give points</p> <p>Comment on their answers</p>	<p>Work in groups</p> <p>Nominate a person to name the food/spices</p> <p>Look up the information on the origin of the spices in the internet</p> <p>Select a person to present the information</p>	<p>Use of the senses</p>

10:00-10:15	<p><b>Activity 2: Powerful senses of sight and taste</b>  <b>Step 1: (5 minutes)</b>          Instruction: Each group will be given pictures of different local vegetables, and are asked to write down their names in 90 seconds. The winner is the fastest with the correct answers.  <b>Points: 02 correct answers = 01 point</b>          List of the suggested vegetables (these are the local vegetables that the people often eat in their main dishes; their names are written in the Vietnamese language)  <b>Step 2: (5 minutes)</b>          For every type of the vegetables, students are asked to name one dish that contains the vegetable. The winner is the fastest with the correct answers.</p>	<p>Give instructions          Ask 02 teachers/student s to come on stage to help with the demonstration          Demonstrate the game          Manage the game          Announce the winner          Comment on their answers          Make links to the next activity</p>	<p>Participate in the activity          Respond to the pictures</p>	<p>Bodily movements, interactions with friends, use of the senses</p>
10:15-10:55	<p><b>Activity 3: Discussions and Presentations</b>  <b>Step 1: 15 minutes</b>          Instructions: in teams, students will be given a basket of vegetables and are asked to think about a dish that contains/uses the vegetables given to present the dish (Suggestions: the origin of the vegetables, the cultural value of the dish, and the reason for having it)  <b>Step 2: 20 minutes</b>          Instructions: within 02 minutes, 02 members of each team will present the answer to the question, then each team will vote the answers that they like the most. (Cards to vote with be prepared beforehand.)  <b>Step 3: 5 minutes</b>          A conclusion on the gastronomical philosophies that underpin the cuisine in the Mekong Delta is provided by the lecturer</p>	<p>- Give instructions          - Manage the activity          - Go around and support all the teams          - Give comments and conclusions</p>	<p>Students have to use a laptop and show slides/pictures</p>	<p>Verbal communication, interactions with friends, use of the senses</p>
10:55-11:00	<p><b>Wrap up, and take photos</b>  <b>Questions and answers</b></p>	<p>Respond to the students' questions</p>	<p>Raise questions</p>	
Afternoon	<b>Team-building activities</b>			<p>Corporeal movement and teamwork</p>

**Students' feedback on VNC104 (Vietnamese Culture)**

At the end of the program, the 70 attendee students were given an online form to evaluate. The primary objective of the form was to let the lecturer and student exchange program organizers be reflected on the (in)effectiveness of their attempts to use the embodied cognition model. The result is presented in Table 2 below.

Table 2. Students' Feedback on VNC104

No.	Questions	Students' evaluation
<b>1</b>	<b>The match of the learning activities with your expectation</b>	
	Very appropriate	57/70
	Appropriate	12/70
	Neutral	1/70
	Not appropriate at all	0/70
<b>2</b>	<b>The effectiveness of organization and logistics</b>	
	Very effective	60/70
	Effective	10/70
	Neutral	0/70
	Not effective at all	0/70
<b>3</b>	<b>The usefulness of the program</b>	
	Very useful	60/70
	Useful	10/70
	Neutral	0/70
	Not useful at all	0/70
<b>4</b>	<b>Your overall satisfaction with the program</b>	
	Very satisfied	55/70
	Satisfied	14/70
	Neutral	01/70
	Not satisfied at all	0/70
<b>5</b>	<b>The interactions among the attendees</b>	
	Very good	63/70
	Good	07/70
	Neutral	0/70
	Very bad	0/70
<b>6</b>	<b>Aspects of the program you were interested in</b>	
	The staff and lecturers were supportive, knowledgeable, and friendly.	16/70
	Team-building activities	18/70
	Interactions with the lecturers and friends	29/70
	New, useful, and interesting knowledge	50/70
	Teamwork	06/70
	The positive and friendly rapport with friends from the other university	21/70
	Knowledge about food in the region	22/70
	The interesting lesson taught by the lecturer	07/70
	Music show	20/70
	The diverse and interesting teaching activities	22/70
	Play and study at the same time	11/70
	The hospitality of the host	20/70
	Food at FPT University's canteen	03/70
	Impression with FPT University's state-of-the-art architecture and facilities	05/70
	Tea break	12/70
	The puzzle of culture	1/70
	Backdrops of the classroom	30/70
	The energy and enthusiasm of the lecturers and fellow friends	30/70
	Changing personal attitudes about styles of learning	15/70
<b>7</b>	<b>Your expectation to join another program similar to this one in the future</b>	70/70
	<b>Topics you want to study (with open-ended questions)</b>	10/70
	+ The local history	20/70
	+ Traditional clothes	10/70
	+ Vietnamese culture and custom	20/70
	+ Vietnamese people's psychology during wartime	5/70
	+ FPT University's organizational culture	12/70
	+ Tourism in the Mekong Delta	22/70

The majority of students thought the lesson's learning activities matched their expectations. Of 70 students, 57 believed it to be appropriate, and most stated their enjoyment of the course. Many students said the lesson was both valuable and effective in terms of the structure, logistics, and usefulness of the program. Question 6 explored the various aspects of embodied learning. The results of this question show that embodied cognition includes new knowledge that is formed by their encounters with others and teaching aids. It also entails the administration and logistic support and learning amenities that were arranged before and during the lesson. Bodily activities such as team-building games, music shows, and teamwork movements also add to the students' embodied cognition. Tangible objects such as classroom decorations, food and spices, Intangible objects (staff and friends' hospitality and the energetic atmosphere in the class) that stand as equipment for learning are also contributive to developing the students' embodied cognition.

An open-ended question in the evaluation form allowed them to express their thought over the lesson. Some stated that they felt that they were able to understand the philosophy of cuisine better. For example, a student said:

*Learning is really fun. I was able to interact with my friends, and we used our senses to activate our learning. We smelled the spices, heard our friends' touches of the spices to guess what they were, and moved. It was never boring!*

The way this student learned includes certain aspects of feelings and emotions. He further stated that his senses, bodily movements, and interactions with others and things enabled him to understand the philosophies of using the spices in a particular dish before he could remember the names of the spices in English. In this vein, his remembering appeared after his understanding. This is why Bloom's hierarchical levels of cognition does not always come in order. One's cognition is often enforced by the use of their embodied engagement in the verbal interactions and corporeal movements. Similarly, another student expressed:

*I was amazed at how the lecturer taught us! She was very engaging. She asked us to work in groups. Working in groups is normal, and this is what we do almost every day. But here, our group had to be always active: running to pick up the right spices after one of us smelled them. We also had to quickly discussed the secret behind the spices that went accordingly with a dish. I think we could analyze the underpinning secrets of cooking in terms of the country's geographical features better than before!*

Like the student referred to earlier in this section, he used some expressive words to show his positive feeling when participating in the class activities ("amazed", "engaging", and "better"). It can be concluded that students' cognition is a felt dimension that can contribute to their learning processes. This quote also shows that the students' interactions with others, bodily engagement, and use of their senses in the teaching activities allowed them to move to the level of analyzing after those of remembering and understanding. It is reasonable because sometimes, students come to class with their prior knowledge that can contribute to their ability to analyze, evaluate, or even create a certain piece of the lesson content (e.g. in this case, their knowledge of the spices and cooking techniques). What can further be improved is to allow them to use their prior knowledge to

develop other aspects of the lesson. These aspects can well be improved by encouraging them to use their embodied cognition to immerse themselves in exploring. Once they have been able to lead their own learning, they can develop their understanding of intercultural diversity. For instance, that student continued to say:

*We interacted with other students coming from different classes and even from a different university. They told us very different things about food and cooking styles in their families. Now, I know that sausages can be made of beef. Lime leaves could be used to increase the flavor of chicken and even rats! That's funny!*

His verbal communication with his friends in group work and use of his senses enabled him to further develop his prior knowledge, letting this student achieve one of the outcomes of the lesson. In addition, he began to understand that food in the same region can be different. His understanding initially dismantled his bias about “weird cooking styles” that he had observed before. Other students similarly expressed their intercultural diversity by interacting with others and joined bodily activities. Some said that they were able to “know that culture has its sub-culture”, “there is nothing wrong to eat rats”, or “tumeric can be used to whiten facial skin and add color to food at the same time”. Many of them expressed that such an understanding allowed them to realize that there are always differences in the way people interpret and experience culture. In other words, culture is inside them. This understanding can only be developed and nurtured when amenities for learning are provided adequately. These may include administrative work support, teaching aids, spaces for teamwork activities, and lecturers’ open attitudes towards making changes from traditional teaching methods into innovative approaches. A student told us:

*We are grateful that it [the student exchange program] happened. We learned a lot indeed. Learning happens beyond the walls of the classroom. We were with our friends, playing and studying at the same time.*

This student pointed out her excitement to try a new way of locating herself in a new ambience (“beyond the walls of the classroom”). Learning is, in this sense, experienced and initiated to happen in a geographical locale. The experience of being located in a geographical position is encountered through the students’ interactions with friends and bodily activities. Being in a place where learning happens does not mean that students are confined in a geographical place but rather, how such a space influences the negotiation of their sense-making of that place with others for learning purposes.

Intercultural diversity can be more easily learned when students understand that cultures always include differences that can be neither wrong nor inappropriate. Such an understanding can be formed when they have a chance to listen to others and participate in bodily activities that allow them to observe what is done. One student said:

*I learned a lot from my friends’ stories about the way their families cooked food at home. My mother does something different but in the end, it is what we eat. It isn’t what other people think we have to eat. I mean my friends explained what they eat means to them. It’s more than the food itself.*

Another student added:

*Yeah, somehow it is about our understanding and sympathy. Cultures are always different, but understanding that cultures are different requires us to be sympathetic. We need to show our respect to the different ways of cooking and consuming food as they are tied to our own cultural practices and beliefs. We are all different!*

This student showed her evaluation of cultural differences through her interactions with her friends through group work, which were intensified by her active engagement in the in-class and team-building bodily activities that included the use of her senses at the same time. Her understanding of and respect towards intercultural diversity were formed and developed by her sympathy for cultural differences. Therefore, the authors of this paper, at this early stage, can confirm that embodied cognitive teaching approaches can cultivate and enhance understanding of intercultural diversity.

## Conclusion

This paper attempted to showcase the embodied cognitive teaching approach that combines Bloom's taxonomy with an embodiment viewpoint. This model was applied in a Vietnamese culture course at a private university in Vietnam through a student exchange program. This original model of embodied cognition emphasizes the importance of Bloom's taxonomy in teaching activities and methodologies on the one hand but highlights the significant intensification of embodied cognition when combined with this taxonomy on the other. The authors of this paper believed that we are our bodies, which enable us to interpret and experience the world to form new knowledge for ourselves. Without the body, we would become mere objects existing in the world to be filled with bunches of information provided by teachers. No active learning could be allowed to happen. In contrast, the body with its powerful senses, the exercise of physical and corporeal abilities, and the human nature of interacting with others encourage us to absorb and form new knowledge for ourselves.

Students' embodied cognition allows them to comprehend cultural differences and respect intercultural diversity which can later shape their global citizenship. In this sense, the qualities of global citizenship can be acquired through the six levels in Bloom's taxonomy that students do not always go from one to another in order. Their cognition, which is said to reside in their minds, can be developed and intensified by their active immersion in the world with others and objects. Their immersion in the world can be enacted by their corporeal engagement with other friends, lecturers, and teaching and learning facilities through verbal communication, uses of their senses, participation in bodily activities. Their engagement in the learning environment is always emotional. It is the felt dimension of embodied cognition. It is always geographically experienced when the meaning of spaces is made and negotiated through students' encounter with others in corporeal activities.

In a nutshell, students' bodies and minds allow them to construct new knowledge about intercultural diversity by themselves and for themselves.



## Recommendations

Future research can be conducted by obtaining individual students and teachers' perspectives to examine the reliability and validity of this integrated model. Furthermore, future studies can be done in other areas to gain deep insights into the model's effectiveness.

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## Rethinking (Non)Nativeness among English-Speaking Teachers in Vietnam

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**Abstract:** In Vietnam, language teaching and learning have recently been a concern of not only educators and language learners but also parents and families who have school-aged children. When finding a suitable language course, language learners and their families tend to ask questions about the nativeness of the teachers and their language fluency. Being a native speaker has become an advantage for language teachers. Their actual proficiency and educational qualifications may come in second place. This situation may lead to poorly qualified language teaching courses and unequal treatment of qualified non-native language-speaking teachers. To confront this problem, the Vietnamese Ministry of Education and Training (MOET) has tightened the job entrance requirements for foreign English-speaking teachers, especially those who apply for work as English lecturers at university. It is identity and qualifications that matter. This literature review reflects on the ambivalent approach by the MOET to recruiting qualified human capacity building for the national English development project and developing and retaining English-speaking Vietnamese lecturers. This paper argues that the influence of monolingual ideologies in language teaching and learning in Vietnam that was once encountered at schools and universities some years ago has now shifted to a more open but competitive ambiance for national integration into the global market. In this sense, teaching English is not an apolitical activity. It is a politically designated career in this socialist market-oriented economy.

**Keywords:** Teaching English, Monolingual ideologies, Nativeness, Identity, Power

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### Introduction

The appearance and use of foreign languages in Vietnam have been reflective of colonization and social transformations. During the feudal time and under the Chinese invasion, the Chinese language was used in Vietnamese society. By the 16<sup>th</sup> century, British merchants alongside other European ones came to this country for some international trading (Sundkvist & Nguyen, 2020). Such languages as Portuguese, Italian, and English were brought to Vietnam, but none of them thrived because the ruling kings continuously rejected foreigners. Later arrivals included Christian missionaries from European colonizing countries who, together with the

invasion of the then-French Government, brought their foreign languages to Vietnam. French was taught to the elite population and used in formal contexts. It was one of the many ways that the French used to dominate the colonized people's mindset about France as the Mother Country (Nguyen, 2013). After 1954, the US entered Vietnam, leading to the Vietnam War, which divided the country into two. The South of Vietnam, which was US-backed, adopted English in formal communication, education, and work. The North of Vietnam did not appreciate the position of the English language. Instead, Russian was taught at many schools and colleges as Vietnam gravitated against Russia (Sundkvist & Nguyen, 2020). However, since 2000, when Vietnam began to diversify its international relations with countries outside the former communist block for its deeper integration into the global market (Nguyen, 2021), English has been taught at many schools, colleges, and universities as the compulsory subject, as well as at foreign language centers. The promotion of this language is seen as a human capacity-building strategy. Other foreign languages such as Japanese, Chinese, French, German, Korean, and Spanish are also taught, but they are not compulsory subjects at schools.

Recruiting teachers to teach these foreign languages has historically come from several sources: native speakers, local teachers who are trained at domestic institutions or graduate from abroad, and even sporadic native speaker travelers. In Vietnam, selecting a foreign language to learn and the kinds of speaker-teachers to learn with may not always be a personal choice. Neither is teaching foreign languages. Unlike teaching other subjects, the practice of English in Vietnam is likely to be related to teachers' identity and negotiations of power between parents/students and teachers, employers and teachers (Bright & Phan, 2011), as well as foreign teachers and the government under social transformations. It is also the desire of the government to select and use English foreign teachers. For foreigners, teaching English is a politically designated career in Vietnam. This is the first argument that this paper aims to unpack.

According to Jenkins (2009), Vietnam belongs to the expanding circle of the English language. This term, which is suggested by Kachru (1990), refers to the countries where the English language is considered a foreign language (EFL). EFL in Vietnam plays a little governmental role, but it is the Vietnamese Government's objective to spread it as a means of international integration. English is a useful means for communication purposes, but English language teaching seems to be a controversial topic. Shuck (2006) believes that language and identity are interlinked through the self and the other (see also Bright & Phan, 2011). The self can refer to native speakers who see themselves or are seen as norms and who are seen as unproblematic. The other can refer to learners who aspire to learn the correct norms and standards produced by native-speaking teachers together with the use of Western technology in the classroom (Bright & Phan, 2011). The norms of native-speaking teachers are then associated with monolingual ideologies. These ideologies are now being challenged in Vietnam as some native English or foreign English-speaking teachers are found to be problematic. This is another argument formed in this paper.

These two arguments are interchangeably presented in several parts of this paper. The first one discloses the interlink between nativeness, identity, monolingual ideologies, and qualifications. This part is followed by a discussion on the politics of monolingual ideologies and their influences on English teaching. These theoretical

parts are examined in the case of Vietnam's recent dual efforts in improving the quantity and quality of foreign English teachers that exacerbate some ambiguity in their teaching career. While previous studies (e.g. Bright & Phan, 2011; Kharis *et al.*, 2020; Manh *et al.*, 2017; Shuck, 2006; Sundkvist & Nguyen, 2020) acknowledged that native English-speaking teachers are less likely to face difficulties in applying for English teaching jobs in Asia and Vietnam, the arguments in this paper, on the one hand, are congruent with this commonplace view in some ways but on the other hand, challenge it. The major contribution that these arguments infer in this paper can be found in the new way for policy-makers and researchers to rethink the relationships between teacher identity and social transformations rather than the mere relationships between teacher identity and students' appreciation of and preference for monolingual ideologies.

### **The interlink between nativeness, identity, monolingual ideologies, and qualifications**

Linguistic ideologies that are embedded in teaching can be (and used to be) a means of colonialism (Canagarajah, 1999). As colonizers, native speakers are seen as the correct conveyors of the grammar, vocabulary, accent, pronunciation, and style of that language. Nativeness, in this sense, is the norm. Their speakers are unproblematic and stable Cook (1999). Many previous studies (e.g. Bright & Phan, 2011; Cook, 1999; Joseph & Ramani, 2006; Kharis *et al.*, 2020; Manh *et al.*, 2017; Shuck, 2006; Sundkvist & Nguyen, 2020) found native language models are preferred in non-native contexts. Students may prefer to study the English language with native English teachers rather than with non-native English-speaking teachers. This phenomenon leads to an unfavorable situation for the latter. Why wouldn't one want to speak English like an English person authentically?

However, Jenkins (2009) and Kramsch and Whiteside (2007) have collectively argued that the definition and the use of the term nativeness may not be appropriate in the contexts in which English is regarded as a *lingua franca*. In this part, the authors argue that while debates about nativeness and non-nativeness have flooded the current body of research on language and education (as shown in the above paragraph), the concepts are linked to identity. Normally, a native speaker is one who acquires the language either at birth or after many years of acquisition before he or she turns puberty. In contrast, people who speak a language as a second or foreign language are seen as non-native speakers (Cook, 1999). What if a Vietnamese person was born in the US with American citizenship and has lived there for years and speaks English as the mother tongue? He or she looks exactly like Vietnamese people, and then is he or she favored to teach English in Vietnam compared with Americans who are white? Linguistically and legally, yes.

But the authors' experiences as the managers of English language departments at some universities indicate that white people are more prioritized as students and parents still think white people speak English more authentically (for more evidence, see Bright & Phan, 2011; Sundkvist & Nguyen, 2020). Many Filipino teachers have flown to Vietnam to teach English as the demand for native (or native-like) English teachers is soaring. Their English shows some heritage of a colonized language. The MOET requires them to sit for a Common European Framework of Reference (CEFR) test, at the minimum expected grade of Level 5 (Government, 2018,

2020, & 2023), but their salaries can be twice or three times higher than those Vietnamese teachers can be entitled to have. This score is the same as Vietnamese teachers teaching English at the high school and university levels. What is the difference? The former are foreigners! Have you ever seen an American speak Vietnamese fluently, but local people tend to speak English (though at a very humble level) back to him? Probably, the very popular Youtuber Trần Luân Vũ (or Joshua Ryan in his American name, who has his own Youtube channel) is a typical example of this paradox. He is a 100% American who learned Vietnamese in the US before going to Vietnam to work as a freelance English teacher. His videos show many situations like this. Identity is not necessarily constructed by speakers themselves, but also by others' beliefs and recognition of who they are. In other words, nativeness matters, but identity matters too. The two are intertwined.

Further, nativeness and identity are linked to monolingual ideologies. Language ideologies, in general, refer to individual beliefs about the rationalization and justification of language use (Bacon, 2018). These beliefs are formed by both native speakers and non-native speakers of that language. In this sense, monolingualism is recognized as the ability to use a language as the mother tongue which is recognized by the native speakers of that language community. However, the assumption that native speakers are monolingual seems to be inappropriate. Due to immigration and globalization, monolingual and mono-cultural communities tend to become rarer (Bacon, 2018). Recently, the number of societies where all people speak the same languages and share the same cultures has been reduced (Kramsch & Whiteside, 2007). People may be monolingual when they are young, but they may learn another language at home or at school. The need to learn languages besides mother tongues is increasing. Most schools around the world tend to have at least one second or one foreign language subject. Also, Kramsch and Whiteside (2007) claim that there are more and more people who learn languages that are not their first and only language and are able to use those languages at various proficiency levels. Thus, the identity of monolingual NS tends to change when people learn other languages. As such, recognizing a person as a monolingual native speaker of a language is often misleading.

But the assumption of native English speakers remains true in Vietnamese EFL contexts, where parents and students trust the ability of a white speaker to speak correct and standard English as a norm. The government distrusts non-white foreigners who teach English by asking them to sit for a CEFR test. In fact, Circular 21/2018/TT-BGDĐT and Decree 152/2020/ND-CP (Government, 2018 & 2020) dictate English foreign teachers who are not native speakers to obtain the C1 level to meet one of the requirements for a work permit in Vietnam. They are also asked to possess at least a college degree to teach at foreign language centers, a bachelor's degree at the upper secondary school level and lower, and a master's degree at the university level. The negotiated salary (usually higher than local teachers, see Bright & Phan, 2011) can be an attraction, but would that deserve to be the main driving force for those who are very qualified for decent jobs in their own countries to relocate to an exotic place?

Another aspect that influences the interlink between nativeness, identity, and monolingualism is qualification. Being a native speaker of a language does not always mean that person can teach it. Teaching is a science that requires people to attend formal training programs that consist of various modules. A program in education,

teaching, Teaching English as a Second Language (TESOL)/Teaching English as a Foreign Language (TEFL), English/American literature, or linguistics is constituted by courses on professional skills, foundational knowledge, professional knowledge, and electives. These blocks of knowledge and skills allow teacher students to familiarize themselves with educational environments, as well as understand students' psychology and physiology, educational policies, and challenges. They also equip them with expertise in the English language and teaching methodologies. Qualifications may include teachers' positive and open attitudes towards differences that emerge from multicultural contexts or social biases (Bright & Phan, 2011). They also encompass teachers' adaptability and flexibility in suiting their teaching styles and attitudes to meet communities' and students' needs. Respect for differences is vital. These qualifications are not simply accumulated by native teachers themselves. They are measured, justified, examined, and even tried by the universities where they have studied, students, parents, employers, and communities. In this sense, being a qualified native English teacher is not a personal choice or a separate domain of being native biologically and linguistically. It is an interrelated effect of decisions and choices made by many agents.

### **The power of nativeness in monolingual ideologies**

No matter how struggling the job application processes can be, foreign and native English-speaking teachers can still find ways to arrive in countries that need English for their economic growth. Monolingual ideologies are reflective of several personal, economic, educational, and social orientations. The authors of this paper further argue that these orientations are concerted, creating both friction and the possibility for monolingual ideologies to manifest themselves in practice that can be considered as the working politics of monolingualism. For instance, on the personal level, opportunities for learning, experiencing, making a living, extending professional and social lives, and challenging themselves enable them to spend some time (some even prolong more than initial intentions) working in new countries. They still have an advantage that non-native teachers do not have: being native. Their being native is supposed to be a reflection of a monolingual capability that defeats non-native speakers' deviations in language use. The thirst for using the correct language emerges in non-English speaking countries and communities, and these social and educational demands enable their nativeness to excel. Vietnam, for example, was ranked in the last position in the league of 60 countries with moderate proficiency (English Proficiency Index, 2022). When the country is in the industrialization and modernization process, a highly skilled workforce who can speak foreign languages confidently, correctly, and effectively is always needed (Nguyen, 2021). As a consequence, demands for native (and even native-like) English teachers are high.

However, Vietnamese society is not an English-speaking country. Learners find it extremely hard to interact with others for fluency and language development outside the classroom. They lack a communicative environment that is supportive of their language practice and learning (Edmett, Donaghy, & Tysoe, 2021). Learning with foreign teachers, no matter what qualifications they have, is always favored. Let's think about the colonized Singapore back in the early to mid-20<sup>th</sup> century, when foreign teachers might have come from India, Ceylon, or European countries. Singaporean students might have needed some standards to follow and an English communicative environment for daily exchanges. It took generations for Singapore to turn English from

a lingua franca that connected diverse ethnic groups to one of the official languages. In some way (though this can be an exaggeration or presupposition), the lack of some colonialization heritage may pose an advantage for foreign identities and supposed language competence to rise.

In addition, monolingual ideologies may approach ESL/EFL learners in various ways including the materials used for teaching and learning. Phan (2008) notes that teaching and learning materials and examination frameworks published by the native English-speaking countries seem to indicate that their English varieties and pedagogies are global models and other varieties are used merely in minor communities. Thus, this assumption seems to be a product of the monolingual imperialism of the source (L1) countries. Many people have this assumption and conclude that traditional teaching in their countries is disadvantageous compared to foreign pedagogies. Perceptions created, spread, and determined by the countries from which teaching materials are distributed seem to have a significant influence on pedagogies in general (Canagarajah, 1999). In other words, a great number of teaching and learning materials in ESL/EFL countries are published by L1 countries which are assumed to own the standard varieties of English. EFL teaching in Vietnam is not an exception to this reality.

Many educational institutions and universities in Vietnam are using foreign pedagogical models and foreign published materials from L1 countries, especially from the United States and the United Kingdom. For example, from 2008 to 2012, the materials which were used by our university for English major students were the series of Interaction and Mosaic published by McGraw Hill, an American educational company. Also, Top Notch and Summit series from Pearson, a media company founded in the United Kingdom, are used in teaching and learning the preparation English courses at the university where the authors are working. Teachers, students, and parents seem to take that phenomenon for granted and never ask why foreign methods and materials are used instead of domestic materials and traditional pedagogies. Curriculum developers at universities may explain that non-native teachers/lecturers may not possess the correct and standard use of the English language, thus producing a textbook can cause some disadvantages. If it is reviewed by native experts in the field, it certainly takes time and financial resources.

Another reason is that non-native teachers/lecturers/textbook writers may compile their materials from publications produced by native experts. The tasks of writing a textbook may not be original. Also, using textbooks written by well-known native authors and published by prestigious publishers can even help marketize the universities' brand during the student recruitment process. Nevertheless, this is not the case for elite universities in Vietnam which are able to recruit and train very well-known lecturers in Vietnam and abroad. But overall, as Canagarajah (1999) has noted, ideologies and cultures which could be foreign to language learners may be deeply embodied in the English language. The practices of foreign methods and the use of foreign materials may be related to the economic and educational prestige of those native English-speaking countries.

Monolingualism is also exacerbated by social prejudice. In Vietnam, there is a stereotype that Western countries are the best place in the world (see Bright & Phan, 2011; Kharis *et al.*, 2020). Those countries are considered



“heaven” by many Vietnamese people because most of those countries have strong economic status and prestigious educational systems (Nguyen, 2014). Their cultures and language varieties are assumed to be elite, and their educational systems are believed to be among the most prestigious. As a result, language users and learners tend to prefer native models rather than local models. Many Vietnamese speakers of English are also found to consider the native speaker as the correct standard for them to follow in oral and written communication (Sundkvist & Nguyen, 2020). Young Vietnamese people like to code-switch and code-mix English in their daily conversations as a sign of being fluent, elite, and educated (Ha, 2022). Walkinshaw and Duong (2012) claim that, in the EFL teaching context of Vietnam, there may be a bias towards non-native English teachers due to the imperialism of the L1 countries. As stated above, many English educational materials and methodologies which are sponsored by the L1 countries are applied in ESL/EFL education. Those materials and methodologies seem to enforce the importance of native English teachers. Many people thus believe that native English teachers are able to teach more effectively than their non-native counterparts (Bright & Phan, 2011; Cook, 1999; Phan, 2008; Sundkvist & Nguyen, 2020).

The imperialism of nativeness could be reflected in the world rankings of Western universities, international English examinations, and ESL/EFL teacher training programs in the L1 countries. The Quacquarelli Symonds (the United Kingdom, Times Higher Education (the United Kingdom), or Shanghai Academic Ranking of World Universities (China) have continuously highlighted the very top rankings of American, British, and Australian higher institutions, making these countries the top study destinations for talented students, or second chance students who have failed the national university entrance examinations in Vietnam but can secure financial support from their relatives' income (Nguyen, 2013 & 2014). Domestic universities in Vietnam look up to these universities, trying to advance themselves to the league of the top 1,000 or 2,000 (Nguyen, 2021). Presumably speaking, Western countries and their universities are the best, and their lecturers are also the top of the top! Learning with and from people who come from these countries can (mistakenly) benefit learners who cannot afford a language study trip overseas. English teachers with degrees conferred by Vietnamese universities are not given a fair chance to apply for teaching jobs. Many advertisements for lecturer recruitment at the university level or even famous English language centers in Vietnam explicitly prioritize those who have graduated from overseas, though the word overseas (“nước ngoài”) may mean every country! They are disadvantaged. The influence of monolingual ideologies may also be the reason why students in ESL/EFL countries choose a course in an L1 country instead of equivalent courses in their countries despite the high cost of studying abroad.

According to Canagarajah (1999), the L1 countries are famous for training educators. A certificate or degree from those countries may benefit people who hold it in EFL-speaking countries such as Vietnam. International English proficiency test scores are one of the requirements for non-native people to meet when they apply for studies, work, or immigration in English-speaking countries. They are also used for social and professional advancement in their home countries. These examinations are organized by famous English-speaking syndicates such as Cambridge Assessment English, British Council, Pearson, Educational Testing Service, or Duolingo English Test. Some Vietnamese universities give a bonus of three marks in their entrance examinations or

exempt them from taking English preparation courses after enrollment to students who have an International English Language Testing System (IELTS) score higher than 5.0 (VnExpress, 2023). Although some non-English-speaking countries have developed their own English testing systems to meet the local demands for English test scores for education and work, these testing organizations have the ruling power in these emergent markets. English native teachers who are qualified to teach the preparation courses for these tests are mostly favored.

These biases cause misjudgments of students or non-native English teachers about their own language proficiency. They may also discourage students to claim their authority over their language varieties. Seidlhofer (2001) argues that, due to the definition of the term native speaker, non-native speakers are not able to be native speakers of a language despite their proficiency in that language. The monolingual ideologies may cause ESL/EFL users and students to think that they have no power over the English language and that their language varieties are non-mainstream. Further, Kirkpatrick (2007) notes that, due to the high need for native English teachers, nativeness tends to become the only requirement for teacher recruitment in many countries, and thus many teachers without professional training are recruited. One of the authors of this paper observed that situation when she searched for a part-time teaching job after graduation from a university in Vietnam. When she worked in an English language center in Vietnam, she found that her co-worker who was a native speaker did not have a higher educational degree or any qualification in education. Most foreign language centers where she submitted her job applications asked for a teaching diploma. In contrast, many foreigners who worked there only graduated from high schools and did not have any professional training in teaching. Some of these foreigners were Filipinos and Germans! Their salaries were about three times higher than those of local non-native English teachers. Normally, Vietnamese-speaking teachers are put in a lower rank compared to non-native English teachers no matter how well they are trained and experienced (Cao, 2009).

### **The power of non-nativeness in bilingual ideologies**

This section argues that non-nativeness can also speak in several ways compared to nativeness in relation to bilingual ideologies. First, unfair prejudices towards native (native-like or foreign) and non-native English teachers seem to be inappropriate. Native-speaker models may not always be an advantage for language learners. The proficiency of native teachers which seems to be unattainable to students may overwhelm them. Actually, if students find these models too difficult to achieve, they may be unmotivated and discouraged to study (Cook, 1999). In contrast, non-native teachers may be found to be more achievable and efficient for students. Some non-native English teachers in Vietnam, for example, can speak English, and Vietnamese as their mother tongue, as well as use at least another foreign language at least at the survival level such as French, Chinese, or Japanese, to name but a few. Vietnamese teachers who teach English in schools located in ethnic minority communities can even pick up the local languages such as Cambodian or H'Mong to communicate with students and parents at the social level. The university programs in English Education (Sư phạm tiếng Anh) or English Language (Ngôn ngữ Anh) include courses on second foreign languages (e.g. *VNU Hanoi-University*

*of Languages and International Studies*, 2023). The ability to use more than one foreign language allows these teachers to understand the foreign language learning process and mechanism and to compare and contrast the similarities and differences between English and the second foreign language they know so they can better create and devise teaching strategies that can best fit their students' learning styles and education system. Native or foreign English teachers may also know several foreign languages, but the way they have learned is fitted in their countries' education systems.

Second, managerial roles at domestic institutions in Vietnam are often played by Vietnamese teachers/lecturers because of several reasons. Managers at departmental levels in public schools, colleges, and universities must be full-time faculty, have at least a master's degree and a doctoral degree at the university level, be a Communist Party member who can lead the team in accordance with the one-party political system and mandates, and have some years of teaching experience (Government, 2014). Being a Communist Party member hardly becomes a reality for native or foreign teachers. Most foreign teachers have fixed-term work contracts. Although some are employed as full-time members, they are required to extend their visas and work permits, and this process is cumbersome. Non-native local teachers do not have to go through this process. Also, understanding students' motivations, being to communicate with communities, and attending to the authorities' requests are more suitable for local managers than foreign ones. In addition, native or foreign English teachers/lecturers are normally assigned to teach and supervise speaking tests and examinations. Final examination questions are usually created by local non-native English teachers who know exactly what the requirements and meanings of the tests and examinations are. In this vein, foreign or native English teachers seem to lose their race.

Third, non-English-speaking teachers who share the same culture as EFL learners do not seem to encounter teaching problems caused by cultural differences. In contrast, cultural distances may be a challenge for native or foreign teachers in teaching ESL/EFL learners. Actually, cultural differences are quite common in classrooms where teachers are foreigners. According to Walkinshaw and Duong (2012), misunderstandings between foreign teachers and Vietnamese students may occur because native English teachers do not seem to have as much knowledge of Vietnamese culture as students do. Cultural differences may negatively influence the teaching process and limit the achievements of students. For example, one of the authors experienced cultural distances between the lecturers and foreign ESL students when she studied English at Melbourne University in Australia. One of the lecturers did not seem to understand the students' Asian cultures. She complained that she could not stand our silence when she asked questions. This situation caused tension between her and us. Most students in Asian countries tend to remain silent when they are asked a question in general and the teacher does not choose a specific individual to answer it. Students will answer if they are chosen and asked in particular by the teacher. We, who were from China, Taiwan, Hong Kong, and Vietnam, seemed to share the same cultural ideology in class about politeness. Our perspectives were different from our lecturer's. Our lecturer who embraced the western perspective regarded the silence of the students as rude and passive. On the other hand, most of us who were from Asian cultures considered the silence polite and humble. From our perspective, students should remain silent if they do not know the answer or if the question confuses them. Asking questions back to teachers is not quite common in our cultures. Because of the tension caused by the cultural differences between us and

our lecturer, the lesson was interrupted. The lecturer was disappointed, so she had to stop teaching to ask the students the reason why they remained silent in her class. In this sense, cultural distances may prevent the efficiency of teaching and learning. Being taught by non-native English teachers who share the same culture can provide students with an important benefit which is able to prevent misunderstanding of cultural ideologies. Sharing the same cultural perspectives, teachers and students are able to avoid misunderstandings and cultural shocks which may negatively influence the process of teaching and learning (Walkinshaw & Duong, 2012).

Fourth, because non-native teachers were once EFL students, they may have similar experiences with students while native English teachers may not fully sympathize with them or understand the process of or difficulties in learning a foreign language (Cao, 2003; Seidlhofer, 1999). Besides experiencing challenges, non-native English teachers (including foreign non-native English teachers know how to acquire English as a foreign language while English natives acquire it as their first language. Non-native teachers are experienced learners of the target language, so they may know how to achieve that language proficiency effectively (Seidlhofer, 1999). They and their students seem to have similar cognitions of the English language learning process because they share similar perspectives on foreign language learning. In contrast, non-native teachers acquire English naturally as their mother tongue since they were born, so the way in which they approach that language seems to be different from the way students do. Their understanding of the English language is the perspective of L1 speakers, and thus their explanations and lectures may confuse students.

Fifth, learning grammar with non-native English teachers may be easier for students. Unlike native teachers who acquire grammar prescriptively, naturally, and routinely, non-native English teachers have to learn it as grammatical knowledge of a foreign language. Most of them are better at teaching grammar and giving commentaries because they have experience in learning English grammar (Cao, 2003; Seidlhofer, 1999). Knowing the mother tongue can help these teachers explain unfamiliar concepts or grammatical points for beginner students to easily understand.

Sixth, the imitation of ideal pronunciation and accents produced by native English teachers is important, but it may not be as important as the efficiency of communication purposes and test scores at schools or universities that focus on grammar and reading. The national upper secondary graduation examination which is created and managed by the MOET consists of stresses, pronunciation, vocabulary in use, social interactions, synonyms and antonyms, grammar, sentence building, and reading comprehension (MOET, 2022). All are in 50 multiple-choice questions. Regular tests and examinations at schools do not consist of listening or speaking parts, and neither does the English examination in the national upper secondary school graduation. Pronunciation can be taught by using pictures and listening to audio. The tests and examinations do include pronunciation checks, but students can learn the phonological rules by heart. Technologies such as English teaching and learning video clips created by both native and non-native English speakers/teachers/organizations, Google Translate, and the like in some sense weaken the position of native English teachers in non-English-speaking countries or communities. Learners may use a variety of accents in their Englishes to communicate as far as they get themselves understood and understand others. In other words, bilingualism challenges the power of

monolingualism in a non-English-speaking learning context.

### **An ambivalent approach to the bargaining power of (non)nativeness**

As Nguyen (2014 & 2017) pointed out, Vietnam during the period after the 2000s saw growing demands for a skilled workforce for its global integration. Accordingly, the demand for speaking English as one of the international languages became stronger. In 2008, the Prime Minister officially promulgated a radical reform in English teaching and learning through the National Foreign Language 2020 project, which aimed to increase both the quantity and quality of English-speaking educated nationals in Vietnam from 2008 to 2020 (Government, 2008). The project (often referred to as the 2020 Project) which was funded US\$500 (Sundkvist & Nguyen, 2020, p. 698) was carried out in three phases. The first one which lasted from 2008 to 2010 focused on re-writing English textbooks from primary to high school levels. The second phase from 2011 to 2015 aimed to implement the reformed English curricula. Normally, students study 805 hours of English per year (Sundkvist & Nguyen, 2020). The last phase from 2016 to 2022 increased the intensive use of English at post-secondary levels and higher (Van, 2015). Each was accordingly measured on the scales of the CEFR. The principal purpose was to enable a large section of the young people with knowledge and working skills to speak and use foreign languages (primarily English) “independently and confidently” (Government, 2008, p. 1) for study, work, and communication in an international and multicultural environment when the country was advancing its global integration and developing its knowledge economy. In particular, in 2014, the MOET issued Decision 729/BGDĐT, which specified the levels of English for teachers, and some examples of the anticipated outcomes of this scheme in each last level of education are as follows:

Table 1: Expected English Levels for Particular Groups of People and Occupations in Vietnam

<b>People</b>	<b>Expected English level</b>
Primary students (Grades 1-5) (schools in remote areas start teaching English in Grade 3)	A1
Lower secondary students (Grades 6-9)	A2
Upper secondary students (Grades 10-12)	B1
University students	B1
Bachelor and master of English students	C1
Post-graduate students in majors other than English	B1
Doctoral students	B2
Primary and lower secondary teachers of English	B2
Upper secondary teachers of English	C1
University lecturers in English	C2 (but as there was no one of a higher certificate than C2, C1 was acceptable)
Medical doctors	B2
Military/Defense officers of a rank higher than Major	B2

Not many Vietnamese teachers teaching English, people, or students were able to achieve these expected test results when they sat for Cambridge ESOL. Later in 2014, the MOET issued the Vietnamese Standardized Test of English Proficiency (known as VSTEP), which was indeed a Vietnamese-adjusted version of the CEFR test by Cambridge ESOL. Ambivalent approaches to improving the quantity and quality of English-speaking people in Vietnam have been adopted in achieving this project. For example, English textbooks from primary to high school levels were outsourced to international publishers such as Macmillan Education and Pearson. These textbooks were co-written with local English teachers who were appointed by the MOET. An ambivalent approach was clearly expressed in this collaboration. On the one hand, the MOET expected the quality of these textbooks to be of a correct standard of the authentic English language spoken and used by native speakers. On the other, the MOET wanted to increase localized knowledge that suited the general education system in Vietnam (Van, 2015). This approach is also based on an increasing number of world-renown experts in TESOL who are Vietnamese.

Nevertheless, the outcomes were not as good as intended. In fact, more than 80% of English teachers at state schools failed the requirements (Manh, Nguyen, & Burns, 2017. p. 24). The MOET allowed them to take IELTS or TOEFL as equivalents. Still, these international English proficiency tests seemed to be as hard for many of them. The report by EF Education First (English Proficiency Index, 2022) showed that Vietnam's English Proficiency Index average score was 473/800, continuously placing this country in the low-proficiency category. In 2017, the first phases of the project were said to fail (Manh, Nguyen, & Burns, 2017). The project continued until 2020, the end of its life. But the MOET never stops their ambition: a website for the National Foreign Language project was created and has been well-updated with information about training courses, new regulations related to foreign language education, learning resources, international partnerships, and the like (<https://ngoainquocgia.moet.gov.vn>).

This paper does not intend to explore or examine the causes of this failure but instead, argues for the ambivalent approach to recruiting native/foreign English teachers. Let's begin by looking at an evaluative report conducted by British Council and commissioned by the MOET (Edmett, Donaghy, & Tysoe, 2021). This report identified three main limitations in the project: shortages of qualified foreign language learning resources, technologies necessary for teaching and learning foreign languages, and a suitable foreign language speaking environment. None of these limitations was found to be related to a lack of native English-speaking teachers. The CEFR and VSTEP, or IELTS always include a speaking test module. Being fluent also requires good use of writing techniques that express fluency like native speakers. Studying with native English teachers is always important, but this project seemed to downgrade the value of this exotic human resource. Another limitation that added to the failure is the shortage of qualified teachers who obtain the expected levels of English. With regard to native or foreign English teachers, before 2019, English teachers from foreign countries submitted their documents to their employers, who submitted these documents together with their request to the province's or city's Department of Labor, Invalids, and Social Affairs for approval. Since then, all the documents have been sent to the Ministry of Labor, Invalids, and Social Affairs for approval. The requirements have also been tightened. Some foreign language centers must shut down their businesses because they cannot recruit qualified

native/foreign English speakers as they promised to parents and students. The authors typed the Vietnamese phrase “trung tâm ngoại ngữ đóng cửa” (“foreign language centers shut down) in the search of the most popular online Vietnamese newspaper *VnExpress*, we found that there are at least 500 foreign language centers had to close their business because of many reasons, one of which is their inability to recruit native teachers that meet the new work permit requirements.

In particular, all foreign language teachers must possess at least a bachelor’s degree related to TESOL or linguistics, or a bachelor’s degree in a related field to teaching plus a TEFL or TESOL 120-hour certificate. At the university level, potential candidates must have at least a master’s degree in TESOL, linguistics, or literature or a master’s degree in a related field to their teaching and a TEFL or TESOL certificate (Vietnam’s Immigration Office, 2022). The only difference among types of native English teachers lies in their citizenship. A teacher is seen as a native English teacher if he or she holds citizenship in an English-speaking country such as the United States, the United Kingdom, Canada, or Australia. Then he or she needs only a bachelor’s degree in TESOL/English Linguistics. This issue raises some questions. For example, what if an English teacher who is originally from Hong Kong and lived there for many years before permanently migrating to the United Kingdom and acquiring British citizenship while this person speaks English with an entirely Cantonese accent? This teacher is truly Asian biologically and linguistically, but he is truly British legally. Another example is a Filipino teacher who has a bachelor’s degree, has lived in an American English-speaking community, and has graduated from an American university, would he or she be considered eligible to apply for a faculty position at a Vietnamese university to teach English? The answer is no because this person does not hold an “English-native speaking citizenship”. In this sense, qualifications can be compensated by citizenship as well. Citizenship may equate to an accumulation of several degrees but a minus of identity!

In addition, although the demand for native English teachers teaching children in Vietnam has been increasing after the Covid-19 pandemic (*VnExpress*, 2022), not much is known about their teaching adult learners or students. The quest for children to learn authentic and native language models from native English-speaking teachers is high, but not for students or those in employment who cram for tests. In Vietnam, testing, in some ways, degrades nativeness, but the desire for learning to speak as a native speaker upgrades it. The power of nativeness is now bargained. We suspect once the supply of native English teachers is humble, those who meet the requirements may ask for a higher salary. *You get what you pay for*. Foreign and native English teachers can bargain the pay for their values as well! But this bargain is made under the effects of social transformations in Vietnam that result in the demand for increasing the quantity and quality of English speakers for economic growth.

Now, let’s get back to the national foreign language project. The purpose of this part is not to focus on examining the effectiveness of this project (which, indeed, deserves space in another paper, or has it already been thoroughly researched and informed?). Instead, it focuses on pointing out some implications about the expression of nativeness among English teachers in Vietnam. First, while the quantity of those who meet the expected standards of English remains humble, why does MOET tighten the recruitment or entrance

requirements for English-speaking foreign teachers? At this stage, the number of foreign teachers at the tertiary level is managed and recorded by the Ministry of Labor, Invalids, and Social Affairs, and that at the school or foreign language center levels is processed and managed by provincial/municipal Departments of Labor, Invalids, and Social Affairs (Government, 2023). The total number of these teachers is not publicly available. We don't actually know for sure the current trends of incoming foreign teachers in Vietnam since there is little evidence about the root of these policy changes. Researchers are also less likely to have access to the policy developers. They can only approach the people who handle the paperwork, but these people may not know the reasons for these changes. The ambivalent approach which is reflective of a division of paperwork management to processing work permits creates some ambiguity for researchers and foreign teachers. The report by British Council (Edmett, Donaghy, & Tysoe, 2021) pointed out that there seemed to be little influence of native or foreign English-speaking teachers on the low scores of Vietnamese people in the English Proficiency Index. It pointed out that there is a lack of a foreign language-speaking environment in Vietnam that limit people from achieving English proficiency. Together with the tightening of the work permit regulations, this may mean that the MOET may want to focus on the quality rather than quantity aspects of foreign English-speaking teachers in Vietnam.

This project might also aim to increase the quality of domestic English teachers, though the targets were hardly reached. Acquiring both education and foreign language proficiency, especially English, is still practiced and is evident in several ways. For example, Nguyen (2021) has pointed out that there were more than 120,000 Vietnamese students studying in 46 countries and territories, although the number of returning graduates is not made public or widely known. These students certainly have possessed or will possess high proficiency in the language in the destination countries. The MOET has also allowed foreign universities to run their campuses in Vietnam and/or joint programs with domestic universities. RMIT is the first foreign-owned university that has campuses in Vietnam. La Trobe University, Swinburne, and many Singaporean schools, to name but a few, have taught their academic degree programs in Vietnam. So far, there have been more than 300 international twinning and advanced programs in Vietnam. At the same time, domestic higher education institutions expand their international relationships with foreign partners to run student and faculty exchange programs (Nguyen, 2021). Allowance for citizens to study abroad and with foreign educational providers at home is a sign that shows the government's desire to let people acquire their language proficiency for study, work, international communication, and professional relationship extensions through nativeness or near-nativeness. Nativeness can now bargain its power, but in its own country or through international collaboration through the Vietnamese Government's dual project in human capacity building.

## **Conclusion**

By no means do we degrade or confront to judge the tremendously moral and educational values that native and non-native English teachers in this paper. Some of them have certainly been our teachers, who made us who we are today: confident in intercultural exchanges and academic communication! We owe them a sincere thank-you that we cannot simply approach and say so! Instead, in this paper, we outlined the interlink of nativeness,



identity, monolingualism, and qualifications so that we could elaborate on the rise and fall in the power of nativeness and non-nativeness. We spoke from the perspectives of English language lecturers and the English department manager when relating to the valuable resources of the native and non-native English colleagues we have worked with so far. To make this long paper short, we summarize the highlights with inferences to the broader fields of language education and foreign language policy planning in the following dot points:

- (Non)nativeness, Identity, monolingual ideologies or bi/multilingualism, and personal and educational qualifications are interlinked. Although speakers or teachers can make up these features, they cannot only be characterized by themselves. Actually, they must be agreed upon and recognized by communities, students, and legal regulations. On the one hand, the making up of these features is a personal matter. On the other, this interlink is changed constantly, becoming volatile and fragile under socio-political transformations and social prejudices.
- This interlink can allow monolingual ideologies to encounter both challenges and possibilities to manifest themselves with some bargaining power. In this sense, the imperialism of nativeness may be weakened and strengthened at the same time. Choosing an English teaching career at home or abroad is a personal choice that is managed by socioeconomic development strategies and changing legal conditions. It is not an apolitical activity. It is a personal-social sphere that involves negotiations of power based on the interlinks of personal (non)nativeness, qualifications, and mono/bilingualism to social prejudice, legality, and social transformations.
- The bargaining power in the interlink between (non)nativeness, identity, mono/bilingualism, and qualifications is often negotiated by the matches between individual choice and the regimes of foreign language entrepreneurship and politics. Citizenship can be used as a tool for some kinds of foreign English teachers to bargain for their lack of necessary qualifications and their (confusing) identity.

### **Recommendations**

Let's now move on to some recommendations which are related to the future of nativeness and non-nativeness, at least in Vietnam's context: foreign language planning. Albeit a bit too outdated, Cooper's (1989) framework for language planning policies has still been valid as we need to consider the influences of the actors involved in the policy planning processes on specific groups of people's behaviors in certain circumstances. Language policies must be reviewed and amended as conditions may change over time. Language reform must remain national identity and, in some ways, nationalism (Kharis *et al.*, 2020) under the effects of social change (Cooper, 1989) that happens on the national and international scales. Practice, trust, and management must go hand in hand in the foreign language policy process (Spolsky, 2021). Any changes in the recruitment process for foreign English teachers must be informed internationally and nationally before an employer may choose a person who does not meet the qualification requirements, or a potential candidate may feel upset when being sacked upon the employer's acceptance. The identity of a teacher may count, but the quality of his or her teaching delivery,

which is embodied in his or her devotion to working in a foreign country and expressed in his or her qualifications matters more. Therefore, the screening of documentation is important at the legal scale, but the communication or an interview between an employer and a foreign teacher at an organic level counts as well.

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## An Educational Ethnography of the Development of Complex Thinking: Students' Point of View on Their Self-perception of Achievement

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**Abstract:** The United Nations 2030 Agenda for Sustainable Development and the Inner Development Goals argue that addressing the world's challenges in the 21st century requires people to develop diverse skills. On the one hand, anyone, regardless of age and educational level, can develop multifaceted, transdisciplinary, and integrated competencies to address these challenges. On the other hand, people must work on skills and qualities relevant to inner growth to contribute to a more sustainable global society. Latin America is one of the regions in the world with the lowest skills indexes. Developing complex thinking competency allows individuals to increase their ability to address problems and challenges in their environment, a necessary skill for any professional. However, little progress has been made in documenting pedagogical implementations that develop disciplinary and transversal competencies, such as complex thinking competency, and students' results in mastering this competency. The present contribution identifies the units of analysis for an educational ethnography focused on recording the complex dynamics of educational systems and the implications of a competency-based educational model and presents students' perceived achievement of complex thinking competency as measured by a validated instrument.

**Keywords:** Educational Innovation, Higher Education, Professional Education, Complex Thinking, Latin American Educational Ethnography

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### Introduction

The United Nations 2030 Agenda for Sustainable Development sets as goal 4 to ensure inclusive and equitable

quality education and promote lifelong learning opportunities for all; and recognizes that the expansion of information and communication technologies and global interconnection offers great potential to accelerate human progress, overcoming the digital divide and developing knowledge societies (UN, 2015). Various international organizations such as the UN, UNESCO, OECD, WEF, PM, and IDGs have analyzed the future that people will face and detected some complex global problems that will need to be solved through education, specifically with the development of certain skills. Education in the twenty-first century has changed drastically from the previous century, now educational institutions recognize that each student has different knowledge, skills, attitudes, and values and, therefore, can learn differently.

## Literature Review

### A Commitment to Educational Innovation to Solve Complex Global Problems

According to the OECD (2019), curricula must allow for nonlinear learning trajectories rather than expecting all students to follow a linear progression along a single, standardized path. That is why the OECD's Education and Competencies 2030 project was created, which contains seven principles: the basic foundations that students must have (cognitive bases such as literacy and numeracy, physical and mental health, and social and emotional bases such as morality and ethics), three transformative competencies (create new value, reconcile tensions and dilemmas, and take responsibility), the student's agency and co-agency, four types of knowledge (disciplinary, interdisciplinary, epistemic, and procedural), three types of skills (cognitive and metacognitive; social and emotional; and practical and physical), attitudes and values, and an iterative learning process called the "Anticipation-Action-Reflection cycle" (AAR), where students continually improve their thinking and act intentionally and responsibly. The OECD defines competency as more than just "skills" because the latter is the prerequisite for acquiring competency.

In this sense, a competence involves more than the mere acquisition of knowledge and skills; it involves the mobilization of knowledge, skills, attitudes, and values to respond to complex demands in situations of uncertainty. As mentioned, these competencies must be transformative for students to have the ability to create new values, take responsibility, and reconcile conflicts, tensions, and dilemmas. Preparing students to be innovative helps them build greater resilience when faced with uncertainties and changes and build their self-esteem.

The sense of responsibility should be instilled in students, as it involves the understanding that actions have consequences and that people have the power to affect others. It is also important for students to expand their ability to reconcile multiple and often conflicting ideas or positions and recognize that there may be more than one solution or method of finding a solution. The AAR cycle provides guidelines for students to plan, act and reflect on the transformative competencies acquired to deepen their understanding and broaden their perspective. While the OECD project focuses on secondary education as a starting point, it establishes that the seven principles are applicable to all levels of formal and informal education, and lifelong learning.

UNESCO (2019) recognizes that curricula towards competency-based approaches have gained momentum, while noting that more and more countries are undertaking a process of aligning curricula with the competency approach. The curriculum is the first operational tool to ensure the sustained relevance of the development of education and learning systems and should adopt a competency-based approach to enable young people and adults to acquire the right tools to take advantage of opportunities effectively. Seven macro-competencies are considered relevant in the curriculum: lifelong learning; agency, interactive use of various tools and resources, interaction with others, interaction with the world, multi-literacy (digital, cultural, financial, health and media), and transdisciplinarity.

The World Economic Forum tried to build starting points through the global competency taxonomy (WEF, 2021). This taxonomy is a tool for new hiring practices that will help align the needs of employers, the curricula of educational institutions, and people's core competencies. The WEF's recommendations for adopting competency taxonomy in recruitment, learning, development and relocation practices are: understanding current skills gaps, setting targets and communicating the benefits of adopting a common taxonomy; adopt new competency-based recruitment, learning and development practices, and create opportunities for individuals to take ownership of their competency-based lifelong learning journeys; and incorporate competency-based practices across sectors, countries and globally, raising awareness among the general public of the benefits of aligning around a common taxonomy. According to this international organization, the top 5 of competencies projected for 2025 at global, national, and industrial levels are: analytical thinking and innovation, active learning and learning strategies, complex problem solving, critical thinking and analysis, and creativity, originality, and initiative. Nevertheless, from a critical perspective, this global competency taxonomy focuses on graduates finding a job. It does not reference the importance of a deep sense of responsibility and commitment to values and purposes related to the good of the whole.

However, from the perspective of a non-profit, open-source initiative, the only way to achieve the Sustainable Development Goals of the UN Agenda 2030 is through the Inner Development Goals, which encompass five dimensions and 23 skills and qualities (Inner Development Goals, 2021). The first dimension is "being," the relationship to self; the second comprises thinking and cognitive skills; the third is relating and caring for others and the world; the fourth comprises collaboration and social skills; and the fifth is acting to drive change. These goals infer that we talk much more about what needs to be done to solve the world's problems than about how to develop the skills of the actors in a position to achieve the visions. The purpose of the Project is to draw attention to the need to support the development of skills, abilities and other internal qualities of the people and organizations involved in efforts to contribute to a more sustainable global society. In short, the Project works to identify, popularize and support the development of skills, abilities and qualities relevant to inner growth, through consciously supportive organizations, companies and institutions, to better address global challenges.

Formal education is not enough to achieve the Sustainable Development Goals. What is required is an expanded vision of learning and action as a "lifewide" (every part of life at any point in time) and lifelong (every moment along life's journey) process and a culture that values learning in all aspects of life. The foundation of lifewide

education is a lifewide curriculum that enables learners to integrate learning, development, and achievement from any aspect of their lives into their educational experience (Jackson, 2021).

### **Education in Latin American region**

Statistics indicate that a person born in Latin America and the Caribbean reaches adulthood with fewer skills than someone born in the United States (IDB, 2017:78). This knowledge gap, combined with the adverse effects of the COVID-19 pandemic, the current recession, and the high degree of uncertainty caused by technological changes and automation, means it is in everyone's interest to develop skills for complex problem-solving. It is estimated that between 5% and 10% of jobs in developing countries could be fully automated, 30% of activities in another 60% of occupations could be automated, and 8% of jobs in EBRD countries and 9% in developed economies could automate more than 70% of their tasks (AfDB, ADB, IDB, EBRD, 2018:6-14).

The displacement of human activity at work should not overshadow the pursuit of decent work for all men and women (International Labour Organization, 2018); productive and high-quality employment and inclusive labor markets are included in Goal 8 of the 2030 Agenda. Decent work is also a transversal theme under the SDGs, strongly present in many other goals, such as Goal 1 (End poverty), Goal 4 (Ensure quality education), Goal 5 (Achieve gender equality), Goal 10 (Reduce inequality), Goal 14 (Conserve marine resources), and Goal 16 (Promote justice and institutions).

Much remains to improve the skills of its young people and adults and to adapt jobs to the new social and economic context. The Human Capital Index of the World Economic Forum (WEF, 2017) indicates that Latin America, the Caribbean, and Africa have the lowest skills. Therefore, it is necessary to invest in human capital through education that embraces new high-level digital, socio-emotional, and cognitive skills (including creative thinking and the ability to learn and solve problems) (The World Bank, 2016; McKinsey Global Institute, 2018).

In Latin America there are innovative educational initiatives that have evolved teaching and learning methods and techniques with the intention of counteracting the context and problems in the region (González-Pérez and Ramírez-Montoya, 2022; Ramírez-Montoya et al., 2022). Educational innovations include psycho-pedagogical studies, the use and development of technology in education and educational and socio-cultural management, and new processes, products, services, and knowledge, which are the engines of change in education (Ramírez-Montoya and Lugo-Ocando, 2020).

However, little progress has been made in recording the process of implementing innovative pedagogies that develop disciplinary and transversal competences such as complex thinking competence, as well as the results obtained by students in the domain of this competence. This contribution proposes an educational ethnography research that offers the possibility of recording what has transformed the educational model based on competencies from the point of view of educators, students, and graduates.



### **An Ethnography of the Complex Educational System in the 21st Century**

Educational ethnography is considered a field of research that brings together professionals from various disciplines, such as anthropology, sociology, pedagogy, psychology, and linguistics, among others, to understand an educational process from an ethnographic approach. According to Beach et al. (2018), in Latin America, educational ethnography encompasses the global and local spheres. It links the researcher with places, social agents, and objects; is based on a controlled and systematic participant observation; carries out fieldwork whose results show the lived experience; and incorporates the reflexivity that interprets how the theoretical framework of the researcher interacts with the beliefs and convictions of study subjects.

Latin American educational ethnography is permeated by the critical approach of the pedagogical postulates of authors such as Freire (2008), Fals Borda and Rodríguez Brandao (1987), and Rockwell (2011). Interestingly, educational ethnography in Mexico was derived from anthropological interventions in peasant communities and rural schools (Beach et al., 2018). Rockwell (1991) points out that in Latin America, ethnography arises from experiences of popular education and state projects of democratic education; therefore, discussions have arisen about the relevance of other forms of research, including a psychological perspective. However, British and American educational ethnography have also exerted an influence, and some authors interested in incorporating Anglo-Saxon paradigms, such as multiculturalism, have distanced themselves from Latin American social and educational reality. Since the 1980s, educational ethnography has contributed to overcoming the contradiction between formal education and the socio-cultural realities of educational agents, training educators, and facilitating changes.

Nowadays, educational ethnography in Latin America maintains its critical focus: it provides a detailed analysis of activities in the classroom and educational institutions, reveals the broad linguistic and cultural diversity of the continent, shows some problems in official programs that perpetuate exclusion and school dropout, and shines a light on the gender-differentiated experiences in formal and informal educational contexts. Furthermore, Latin American educational ethnography has been innovative in revealing educational issues that have been ignored. It highlights dimensions such as gender, ethnicity, race, and nationality; analyzes in a complex way the political aspect of everyday reality inside and outside educational environments; makes visible the inclusion of young students who have historically been underrepresented; and promotes interdisciplinarity in educational research.

Because educational ethnography has mainly developed a critical and innovative approach from interdisciplinarity, we propose in this contribution that it is an adequate and relevant way to record the complexity in the process of implementing innovative pedagogies such as the megatrend of competency-based education, as well as to give voice to the actors that promote the development of competence of complex thinking and those who scale this competence to deepen the future adjustments that educational institutions will have to make of innovative pedagogies according to the specific sociocultural contexts in which they find themselves. There is a need to offer a wider range of innovative pedagogical options, aimed at invite educators and learners more

active participants in educational processes and content creators, as members of diverse and inclusive knowledge societies (Morin et al., 2003).

According to Chan and Lee (2021), there are four dimensions or levels in educational processes: (a) student learning that encompasses their motivations, their competencies and skills to reflect, their ethical concerns and emotional impact, and the relationship with their teachers; (b) teachers and teacher practices encompassing the difficulties of pedagogical practices, conceptualization of terms, purposes and processes, approaches to reflection, and advice and feedback; c) the institutional one that refers to the priorities in teaching and learning, and the support of the institution; (d) socio-cultural standards and social standards. In this contribution we consider that an educational ethnography focused on educational innovations must at least register these four dimensions or levels in educational processes.

**Results**

Sustainable Development Goal (SDG) 4, set out in the United Nations 2030 agenda, which focuses on ensuring inclusive and quality education for all and promoting lifelong learning, triggered the formation of the Interdisciplinary Research Group "Reasoning for Complexity" (IRG-R4C) in our educational institution to expand complex thinking for all through Open Science. The group aims to characterize the concentration and fragmentation of reasoning for the complexity of various disciplines through Open Science (Figure 1). Ultimately, IRG-R4C aims to contribute to the SDGs while promoting responsible citizenship through generating and transferring open knowledge, developing open and collaborative projects, and fostering entrepreneurship through open technology transfer processes (Ramírez-Montoya et al., 2021).

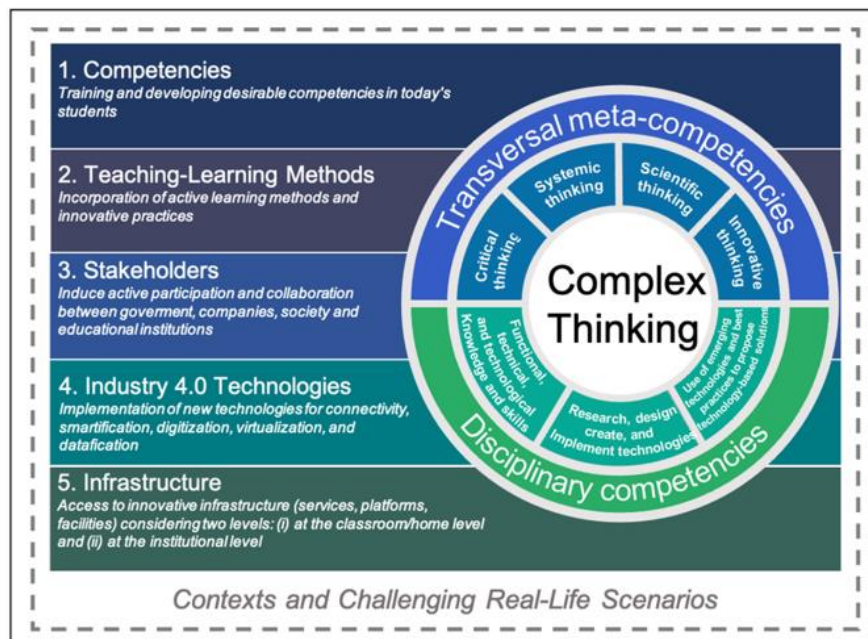


Figure 1. Complex Thinking in Education for Open Science

One result of the first phase of the project was the systematization of the principles of complex thinking theory by authors such as Edgar Morin (2001) to conceptualize and define the macro competency of complex thinking, integrated by four sub-competencies (critical, systems, scientific, and innovative thinking) (Baena-Rojas et al., 2022; Ramírez-Montoya et al., 2022). The macro competency of complex thinking is a cognitive tool that can expand people's thinking capacity when they face challenging situations or problems; it can also develop skills for thinking holistically about reality with a broad vision of the world (Vázquez-Parra et al., 2022). As for sub-competencies, critical thinking is evaluating the soundness of one's own and others' reasoning to form a judgment about a situation or problem and identify false arguments; systems thinking analyzes the relevance of the system elements operating within the existing whole; scientific thinking encompasses a set of reasoning strategies or cognitive processes, such as inductive and deductive reasoning, problem-solving, and hypothesis formulation and testing; and innovative thinking allows problem-solving and designing and creating solutions for social progress (Rodríguez-Abitia et al., 2022). The development of instruments that record the actors' perception of their development of complex thinking competency is the basis of our proposal for an educational ethnography that opens the possibility for comparative studies in other regions.

One of the most significant results of the research group was designing the eComplexity instrument to measure students' perceived mastery of the complex thinking macro competency and its sub-competencies. This instrument was validated theoretically and statistically by a team of experts in the field (Castillo-Martínez et al., 2022; González-Pérez and Ramírez-Montoya, 2022). The instrument is composed of five items (each item is answered on a 5-level Likert scale), grouped into the four sub-competencies, and in turn, each sub-competency was divided into the areas of knowledge, skills, and attitudes or values (Vázquez-Parra et al., 2022). So far, we have used the instrument in various university institutions in 19 different countries: Argentina, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Finland, France, Germany, Guatemala, Italy, Mexico, Nicaragua, Paraguay, Peru, Spain, United States, and Venezuela.

## Final Remarks

The results of applying the eComplexity instrument can be considered a substantial part of an educational ethnography, in the sense that it reflects the voice of the actors quantitatively. The eComplexity results reflect the first dimension or level in Chan and Lee's (2021) educational processes: students' perceptions of their abilities. The students' self-perception is their self-criticism. Therefore, this ethnography subscribes to constructivism and critical theoretical paradigms and is interdisciplinary; various researchers contribute to constructing a way to study, understand, and explain complex educational processes and phenomena in environments of great cultural and social diversity.

The design of an instrument to measure students' perceived mastery of the macro competency of complex thinking and its sub-competencies is the basis of our proposal for an educational ethnography focused on recording the implementation of innovative pedagogies such as competency-based education (a megatrend). An

educational ethnography to record the process of implementing innovative pedagogies, like competency-based education, will require more active participation by the actors and more robust infrastructures with more key actors and resources.

The result of the registry will generate methodologies to build a bridge between the SDG4, the global competency taxonomy proposed by the WEF (2021), the Inner Development Goals and the educational models of higher education institutions so that students scale their complex thinking skills, access to open education and collaboration, and insert themselves into the competitive labor market. This synergy and changes will have an impact on the level of skills and abilities in Latin America.

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## Professional Training in the Beekeeping Sector: Characterization and Identification of Needs


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**Abstract:** The beekeeping sector is demanding, requires knowledge and updated information to be able to deal with the challenges related with climate change, food scarcity, stress, pollution, and other harmful effects from the surrounding environment. Hence, this work intended to make a characterization of the needs in professional training in the beekeeping sector and how these needs can be fulfilled through courses and other actions to help beekeepers to maintain updated. The work was carried out in seven European countries (Croatia, Estonia, Finland, Italy, Norway, Portugal, Spain, Total), and the data was collected through a questionnaire survey, translated into the native languages in all the participating countries. The results revealed that the topics of highest interest for the beekeepers were apiary health and pest control and also colony management throughout the year. The most relevant sources of information were family and professional training/courses. The most valued forms of training were in-person and in workplace/internships, although the digital supporting resources were preferred instead of printed material. The learning materials most valued were videos but also books/paper manuals were considered relevant. The field visits were also greatly appreciated by the participants, and the most preferred assessment format was the realization of practical exercises. In conclusion, this work produced valuable information that can be utilized to design training actions and courses to the professionals in the beekeeping sector to enhance their knowledge and better prepare them to manage successfully their activities.

**Keywords:** Distance learning, mobile-learning, professional learning, beekeeping, survey.

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### Introduction

The capacity of the human brain to learn and accumulate knowledge from a wide amount of information

considered relevant is enormous. It is the synaptic plasticity of the brain that enables it to learn new representations as well as to eliminate previously learned information, constituting a foundation for shaping memory and learning that culminates in the Lifelong Learning (LL) process (Abbott & Nelson, 2000; Gryshchuk et al., 2022; Parisi et al., 2019). LL encompasses different analytic perspectives as such: the social organization of learning and individual learning. These, indicate the way past definitional concerns related with formal, non-formal and informal learning. The recognition of learning outcomes must be modern and consider eventually contrasting viewpoints, namely in the European context as well as from the global viewpoint (Evans & Kersh, 2023).

Present trends seem to indicate that the time for distinguishing learning according to formality of context is outdated. Although this approach has been very relevant in the past to overcome obstacles in the early development of LL systems, in the present society and in view of the novel trends and challenges is now seen as archaic, and the multi-faceted LL requires novel approaches in changing learning environments and social practice beyond initial schooling (Evans & Kersh, 2023). According to Baker et al. (2023), the challenge of LL is to enabling a system to learn and retain knowledge regarding a multiplicity of tasks during its operational lifetime.

Professional training (PT) encompasses the process of building knowledge, skills and competences either being on individual persons or in a group or team. Controlling knowledge is vital to realize that knowledge brings empowerment, which is the basis for meeting existing and future demands and challenges. Technological developments, educational innovative methodologies and modern learning are on the path from using technology to increase knowledge (Ekúndayò & Tuluri, 2011). The development of human competences through training promotes quality, efficiency, and effectiveness and at the same time motivates the professionals, leading to make a commitment with increasing productivity (Segret, 2009). Effective training improves not only knowledge and skills but also attitudes and resilience (Bhavsar-Burke et al., 2022).

The project beeB - Foster for beekeeping bridges through innovative and participative training, was approved by the European Union with Reference no. 2019-1-PT01-KA202-060782, and intends to give a contribution for the technical training to beekeepers and other intervening agents in the beekeeping sector, as well as to provide adequate tools in contexts of mobile-learning (m-learning), to improve the capacity of beekeepers to successfully manage their businesses. The project team includes six partners from different European countries, and it encompasses identification of needs and development of training opportunities, facilitating the beekeepers to access courses, learning platforms and contents on a distance learning basis. In this context, the aim of this work was to undertake a survey using a questionnaire to gather information about the beekeeping activity, past experience in professional training in the context of mobile learning, and most valued forms of training in different countries. These elements will bring valuable information to design courses and other learning tools to make easily available to use by all those interested in beekeeping sector, to improve their knowledge and skills.



## Materials and Methods

### Instrument for Data Collection

For this survey a questionnaire was used, because it constitutes an advantageous way to collect data related to social behaviors. The questionnaire was firstly prepared in Portuguese and then it was translated into the languages of the participating countries and applied to people in each of the countries of the study (Croatia, Estonia, Finland, Italy, Norway, Portugal and Spain).

### Sampling Procedure

The sample was obtained from all the potential people of interest in the different countries participating in the research. The target group was composed of people who engage in activities related to the beekeeping sector, either professionally or as a complement to their other main occupation or means of livelihood. The questionnaires were delivered in person but also complemented with some responded through internet. The participation of the respondents was voluntary and in the end 313 consented valid questionnaires were obtained, distributed by the different countries as: Croatia (n = 64), Estonia (n = 44), Finland (n = 15), Italy (n = 16), Norway (n = 74), Portugal (n = 48), and Spain (n = 52).

## Results

### Sample Characterization

The sample consisted of people aged between 17 and 82 years old, being on average  $48 \pm 13$  years. The mean value for age was higher in Norway ( $55 \pm 12$  years) and lower in Italy ( $41 \pm 12$  years). Most of the participants in the study were male (73.8%), with a lower percentage of women (23.3%), and some participants did not answer this question (2.9%). The country where the highest percentage of women was registered was Estonia (where 35.7% of the participants were female), while in Spain the lowest percentage of women was encountered (only 10.0%). With respect to education level, 58.5% have a university degree, 35.1% have secondary school, and only 3.2% had a very low level of education (basic education). There were still 3.2% of participants who did not indicate their level of education.

It was in Norway that the highest level of education was predominant, with the highest percentage of participants having a university degree (81.9%), while in Spain the lowest percentage of participants with university degree was found (42.0%). Regarding the type of activity that the participants have in the beekeeping sector, Table 1 shows the distribution for each country, considering that some of the participants indicated more than one of the activities and some other did not indicate any of these three possibilities.

Table 1. Beekeeping activities of the participants in the study according to country.

Activity	Croatia (n = 64)	Estonia (n = 44)	Finland (n = 15)	Italy (n = 16)	Norway (n = 74)	Portugal (n = 48)	Spain (n = 52)	Total (n = 313)
Beekeeper	28	43	14	12	74	46	44	261
Technician	23	5	2	2	1	4	2	39
Merchant	13	5	1	1	1	3	0	24
Total	64	53	17	15	76	53	46	313

### Identification of Training Needs

The participants were asked to identify from a list provided, which subjects they considered of higher and of lower interest in the context of training in the beekeeping sector, using a scale from 1 (very low interest) to 5 (very high interest). The results obtained are presented in Table 2, for the global sample. The subjects classified with the highest score by more participants are “Apiary health and pest control” (54.6% gave score 5), followed by “Colony management throughout the year” (42.0% gave score 5) and in third came “Reproductive management/Queens production” (37.1% of score 5). The subjects that were considered by more participants as not of interest were “Beehive production” (considered by 20.8% of participants as very low interest – score 1), followed by “Organic production mode” (17.4% of score 1).

Table 2. Level of interest in training subjects in beekeeping (N = 313).

Subject	→ Increasing Level of Interest →				
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Bee biology	10.8	12.9	20.4	25.4	30.5
Beehive production	20.8	15.2	19.0	18.3	26.6
Apiary health and pest control	4.3	6.0	9.3	25.8	54.6
Organic production mode	17.4	21.8	18.1	14.3	28.3
Meliferous flora	4.8	11.7	22.3	27.1	34.0
Apiary Installation	10.5	17.9	24.2	26.7	20.7
Colony management throughout the year	5.4	8.8	14.2	29.5	42.0
Production of bee products other than honey	9.8	12.7	19.6	22.8	35.1
Food management	8.8	14.6	19.3	27.1	30.2
Reproductive management/Queens production	7.6	12.7	13.7	28.9	37.1
Hygiene, health and safety at work in beekeeping	4.8	12.8	27.7	21.8	32.9
Legislation	8.9	12.3	27.1	28.4	23.3
Business skills	13.9	14.5	22.3	21.6	27.7

Considering the lowest score (1: very low interest) and the highest score (5: very high interest), Figure 1 shows the distribution according to country for all the subjects included in the questionnaire. The results for the lowest interest indicate that, for example, “Business skills” are not considered of interest for a great number of Spanish participants while “Beehive production” is not particularly relevant for Croatian participants. With respect to the highest interest, it was verified that a high number of participants in all countries consider “Apiary health and pest control” as very relevant, particularly for participants from Croatia, Norway and Portugal. Also “Colony management throughout the year” appears as very relevant for participants from most countries, in particular the same countries as before, Croatia, Norway and Portugal.

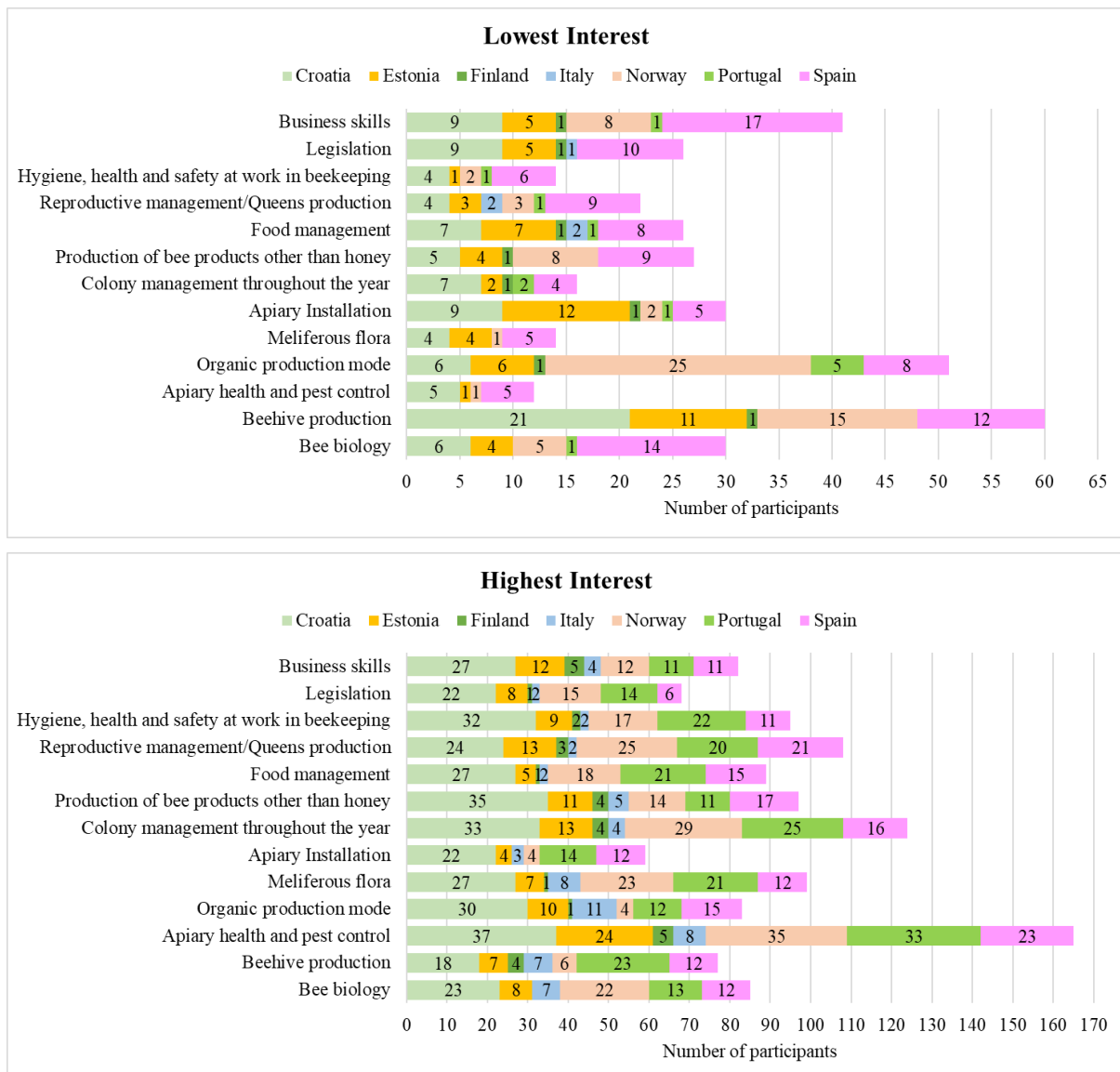


Figure 1. Subjects of lowest and highest interest in beekeeping professional training according to country.

The participants were asked to rate different sources from where they acquire their knowledge, according to their importance, being the results presented in Table 3 for the global sample. All sources were classified by a

high number of participants as most important, with percentages varying from a minimum of 65.5% for “Books” to a maximum of 87.5% for “Family”. The source which showed a highest percentage of participants classifying it as least important was seminars with 22.6%. Still, the percentage of participants classifying as most important was very high also (67.7%).

Table 3. Sources of information (N = 313).

Sources	Importance		
	Least important (%)	Important (%)	Most Important (%)
Family	6.9	5.6	87.5
Other beekeepers	8.7	21.3	69.9
Professional Training/Courses	12.0	13.2	74.9
Books	17.9	16.7	65.5
Seminars	22.6	9.7	67.7
Internet	21.2	11.0	67.8
Others	9.1	18.2	72.7

Figure 2 shows the classification of different sources as most important, according to country. The results indicate that 40 participants from Croatia rated as most important the “Other Beekeepers”. This option was also chosen by 29 participants from Portugal and equal number from Spain.

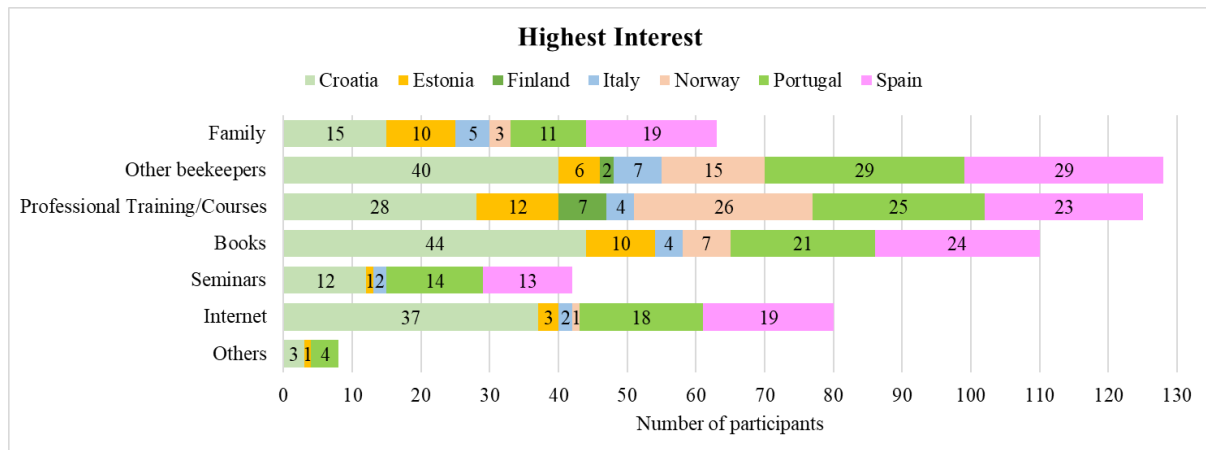


Figure 2. Sources of information of highest interest according to country.

One other aspect that was investigated related to the identification of the difficulties that the professionals experience in their beekeeping activities. The participants were asked to classify on a scale from 1 (most important) to 6 (least important) a set of possibilities presented to them, being the results reported in Table 4, for the whole sample. The difficulties scored with 1, the most important, were mainly “Market issues” (indicated by 28.7% of the participants) and “Access to land to install apiaries” (for 20.3% of the participants). The weight of

the materials was not considered most important by many participants (only 13.0% scored 1).

Table 4. Level of importance of difficulties encountered by beekeepers (N = 313).

Difficulties	→ Decreasing Importance →					
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)
Weight of materials	13.0	23.3	19.3	16.6	15.7	12.1
Hard hand work	18.8	22.2	23.9	16.7	9.8	8.5
Access to land to install apiaries	20.3	11.9	20.3	14.9	20.3	12.4
Market issues	28.7	11.5	16.7	17.2	15.5	10.3
Time consumed in management activities	18.1	26.1	19.7	14.7	16.4	5.0
Others	35.3	15.7	12.7	6.9	5.9	12.5

Figure 3 shows the major difficulties that beekeepers have to deal with in the course of their activity, according to country. For example, “Market issues” were considered of major importance by 19 participants from Estonia, but none from Croatia and only two from Spain. On the other hand, “Hard hand work” and “Access to land and apiaries” were classified as being of great importance by a high number of participants from Croatia (10 and 11, respectively), Norway (14 and 13, respectively) and from Spain (8 and 10, respectively).

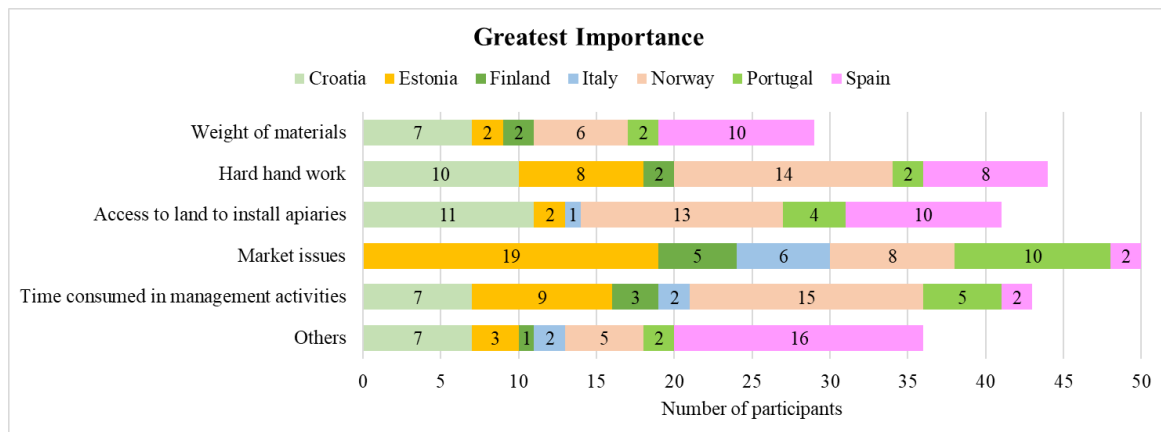


Figure 3. Major difficulties experienced by beekeepers, according to country.

**Experience in Training Activities**

Most of the participants in the study had already participated in training activities in the beekeeping area (78.6%), corresponding to 58.3% of the Croatian participants, 83.3% of Estonian, 80.0% of Finish, 68.8% of Italians, 93.2% of Norwegian, 91.7% of Portuguese and 68.0% of Spanish participants. Considering the whole sample, 178 participants had participated in training activities as trainee, and 109 had participated as trainer/coordinator. As for the distribution between countries, that is presented in Table 5.

Table 5. Role of the participants in training activities, by country.

Activity	Croatia	Estonia	Finland	Italy	Norway	Portugal	Spain	Total
As trainee	32	33	5	11	60	10	27	178
As trainer/coordinator	8	12	11	1	24	44	9	109

The participants were also asked to identify from a list presented to them, which training mode they considered of least and most interest, using a scale from 1 (very low interest) to 5 (very high interest). The results obtained are presented in Table 6, considering the whole sample. The modes most valued by the participants were “In person” (45.5% scored 5, the highest level of interest) and “In workplace/Internship” (43.3% scored 5). Still, also the “Mixed” and “Distance” modes had some preferences (24.2% and 17.5% of score 5, respectively)

Table 6. Level of interest about different training modes (N = 313).

Training mode	→ Increasing Level of Interest →				
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
In person	5.7	7.7	19.1	22.0	45.5
At distance	11.1	26.5	25.6	19.2	17.5
Mixed	3.0	11.9	27.5	33.5	24.2
In workplace/Internship	10.6	9.4	16.6	20.0	43.3

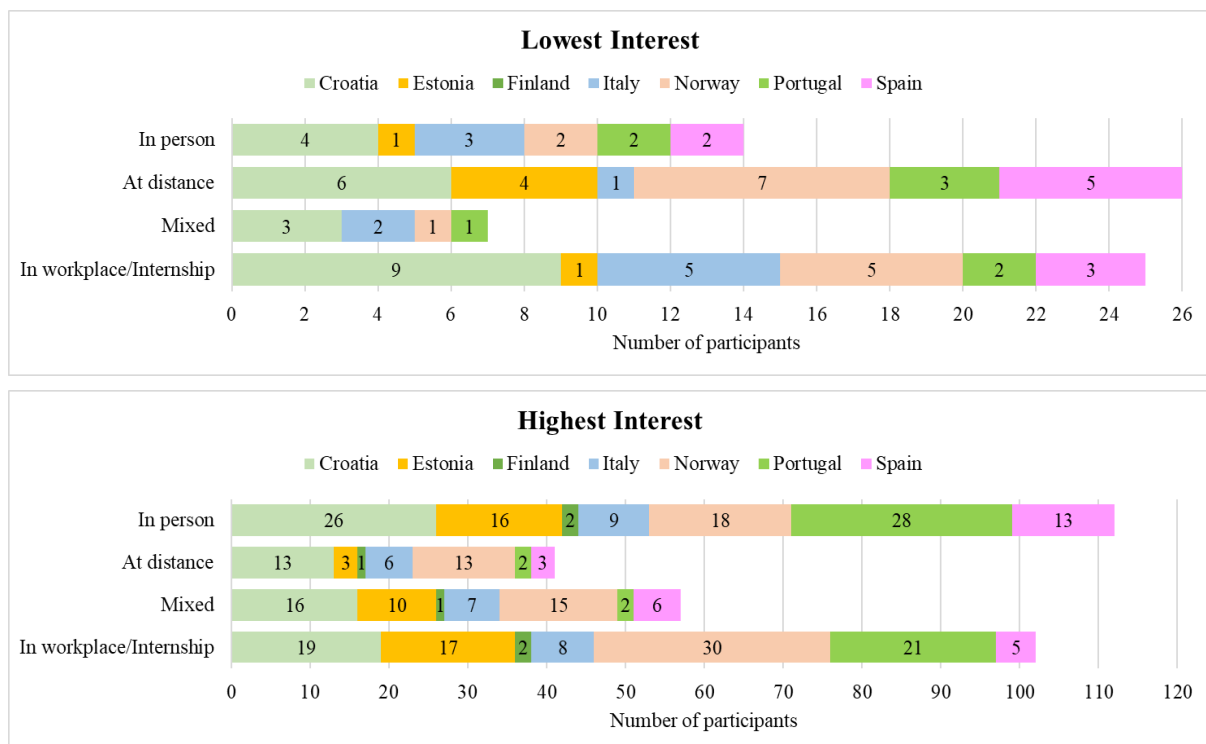


Figure 4. Modes of training with lowest and highest interest according to country.

Noticing the lowest score, 1 (very low interest) and the highest score, 5 (very high interest), Figure 4 presents the distribution according to country for all the different forms considered. A high number of participants classified the “At distance” mode as least important: 6 from Croatia, 4 from Estonia, 1 from Italy, 7 from Norway, 3 from Portugal and 5 from Spain. A similar trend was observed for the form of assessment “In workplace/Internship”, which obtained also a high number of classifications as being of low importance: 9 from Croatia, 1 from Estonia, 5 from Italy, 5 from Norway, 2 from Portugal and 3 from Spain.

The results in Figure 4 also reveal that more participants from Croatia, Portugal or Spain attributed highest interest for “In person” mode when compared with the others. However, for the majority of the Norwegian and Estonian participants, the “In workplace/Internship” was considered the most important. Globally, the most valued form of assessment was “In person”, rated as of high interest by 26 participants from Croatia, 16 from Estonia, 2 from Finland, 9 from Italy, 18 from Norway, 28 from Portugal and 13 from Spain.

### Use of Distance Learning Technologies

The participants were asked how often they use their mobile devices in the ambit of the beekeeping activities. The results in Table 7 show, considering the whole sample, the highest percentage for daily utilization of mobile devices (36.1%) and only a small percentage (7.7%) say they never use them for beekeeping activities. When the results refer to the individual countries, countries where most beekeepers use mobile devices on a daily basis include Italy (62.5%), Croatia (61.7%), Finland (58.3%) and Spain (50.0%). Countries with a high percentage of participants that never or very sporadically use the mobile devices for beekeeping include Estonia (56.8% very sporadically and 13.5% never) and Norway (34.3% very sporadically and 10.0% never).

Table 7. Frequency of utilization of mobile devices in beekeeping activities, global and by country.

Frequency	Croatia	Estonia	Finland	Italy	Norway	Portugal	Spain	Total
Daily	61.7	10.8	58.3	62.5	10.0	37.2	50.0	36.1
1-2 times/week	3.3	13.5	25.0	6.3	25.7	27.9	13.9	16.8
1-2 times/month	8.3	5.4	8.3	0.0	20.0	18.6	8.3	12.0
Very sporadically	23.3	56.8	8.3	12.5	34.3	7.0	27.8	27.4
Never	3.3	13.5	0.0	18.8	10.0	9.3	0.0	7.7
Total	100	100	100	100	100	100	100	100

When asked what they used the mobile devices for, a great number answered to take pictures (n = 185) and to do research (n = 147) (Table 8). It is relevant to notice that participants could choose more than option in this question. When looking at the data by country, the trend is also verified, being these two the most frequent activities for the beekeepers in practically all countries, except Finland and Estonia, where making videos surpasses doing research, although with very close values, as it also happens with Italy.

Table 8. Uses of mobile devices in the beekeeping activities, by country.

Uses	Croatia	Estonia	Finland	Italy	Norway	Portugal	Spain	Total
Take pictures	45	28	8	13	46	23	22	185
Make videos	26	20	6	10	15	9	13	99
Do research	28	18	4	10	35	28	24	147
Use apps	13	4	5	10	11	13	10	66
Use specialized platforms	21	3	1	7	9	15	19	75
Others	1	8	1	1	6	3	3	23

The internet access in the apiaries was investigated, and the results showed that 21.1% of the global participants did not have internet in the apiaries, while 70.4% had access to internet, and 8.5% replied they had access in some of the apiaries but no access in others. Figure 5 shows the data separated by country, and reveals a similar trend, i.e., that the majority of participants in each of the countries have access to internet in their apiaries. There are also some participants who have access to internet in some of their apiaries, but not in all of them.

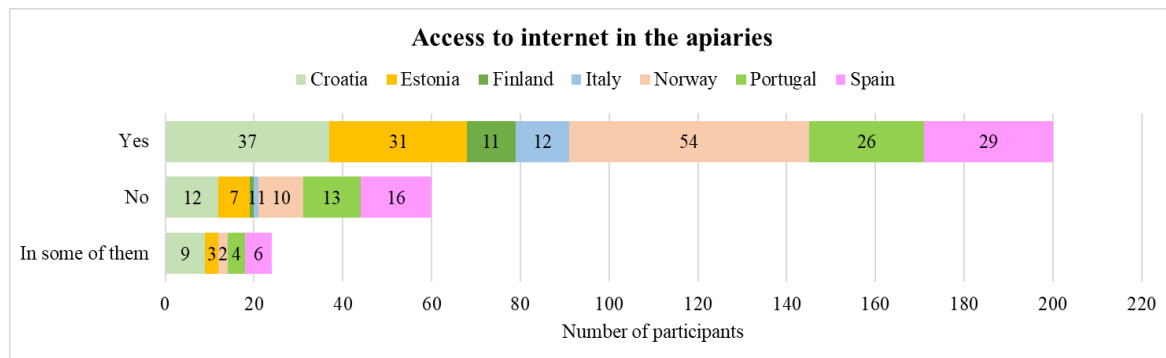


Figure 5. Access to internet in the apiaries, by country.

### Tools for Distance Learning

When asked whether the participants preferred digital or printed information about beekeeping, 177 said they preferred digital and 136 preferred printed information. Figure 6 shows the preferred materials, according to the participants from the different countries. Countries where a higher number of participants prefer digital materials are Croatia (n = 44 against 17 who prefer printed), Finland (n = 9 against 5), Italy (n = 10 against 6), Portugal (n = 25 against 21) and Spain (n = 37 against 15). Contrarily, in Estonia and Norway, a higher number of participants prefer printed materials (Figure 6).

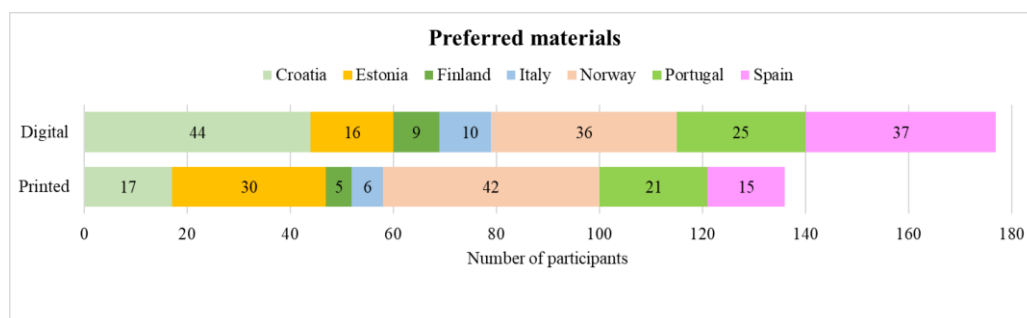


Figure 6. Preferred materials, by country.



The participants were asked about how they classified the usefulness of each of different types of learning materials, rating them on a scale from 1 (little useful) to 5 (very useful). These results are presented in Table 9. The participants rated as most useful the videos (41.8%), followed closely by books/paper manuals (41.4%). The least relevant materials were “Educational games”, which had the highest percentage of low rating (38.7% of participants attributed score 1).

Table 9. Opinions about the usefulness of learning support materials (N = 313).

Material	→ Increasing usefulness →				
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
e-books (electronic books)	13.1	15.7	23.5	23.5	24.3
Interactive platforms	7.9	16.6	24.2	28.5	22.7
Books/Paper manuals	3.2	6.0	19.3	30.2	41.4
Technical leaflets	9.1	13.5	25.5	29.2	22.6
Educational games	38.7	23.1	19.3	11.3	7.6
Videos	3.5	4.2	19.5	31.0	41.8
Specific programs or Apps	10.2	12.5	24.7	29.8	22.7
Others	42.1	7.9	21.1	13.2	15.8

Figure 7 presents the results for the learning materials rated most useful, by country. Considering the materials scored with highest value (5) for usefulness in each country, videos stand out particularly for Croatian and Spanish participants. Contrarily, books/paper manuals are particularly relevant for the Croatian, the Norwegian and the Spanish beekeepers (Figure 7).

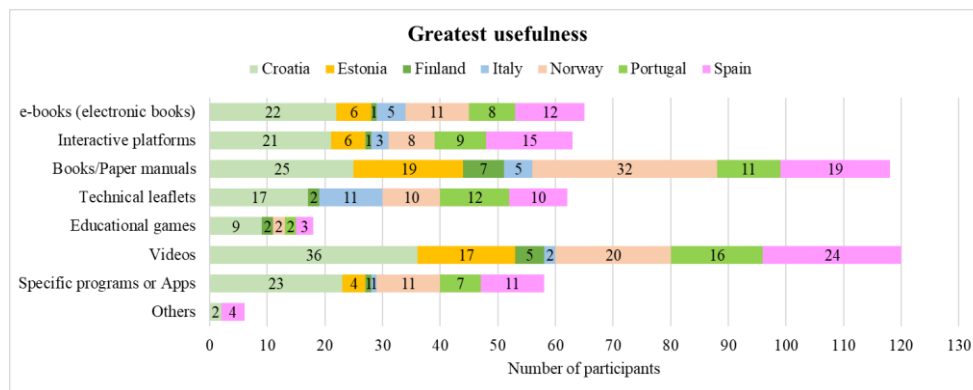


Figure 7. Learning materials rated most useful, by country.

With respect to the learning methodologies, also the participants had to rate their usefulness on the same scale from 1 (little useful) to 5 (very useful). Table 10 presents the results for the whole sample. Higher percentages of the maximum score (score 5) were found for “Field visits” (49.7%), for “Internships” (35.9%) and for “Short courses” (34.5%). “Games/Challenges (gamification)” was, among the methodologies proposed, the least valued, with 26.5% of participants scoring with lowest value of usefulness (score 1).

The methodologies scored for usefulness with lowest and highest values (1 and 5, respectively) in each country are shown in Figure 8. Major discrepancies were found for “Games/Challenges (gamification)”, that were

considered as of low usefulness by many Norwegian participants (n = 23) but by few Italians or Finish (n = 2, in both cases). The Field visits were greatly valued in general, with a high number of participants from all countries attributing maximum score for usefulness: 36 from Croatia, 12 from Estonia, 9 from Finland, 7 from Italy, 24 from Norway, 27 from Portugal and also 27 from Spain.

Table 10. Opinions about the usefulness of learning methodologies (N = 313).

Methodology	→ Increasing usefulness →				
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Long courses	11.9	12.2	27.3	19.4	29.1
Short courses	5.3	6.3	23.6	30.3	34.5
Forum/chat	7.7	21.9	27.4	23.0	20.1
Lectures	2.2	10.0	29.7	31.5	26.5
Based in projects	5.2	16.0	28.4	25.0	25.4
Field visits	1.0	6.3	12.9	30.1	49.7
Monitoring of pilot farms	8.0	13.1	24.4	22.5	32.0
Internships	11.1	9.6	17.4	25.9	35.9
Games/Challenges (gamification)	26.5	29.2	25.8	12.5	6.1
Group work	12.5	11.8	31.8	29.4	14.5
Others	36.4	9.1	18.2	9.1	27.3

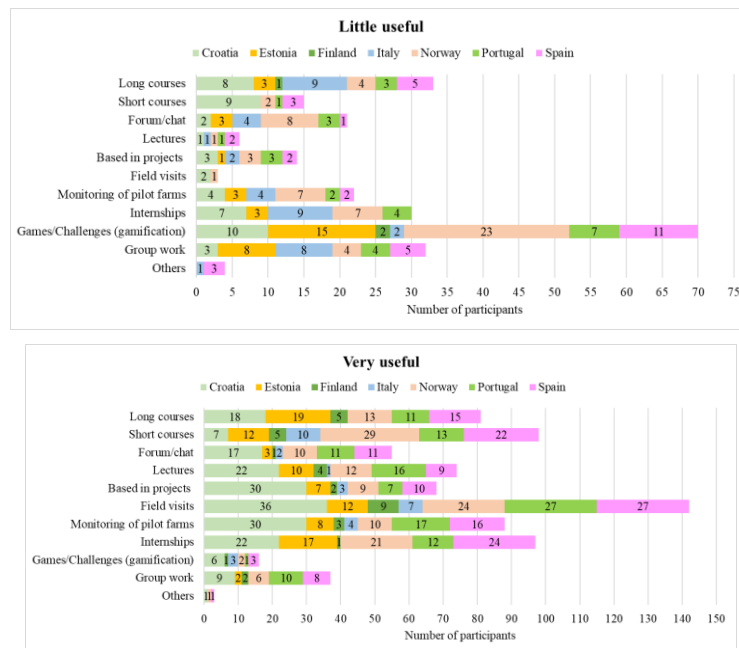


Figure 8. Learning methodologies rated lowest and highest for usefulness, by country.

Also the form of assessment of the learning outcomes in context of distance learning and self-learning, was investigated in this study. Table 11 presents the results, for the global sample, of the participants' opinions about which methods they considered most or least useful to assess learning outcomes, using the same 5 points scale previously described. The most valued form of assessment was "Practical exercises" (39.8% scored maximum, 5) while the least valued were "Online response tests" and "Oral tests", with around 11% of score 1, in both cases.

Table 11. Opinions about the usefulness of formats to assess the learning outcomes (N = 313).

Assessment format	→ Increasing usefulness →				
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Online response tests	11.3	16.0	27.3	21.1	24.4
Tasks/reports	6.1	15.5	34.1	28.0	16.3
Paper tests/questionnaires	9.3	19.7	34.6	23.0	13.4
Practical exercises	5.3	5.6	18.7	30.6	39.8
Orals tests	11.0	18.1	28.0	27.2	15.7
Others	27.8	22.2	22.2	5.6	22.2

The forms of assessment rated with the lowest and highest scores (1 and 5, respectively) were then analysed by country, and the results are shown in Figure 9. The “Online response tests” were not valued by participants from Spain and Croatia (n =10 and n = 8, respectively). The “Practical exercises” were considered very useful for a high number of participants from Croatia, Estonia, Norway, Portugal and Spain (n = 22, n = 23, n = 19, n = 18 and n = 25, respectively), but only two participants from Italy and four from Finland considered this assessment format very useful.

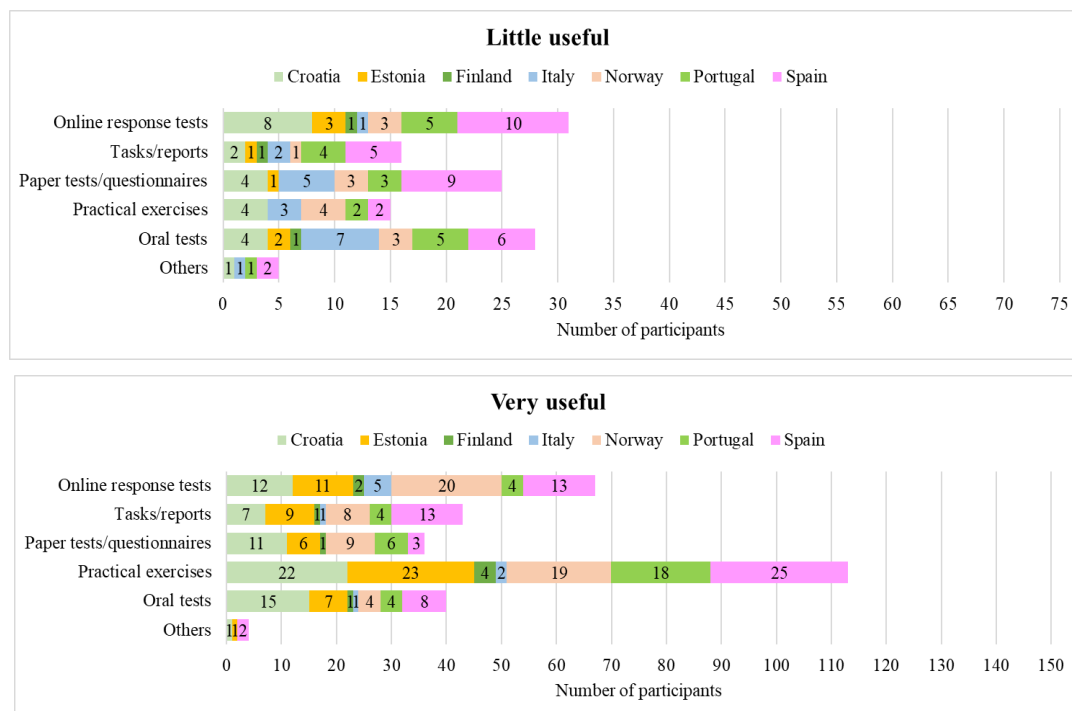


Figure 9. Assessment formats rated lowest and highest for usefulness, by country.

## Discussion

Education is the pathway to increase productivity and competitiveness in any business area, including beekeeping. The beekeeper is the agent and the medium is variable, but undoubtedly that technology is becoming more and more relevant in the context of PT and LL. Among others, e-Learning already assumes the lead and it will increasingly play a dominant role in shaping student’s management systems and the related

learning environments (Ekúndayò & Tuluri, 2011).

Although the enormous possibilities of distance learning have been known for many decades, it is a fact that until the outbreak of Covid-19 pandemic in the year 2020, teaching methods still followed to a great extent a traditional approach based much on frontal teaching in a classroom. But even before that the use of digital tools had been acknowledged as pivotal for achieving the required 21<sup>st</sup> century skills (Yorkovsky & Levenberg, 2022). This forced need to shift rapidly from in-person learning systems to distance learning based on technology, cause an evolution not only in the technology itself, but also in the didactic and pedagogical domains (Segbenya et al., 2022; Segbenya & Anokye, 2022).

The use of distance learning tools for professional training is very advantageous given the lack of time of professionals, who, nonetheless, still need to improve their knowledge, skills and competences, as a way to improve the health of their beehives and the quality of their products, to expand their business and increase competitiveness (Farida & Setiawan, 2022; Lee et al., 2019; Mahdavinejad et al., 2012; Shen et al., 2022). Additionally, managing beehives and bees has many challenges, due to the threats posed by climate change, the use of harmful substances, pests such as the Varroa mite, or those posed by predators such as the Asian wasp (*Vespa velutina*). The building of knowledge founded on updated information, most recent technological developments and scientific discoveries arises as a vital activity to all those intervening in the beekeeping sector (Leza et al., 2019; Malkamäki et al., 2016; Phillips, 2020; Robustillo et al., 2022; Zacepins et al., 2015).

Among the topics that beekeepers identify as most relevant in the context of lifelong learning and professional training, stand the apiary health and pest control, related to the health of the colonies, but also colony management throughout the year, with the differences according to season, namely the dichotomy autumn-winter/spring-summer, and also the reproductive management and production of queens. They feel that they need to improve their knowledge and be better prepared to deal with the problems that affect their beekeeping activities. New discoveries can bring light into novel approaches to improve bee health and increase colony performance (Hong et al., 2022; Jovanovic et al., 2021; Lo & Chiang, 2022). Also new findings are continually being released about the impact of invasive species *Vespa velutina* on honeybees, and how to minimize those effects (Leza et al., 2019; Poidatz et al., 2018). As such, all domains of knowledge linked with the beekeeping sector require continuous update for those involved.

The existence of courses for distance learning and adjusted assessment of learning outcomes, allows a continuous updating of information and development of competences, that are recognized as vital by beekeepers. They feel they want to engage in training activities in domains they find crucial, so curriculum development needs to adapt to this reality. Additionally, they find distance learning a useful means of training, but they recognize that complementing with practical activities is necessary to achieve success. These blended learning approaches are documented as bringing together the best of different approaches (Finlay et al., 2022; Geletu & Mihiretie, 2023; Truss & Anderson, 2023).

## Conclusion

The results obtained through this questionnaire survey applied to actors in the beekeeping sector in different European countries, revealed that the topics of highest interest for the beekeepers are apiary health and pest control, but also colony management throughout the year. For the enquired, the most relevant sources of information are family, but they also get new information from professional training/courses. The most valued forms of training are in-person and in workplace/internships. Nevertheless, the digital supporting resources are preferred instead of printed material, as a way to increase sustainability. The most valued learning materials were videos, but also books (even e-books) or paper manuals were considered relevant. The field visits were also greatly appreciated by the participants, and the most preferred assessment format was the realization of practical exercises.

## Recommendations

Based on the results revealed through this research, the valuable information concerning topics of interest, forms of delivering the classes, materials preferred, or modes of assessment of the learning outcomes, can be utilized to design training actions and courses destined to the professionals in the beekeeping sector, as a way to allow them expand their knowledge and better prepare to successfully manage their beekeeping activities.

## Acknowledgements

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## Mapping the Research Landscape of Falls in Older Adults: A Bibliometric Analysis

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**Abstract:** Aging is a growing public health concern as falls are the leading cause of unintentional injury in older adults. Thus, this study identifies the main areas and current interactions between falls in the field of older adults and suggests future research directions. Using a bibliometric analysis, we examine a sample of 6815 studies from the Scopus database on falls and older adult research starting from 1842 to 2022. Findings showed the United States was an active country, with 1760 total publications and the Hinda and Arthur Marcus Institute for Aging Research, Boston, MA was a dynamic institution. Three prolific authors in this area have been identified, namely Lord SR from Sydney, Kenny RA, and Stevens JA from the Ireland and United States, respectively. While, the most cited paper was from Tinetti M (1988), with the title “Risk Factors for Falls among Elderly Persons Living in the Community” (cites=4922). The Journal of the American Geriatrics Society was the most active journal. The co-occurrence analysis was used to study to explore topics related to aging and falls. The total strength of the co-occurrence links with other keywords was calculated by the VOSviewer software using the normalization of associations and full counting algorithm. Five major clusters have been discussed related on the topics researched. Although research activity on aging and falls occurs globally, a lack of collaboration exists across country lines, especially between authors of developed and developing countries. Research on risk factors related to falls in the community focusing on balance issues and gait was significantly discussed. However, insufficient attention to the diversity of aging and their individual needs particularly with respect to cultural and socioeconomic factors. We conclude by suggesting two potential research directions related to prevention and focusing on sub-populations of older adults such as those with dementia.

**Keywords:** Bibliometric analysis, Falls, Older adults, Prevention, Risk

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## Introduction

Falls in older adults are a significant public health concern, with nearly one-third of older adults experiencing a fall each year (World Health Organization, 2007). Mapping the research landscape of falls in older adults provides insights into the current state of research, identifies gaps in knowledge, and highlights opportunities for future research. A systematic review of the literature on falls in older adults found that the majority of research has focused on individual-level risk factors, such as age, sex, and chronic health conditions, rather than on broader contextual factors, such as social and environmental factors (Gillespie et al., 2012). This review also identified a need for more research on effective fall prevention interventions and for studies that explore the experiences and perspectives of older adults who have fallen.

Further evidence of the need for a more comprehensive approach to falls in older adults comes from a recent meta-analysis that found that multifactorial interventions, which address both individual-level and contextual factors, are more effective at reducing the risk of falls than single-component interventions (Parry et al., 2013). This analysis also highlighted the importance of tailoring interventions to individual needs and preferences and involving older adults in the development and implementation of fall prevention strategies. Overall, mapping the research landscape of falls in older adults reveals the need for a more holistic and person-centered approach to fall prevention that considers both individual-level and contextual factors and engages older adults as partners in the research process.

A great deal of previous research into fall-related in older adults has focused on the challenges. It is now well-established from a variety of studies that have relatively small sample sizes, which can limit the generalizability of the findings. This can make it difficult to draw strong conclusions or make recommendations for broader populations. Perhaps, issues related to ethical considerations also play a major role in this research trend and challenges. Falls can be a serious health concern for older adults, and conducting research on falls can raise ethical considerations related to informed consent, risk of injury, and balancing the benefits and risks of fall prevention interventions.

Up to now, in terms of data collection, previous studies on falls go unreported and are difficult to capture through self-report or other means. This can make it difficult to accurately assess the frequency and risk factors of falls. Previous research findings into fall-related studies have been inconsistent and contradictory, which might be due to their measurement issues. Measuring falls and fall-related outcomes can be complex, as there is often variability in how falls are defined and measured. This can make it difficult to compare findings across studies and draw strong conclusions. By addressing these challenges and continuing to conduct high-quality research in this area, researchers can identify effective interventions to prevent falls and improve the quality of life for older adults.

In order to present the direction of future falls research in the geriatrics population, we downloaded English-

language articles and reviews from the Scopus database and analyzed them visually using VOSviewer and Harzing POP. The general objectives in this current study were to identify the main areas and current interactions between falls in the field of older adults and suggest future research directions. Specifically, there are four research questions, namely:

- (i) *Research Question 1:* What is the current publication trend in board diversity?
- (ii) *Research Question 2:* Which are the most influential articles on board diversity?
- (iii) *Research Question 3:* Who are the most influential authors, top countries, and institutional on-board diversity?
- (iv) *Research Question 4:* Which themes involving board diversity are the most popular among scholars?

This bibliometric analysis will be beneficial for researchers, policymakers, and individuals to understand the research trends in falls in older adults and to discover the potential and opportunities for future research (Bahri, Adnyana, Hasan, Ray, Paramitha, 2022; Suseelan, Chew, Chin, 2022)

## Method

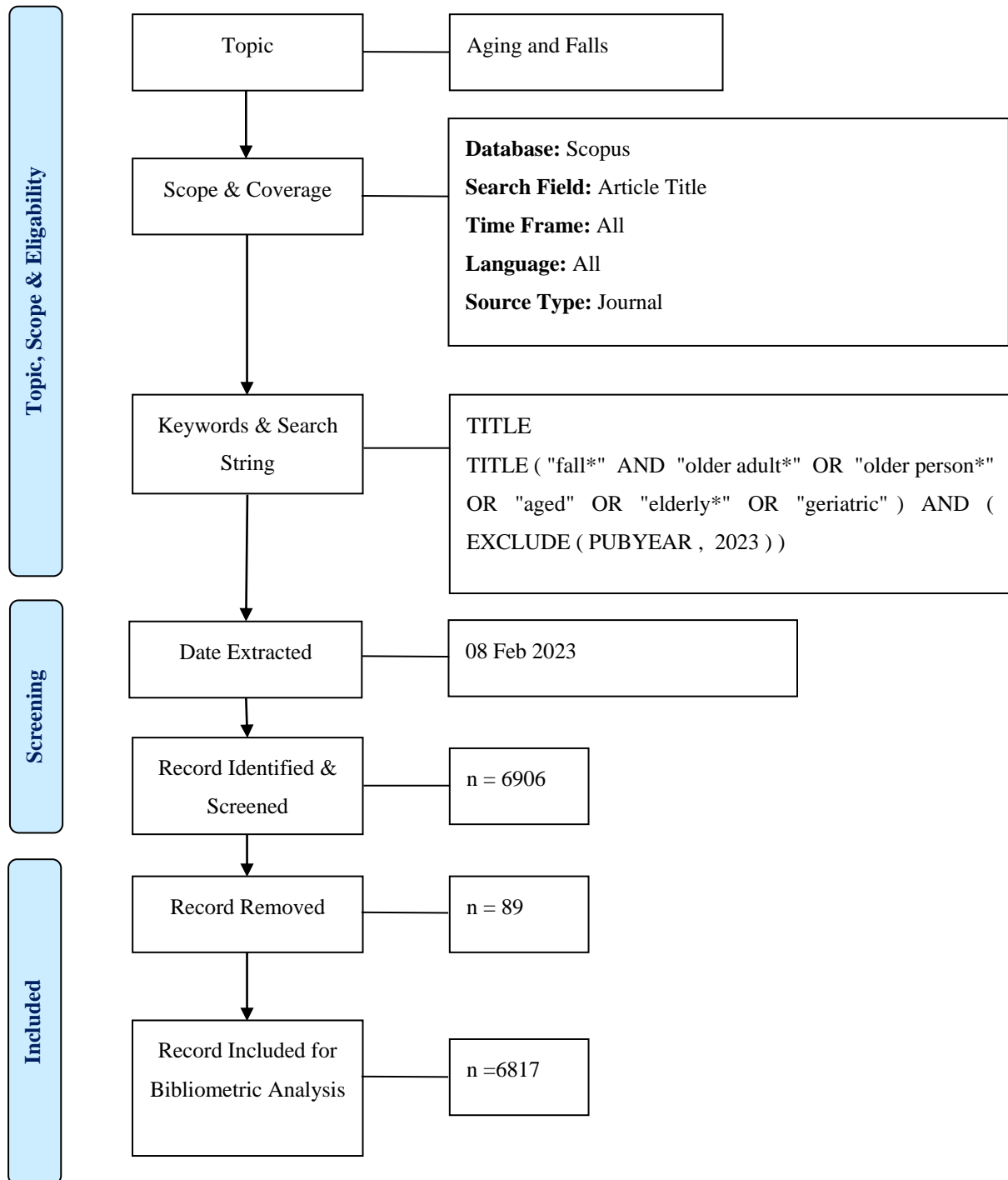
A bibliometric analysis study is a mechanistic approach to understanding the global research trends in a specific area based on the outputs of the academic literature database. This kind of approach distinguishes a bibliometric analysis paper from a review paper which is primarily intended to discuss the latest progress, challenges, and future directions of a certain topic (see Figure 1).

### Data Source and Search Strategy

Data mining was conducted within February 18 2023 using Scopus database. The central theme in this study was research articles containing “fall\*” and “older\*” in the article title. The oldest publication dates to 1842 and the more recent ones are from 2022. The query string used for the search was:

```
TITLE ( "fall*" AND "older adult*" OR "older person*" OR "aged" OR "elderly*" OR "geriatric" ) AND ( EXCLUDE ( PUBYEAR , 2023 ) ).
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This query string resulted in 6817 documents. These articles contained terms such as review, recent, progress, critical, revisit, advance, highlight, in the title and abstract. The search results of the central theme were analyzed based on year, source, author, affiliation, country/territory, subject area, and document type. Bibliometric indicators such as total publications, total citations, CiteScore, FWCI and h-index were used for ranking purposes.



### Data Analysis Method

*Bibliometric maps using analysis of Co-authorship and Analysis of co-occurrence*

Citation, bibliographical, and author keywords information of 6815 articles were exported to VOSviewer (version 1.6.7, Center for Science and Technology Studies, Leiden University, The Netherlands), a software tool

for constructing and visualizing bibliometric maps. Maps created using VOSviewer include items. In this study, the items are the objects of interest, namely the author keywords. Between any pair of items, there can be a link—connection or relation between two items. Each link has a strength, represented by a positive numerical value. The higher this value, the stronger the link.

In the case of co-authorship analysis, the link strength between countries indicates the number of publications that two affiliated countries have co-authored, whereas the total link strength indicates the total strength of the co-authorship links of a given country with other countries. Similarly, in the case of co-occurrence analysis, the link strength between author keywords indicates the number of publications in which two keywords occur together. In the analysis of co-authorship, we included all 252 countries affiliated with 6469 authors. The affiliated countries/territories were clustered into 5 continents: Africa, America, Asia, Europe, and Oceania. Analysis of co-occurrence of author keywords involved 6574 keywords. In VOSviewer, minimum occurrences of a keyword to be analyzed was set to 50. Overlay visualization mode was selected to view the average publication year, number of occurrences, and link strength of the keywords. The colour of a keyword indicates the average publication year of the documents in which a keyword occurs.

## Results and Discussion

### Publication output and growth of research interest

For a period of 180 years, a total of 6815 research articles had been published (see Figure 1 and Appendix). The oldest publication dates to 1948, and there was no other publication record until 1955. It is suggested that strong interest in fall-related in older adults research started from 1977. It was also found that the number of publications increased by 100 for every two years. Therefore, it is anticipated that the annual publication will continue to rise. However, most of these articles are not freely available and the user has to pay to access the information in them. We suggest that an article will likely receive more citations if it is published through an open-access journal.

Fall-related research areas are extensive and many research groups worldwide are working actively in these areas. Analysis on the subject area showed that medical concerns are the primary focus in fall-related in older adult's studies. This is evidenced by the total publications classified under the following subject areas: Medicine (5154 articles, 75.63%), Nursing (1230 articles, 18.05%), Biochemistry, Genetics and Molecular Biology (877 articles, 12.87%), and Health Professions (782 articles, 11.47%). Indeed, fall study is a multidisciplinary area and one of the publications was categorized under multi-disciplinary area.

Results also showed that the articles used in this study were published in more than 20 different languages. English (5919; 84.80 %) was the most commonly used language followed by French (170; 2.44%), Spanish (158, 2.26 %), German (154, 2.21%) and Portuguese (145, 2.08%). Other languages that took about less than 2% such as Japanese, Chinese, Dutch, Turkish, Italian, Korean, Polish, Russian, Danish, Hebrew, Persian, Czech, Slovak,

Finnish, Norwegian, Swedish, Greek, Hungarian, Malay, and Slovenian were used in less than 100 articles. When a publisher submits an article in a foreign language to be indexed in Scopus, the article should have a title and abstract in English.

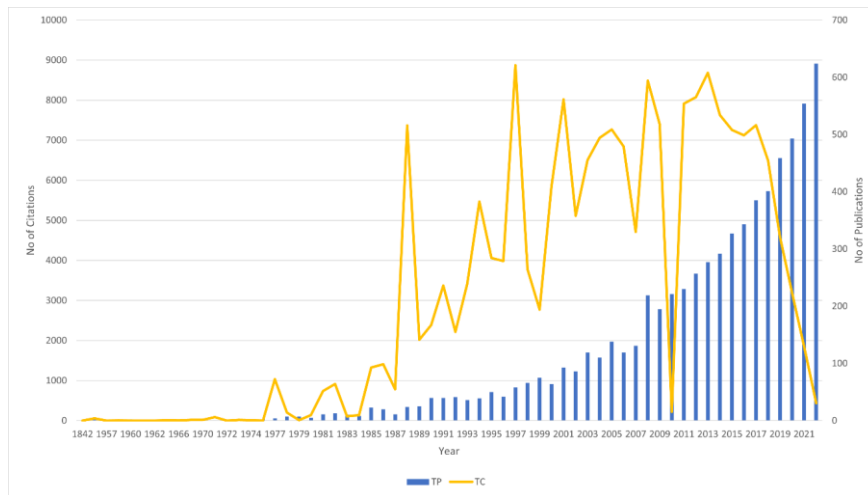


Figure 1. Total Publications and Citations by Year

**Preferred journals**

Our results showed that the top 10 most productive journals are owned by twelve (12) different publishers (See Table 2). The top three journals were published by Wiley-Blackwell, Lippincott Williams and Wilkins, BioMed Central Ltd., Springer Nature and Elsevier Ireland Ltd. The most productive journal was Journal of the American Geriatrics Society with 231 articles covering 3.39% of the total publications, followed by BMC Geriatrics (149, 2.19%) and Archives Of Gerontology And Geriatrics (98, 1.44%). Massachusetts Medical Society was not the most active journals, however one of their articles published in 1988 was the most cited article, with 4944 citations. According to the CiteScore 2016 report, eleven journals had a CiteScore of 5 and above. Journals of the highest and lowest CiteScore belonged to Aging Clinical and Experimental Research (11), and Rigakuryoho Kagaku (0), respectively.

Table 2. Most Active Journals

Source Title	TP	TC	Publisher	Cite Score	SJR 2018	SNIP 2018
Journal Of the American Geriatrics Society	231	21738	Wiley-Blackwell, Lippincott Williams and Wilkins	8.8	2.133	2.24
BMC Geriatrics	149	3221	BioMed Central Ltd., Springer Nature	4.8	1.153	1.693
Archives Of Gerontology and Geriatrics	98	2888	Elsevier Ireland Ltd	5.3	0.953	1.412

Age And Ageing	97	10005	Oxford University Press, NML(Medicine)	11	1.75	3.23
Aging Clinical And Experimental Research	89	1685	Springer Science and Business Media Deutschland GmBH, Springer Nature, NML (Medline)	5.9	0.911	1.471
International Journal Of Environmental Research And Public Health	83	677	Multidisciplinary Digital Publishing Institute (MDPI)	4.5	0.814	1.44
Journals Of Gerontology Series A Biological Sciences And Medical Sciences	83	8449	Oxford University Press, Gerontological Society of America	9.6	1.712	1.738
Archives Of Physical Medicine And Rehabilitation	66	6263	W.B.Saunders, Elsevier	5.3	0.953	1.412
Geriatrics And Gerontology International	65	1334	Blackwell Publishing, John Wiley and Sons Inc	4.8	0.814	1.114
Plos One	56	1736	Public Library of Science	5.6	0.852	1.368
Gerontology	53	2564	S.Karger AG	7.7	1.267	1.667
Osteoporosis International	53	2656	Springer London	7.6	1.108	1.844
Gait And Posture	50	2015	Elsevier B.V.	4.3	0.682	1.24
Rigakuryoho Kagaku	47	47	Society of Physical TherapyScience (Rigaku Ryoho Kagakugakkai)	0	0.106	0.043
Journal Of Geriatric Physical Therapy	44	1213	Wolters Kluwer Health, Lippincott Williams and Wilkins, American Physical Therapy Associations	6.1	0.941	1.579

Notes: TP=total number of publications; TC=total citations;

### Leading countries, top institutions, and international collaboration

Figure 2 shows the top 15 most productive countries contributing to the growth of fall-related studies in older adults in worldwide. About 60% of the global publications were contributed by the United States and Japan indicating these two countries are key players in the fall-related research progress. The United States was the leading country with 1632 publications in a total of 92372 journals, covering 39% of the global total publications. With one-half of USA's total publications, Japan was ranked the second most productive country. The total number of publications (TPi) from The University of Sydney was 104, followed by National Center

for Geriatrics and Gerontology 96, followed by Universidade de São Paulo 69, respectively. The distribution of countries/territories per region is shown in Figure 3.

The closer two countries are located to each other in VOSviewer, the stronger their relatedness and the stronger the link between the two countries, the thicker the line. The highest number of countries per region came from Africa (59) followed by Europe (57), Asia (54), North America (42), Oceania (26), and South America (14). Results of co-authorship showed that the US was the most affiliated country, linked to 39 countries/territories with 491 times of co-authorship. The list was followed by the UK (37 links, 324 co-authorships), Canada (36 links, 256 co-authorships), Australia (35 links, 254 co-authorships), Netherlands (32 links, 204 co-authorships), and others.

It was also shown that 2/3 of the listed countries had international collaborative publications with less than 10 countries. Several possible factors contributing to the dynamic of international collaboration can be attributed to the diversity of research partners, the high percentage of foreign postgraduates/ visiting scholars, and strong research funding. It is also important to have a flexible and stable research policy to ensure the stability of international collaboration.

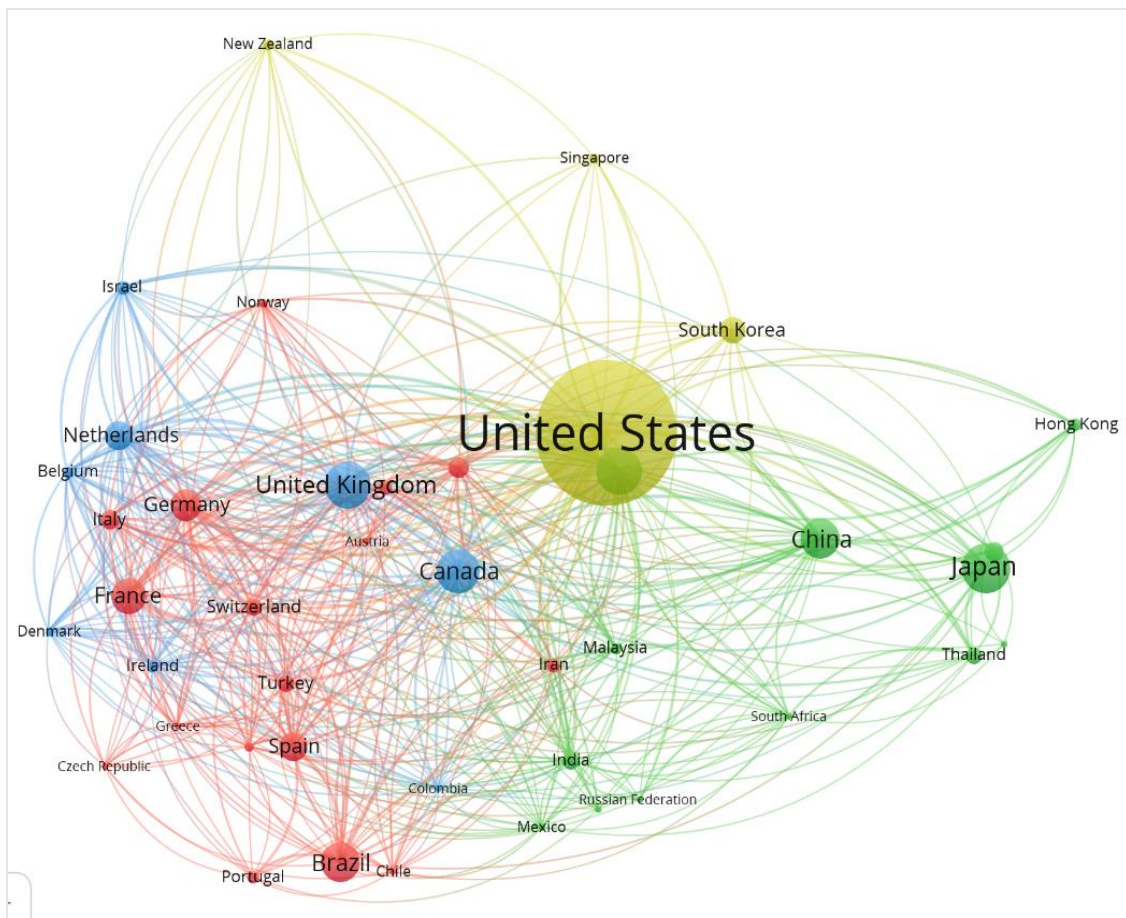


Figure 2. The top 15 most productive countries and academic institutions in fall-related publications. TPC: total publications of a given country; TPI: total publications of a given academic institution

Rank	Country	TPc	Academic Institutions	TPI	Rank	Country	TPc	Academic Institutions	TPI
1	United States	92372	Harvard Medical School	96	9	Germany	4426	Robert Bosch Krankenhaus Stuttgart	35
2	Japan	6656	National Center for Geriatrics and Gerontology	50	10	Spain	3871	Hospital Universitari de Bellvitge	17
3	Australia	13834	The University of Sydney	104	11	Netherlands	11313	Vrije Universiteit Amsterdam	53
4	United Kingdom	18916	Nottingham University Hospitals NHS Trust	23	12	South Korea	3287	Seoul National University	14
5	Canada	19928	University of Toronto	50	13	Sweden	5244	Karolinska Institutet	45
6	Brazil	4576	Universidade de São Paulo	69	14	Italy	3621	Università degli Studi di Firenze	11
								Alma Mater Studiorum Università di Bologna	
7	China	3519	Fudan University	17	15	Taiwan	2306	National Yang-Ming University Taiwan	33
8	France	6984							

### Leading authors

Table 3 lists the 15 most prolific authors in fall-related research in aging, affiliated to eight countries as follows; USA (3 authors), Australia (3 authors), Japan (3 authors), Canada (2 authors), Ireland (1 author), Germany (1 author), Finland (1 author) and Israel (1 author). Lord SR from Australia led the list with a record of 54



publications, 27 h-index, and 4175 times citations. The 2nd and 3rd top authors, Kenny RA from Ireland and Steven JA from the United States recorded 42 total publications (20-h index, 1531 times citations) and 32 total publications (24-h index, 4241 times citations), respectively.

Table 3. Most 15 Productive Authors

Author's Name	Affiliation	Country	TP	NCP	TC	C/P	C/CP	h	g
Lord, S.R.	UNSW Sydney, Sydney	Australia	54	77.31	4175	77.31	54.00	27	54
Kenny, R.A.	School of Medicine, Trinity College Dublin, Dublin,	Ireland	42	36.45	1531	36.45	42.00	20	39
Stevens, J.A.	University of North Carolina Injury Prevention Research Center, Carolina,	United States	32	132.53	4241	132.53	32.00	24	32
Becker, C.	Robert Bosch Krankenhaus Stuttgart, Stuttgart,	Germany	31	27.32	847	27.32	31.00	14	29
Liu-Ambrose, T.	The University of British Columbia, Vancouver	Canada	31	40.32	1250	40.32	31.00	16	31
Suzuki, T.	University of Yamanashi, Kofu,	Japan	31	32.19	998	32.19	31.00	18	31
Kannus, P.	UKK Institute Finland, Tampere,	Finland	30	77.1	2313	77.10	30.00	18	30
Hausdorff, J.M.	Tel Aviv Sourasky Medical Center, Tel Aviv-Yafo,	Israel	29	158.1	4585	158.10	29.00	21	29
Hill, A.M.	University of Maine, Orono,	United States	29	10.9	316	10.90	28.99	12	16
Beauchet, O.	University of Montreal, Montreal,	Canada	28	50.18	1405	50.18	28.00	17	28
Lipsitz, L.A.	Harvard Medical School, Boston,	United States	28	120.96	3387	120.96	28.00	24	28
Clemson, L.	The University of Sydney School of Health Sciences, Sydney,	Australia	27	28.41	767	28.41	27.00	11	27
Shimada, H.	Keio University School of Medicine, Tokyo	Japan	26	25.92	674	25.92	26.00	15	25
Yamada, M.	Graduate School of Medicine, Tokyo,	Japan	26	20.92	544	20.92	26.00	15	23
Sherrington, C.	Faculty of Medicine and Health, Sydney,	Australia	25	59.84	1496	59.84	25.00	14	25

Notes: TP=total number of publications; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; C/CP=average citations per cited publication; h=h-index; and g=g-index.

### Author keywords

The minimum number of co-occurrence of a keyword was set 50. Of the 6574 author keywords was recorded, a

total of 45 meet the threshold and were mapped in the VOSviewer. For each of the 45 keywords, the total strength of the co-occurrence links with the other, keywords will be calculated. The keywords with the greatest total link strength were selected. The word “falls” occurred 1472 times with 2067 total link strength, followed by the keyword “elderly” (937 times, 1360 total link strength) and “accidental falls” (631 times, 943 total link strength), respectively. See Figure 3.

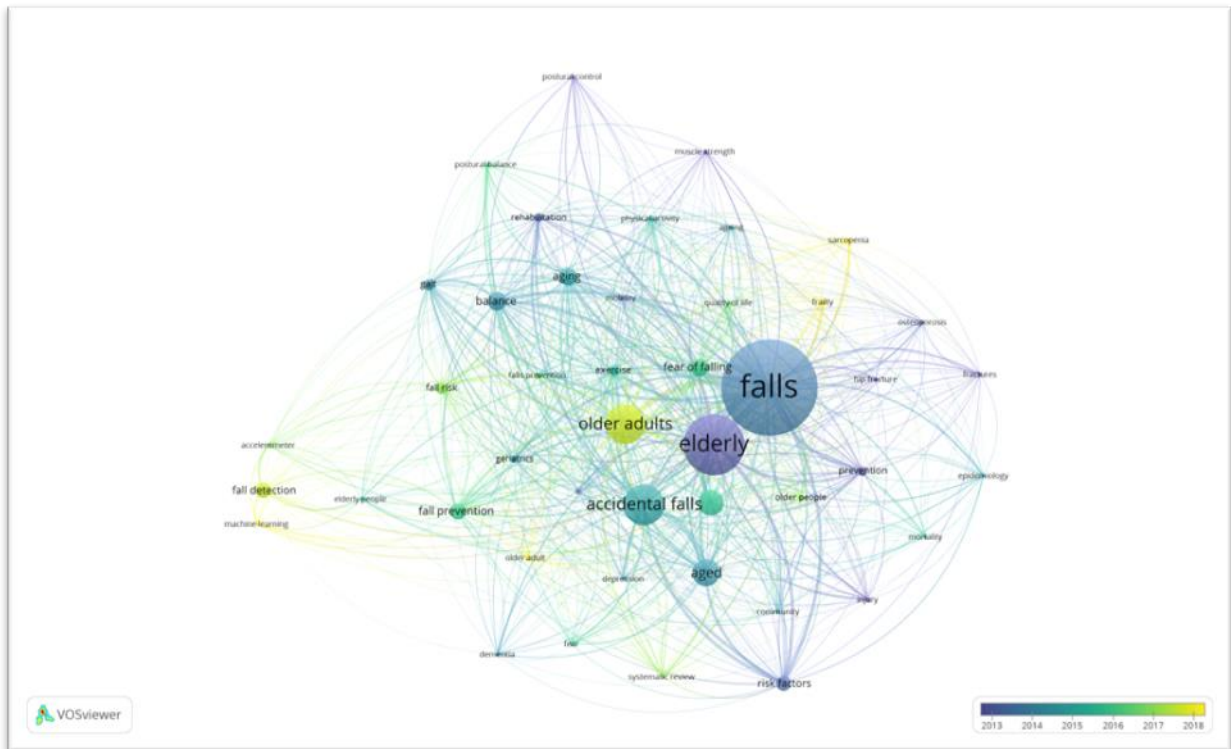


Figure 3. The most common author’s keywords in fall-related publications.

In this study, there are five main clusters, namely (i) Risk factors and falls (ii) Fall detection in falls (iii) Fall prevention and Exercise (iv) Determinants of Falls, and (v) Psychological and Falls. Cluster 1 mainly reports the highest ranking and the majority of this cluster explains the factors associated with falls among older adults. Previous studies had argue that osteoporosis and sarcopenia are important risk factors for falls in older adults, as they can contribute to decreased bone density, muscle weakness, and impaired balance and gait (Latham et al., 2019). These factors may increase the risk of fractures and other injuries, leading to disability and reduced quality of life in older adults.

On the other hand, some studies suggest that the relationship between osteoporosis, sarcopenia, and falls may not be as straightforward as previously thought. For example, a recent systematic review and meta-analysis found that the association between osteoporosis and falls was not significant after controlling for confounding factors, such as age and comorbidities (Huang et al., 2021). Similarly, another meta-analysis found that sarcopenia was not consistently associated with falls in older adults, and that the strength of the association varied depending on the definition and measurement of sarcopenia (Chen et al., 2020). Overall, while there is

evidence to support the idea that osteoporosis and sarcopenia may contribute to falls in older adults, the extent of this relationship remains unclear. Future research is needed to better understand the complex interplay between these risk factors and other factors that contribute to falls in older adults, such as medication use, cognitive impairment, and environmental hazards. Next in the Cluster 2 was discussed on reported the common fall detection tools such as accelerometer as well as machine learning in falls. Accelerometers are commonly used in wearable devices and smartphones to detect falls in older adults. Machine learning algorithms can be used to analyze the accelerometer data and distinguish between normal activities and fall events. A study by Boulton and colleagues (2019) evaluated the accuracy of different machine learning algorithms in detecting falls using accelerometer data from a wearable device. They found that a support vector machine (SVM) algorithm had the highest accuracy (90.5%) in detecting falls compared to other machine learning algorithms.

Another study by Delahoz and colleagues (2021) used a smartphone-based accelerometer to detect falls in older adults. They developed a machine learning algorithm that combined accelerometer data with demographic and health-related variables to improve the accuracy of fall detection. The algorithm achieved a sensitivity of 97.4% and a specificity of 99.6% in detecting falls. A systematic review by Spruit and colleagues (2021) examined the use of wearable sensors, including accelerometers, for fall detection in older adults. They found that the accuracy of fall detection using accelerometers varied widely across studies, with reported sensitivities ranging from 37% to 100% and specificities ranging from 46% to 99%. Overall, the use of accelerometers and machine learning for fall detection in older adults shows promising results. However, further research is needed to evaluate the accuracy and feasibility of these methods in real-world settings. These studies demonstrate the potential for technology-based fall prevention interventions, and their role in improving the health outcomes of older adults.

In the Cluster 3 discussing on the fall prevention and exercise impact on the aging population. Falls are a significant health concern for older adults, with the potential to result in serious injuries and loss of independence. As such, preventing falls among this population is a critical public health issue. One effective approach to fall prevention involves multifactorial interventions, which address multiple risk factors for falls simultaneously. A systematic review by Sjösten et al. (2018) found that multifactorial interventions reduced falls by 36%. These interventions typically involve a comprehensive assessment of an older adult's physical, cognitive, and environmental status, followed by the implementation of multiple interventions tailored to the individual's specific needs. Another effective approach to fall prevention is exercise programs, which can improve balance, strength, and mobility. A meta-analysis by Sherrington et al. (2019) found that exercise-based interventions reduced the rate of falls by 23% and the number of fallers by 15%. Exercise programs can take many forms, including group classes, individualized programs, and home-based programs. They may involve a variety of exercises, such as resistance training, balance training, and gait training.

Environmental modifications are also an important component of fall prevention. Home modifications such as installing grab bars, improving lighting, and removing tripping hazards can reduce the risk of falls. A meta-analysis by Gillespie et al. (2012) found that home modification interventions reduced falls by 39%. Healthcare

professionals can play a critical role in identifying and addressing environmental risk factors for falls among older adults, such as inadequate lighting or slippery floors. In conclusion, fall prevention strategies for older adults can take many forms, including multifactorial interventions, exercise programs, and environmental modifications. These interventions have been shown to be effective in reducing falls among older adults, with a range of studies demonstrating significant reductions in falls and fall-related injuries. By addressing the multiple risk factors for falls that older adults may face, healthcare professionals can help improve the health, well-being, and independence of this vulnerable population.

Meanwhile in Cluster 4, the majority of the publications discussed related to poor muscle strength and postural control that can affect mobility and increase the risk of falls in older adults in several ways. Firstly, reduced muscle strength can lead to decreased physical function, making it difficult for older adults to perform daily activities such as walking, climbing stairs, or getting up from a chair (Liu et al., 2020). This can increase the risk of falls as they may lose their balance or trip while attempting these activities. Additionally, decreased muscle strength can lead to decreased bone density and increased frailty, which are also risk factors for falls (Pizzigalli et al., 2021).

Secondly, poor postural control can also increase the risk of falls in older adults. Postural control refers to the ability to maintain balance during standing or walking, and it requires the integration of sensory information from various sources, including the eyes, inner ear, and somatosensory system (Maki & McIlroy, 2006). Older adults with poor postural control may have difficulty maintaining their balance while walking on uneven surfaces or while performing other activities, increasing their risk of falls. Moreover, the interaction between muscle strength and postural control is important in maintaining mobility and preventing falls in older adults. A study by El-Khoury et al. (2013) found that a multifactorial exercise program that combined strength and balance training was effective in reducing the risk of falls in older adults. This suggests that interventions that address both muscle strength and postural control are important in maintaining mobility and preventing falls in older adults.

In conclusion, poor muscle strength and postural control can negatively affect mobility and increase the risk of falls in older adults. Interventions that address both factors, such as strength training and balance training programs, have been shown to be effective in reducing the risk of falls and maintaining mobility in older adults. Therefore, healthcare professionals should consider these factors when developing fall prevention strategies for older adults and incorporate interventions that address these factors into their clinical practice.ter 4 more into determinants of falls.

In the last cluster 5, most of the previous studies discusses on related the psychological components and falls. Depression is a common condition in older adults that can lead to decreased physical activity, reduced balance and coordination, and cognitive impairment, all of which can increase the risk of falls. A systematic review of 27 studies found that older adults with depression were more likely to experience falls compared to those without depression (Varela et al., 2019). This increased risk of falls may be due to several factors, including

decreased muscle strength, impaired balance, and reduced cognitive function. Addressing depression in older adults through appropriate interventions such as pharmacological and non-pharmacological treatments, including cognitive behavioral therapy and exercise, may help to reduce the risk of falls (Stubbs et al., 2014).

Dementia is a neurodegenerative condition that can cause cognitive and functional impairments in older adults. Dementia has been linked to an increased risk of falls, with one systematic review and meta-analysis of 19 studies reporting that older adults with dementia had a significantly higher risk of falls compared to those without dementia (Veronese et al., 2020). This increased risk of falls may be due to several factors, including impaired balance, gait abnormalities, and reduced muscle strength. Interventions targeting cognitive and physical function, such as exercise programs and environmental modifications, may help to reduce the risk of falls in this population (Li et al., 2012). Fear of falling is a common concern among older adults and can lead to decreased physical activity and increased social isolation, both of which can increase the risk of falls. Paradoxically, fear of falling itself can also increase the risk of falls, with one systematic review of 24 studies reporting that older adults with a high level of fear of falling had an increased risk of falls compared to those with a lower level of fear of falling (Stubbs et al., 2014). Addressing fear of falling through interventions such as exercise programs, cognitive-behavioral therapy, and home modifications may help reduce the risk of falls in this population (Varela et al., 2019).

In conclusion, depression, dementia, and fear of falling are all significant factors that can contribute to an increased risk of falls in older adults. Healthcare professionals can help reduce the risk of falls in this population by addressing these factors through appropriate interventions such as exercise programs, cognitive-behavioral therapy, and environmental modifications.

## **Conclusion**

This study has provided an overview of fall-related in aging research trends based on 6815 publications retrieved from the Scopus database. Publication growth has been rapid since the last 10 years, and it is anticipated to continue to rise. We have discovered countries/academic institutions (United States and United Kingdom) that have a massive number of publications and strong international collaborations. These entities can be an opportunity for researchers from other countries to broaden their research collaborations. We have discussed several areas that are currently well-explored such as material sciences incorporating fall detections and psychological components related to falls research, which can be potential hot topics for future studies.

## **Recommendations**

Future studies to compare the outputs from multiple databases such as Scopus and Web of Sciences are recommended. The search results from Web of Science, for instance, the display automatically the most popular articles in the field by a feature known as 'hot paper', a feature that is still lacking in Scopus. This hot paper

feature displays key papers that are recognized very soon after publication, reflected by a rapid and significant number of citations. Conducting bibliometric analysis using multiple data sources will be useful for a more comprehensive study.

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## Appendix. Study labels

id	label	cluster	weight<Links>	weight<Total link strength>	weight<Occurrences>	score<Avg . pub. year>	score<Avg. citations>	score<Avg. norm. citations>
1	community	1	29	118	52	2014.8077	27.6731	0.8817
2	elderly	1	43	1360	937	2012.6852	28.2209	0.9216
3	epidemiology	1	27	131	73	2014.6986	30.8219	1.2726
4	fall	1	41	479	395	2015.6	12.2633	0.8042
5	falls	1	44	2067	1472	2013.8118	30.3383	1.1975
6	fractures	1	27	126	55	2011.1455	56.9636	2.3357
7	hip fracture	1	21	91	64	2011.6094	28.7344	1.1279
8	injury	1	28	162	80	2012.975	39.6	1.5643
9	mortality	1	23	88	51	2015.5098	24.2549	1.1674
10	older people	1	37	178	104	2016.8077	24.6923	1.5988
11	osteoporosis	1	30	105	54	2013.2778	29.5556	0.9795
12	prevention	1	34	337	154	2012.9481	26.987	0.9072
13	sarcopenia	1	26	107	57	2018.4561	31.1053	2.626
1	accelerometer	2	18	97	70	2016.6571	21.6429	1.2336
2	elderly people	2	24	82	72	2015.1389	18.0556	1.1062
3	fall detection	2	15	122	235	2017.4128	18.4809	1.1784
4	fall prevention	2	37	321	245	2015.9388	36.1592	1.0508
5	fall risk	2	36	250	186	2016.8495	24.6667	1.2068
6	falling	2	36	126	86	2013.6279	30.3372	0.9527
7	geriatrics	2	38	175	115	2014.4522	19.6261	0.7253
8	machine learning	2	17	72	60	2019.35	11.1667	1.2411
9	older adult	2	25	109	74	2017.8919	14.0811	0.839
1	ageing	3	33	123	62	2014.6452	35.8871	1.4391
2	exercise	3	40	369	165	2015.3333	28.3273	1.1905
3	falls prevention	3	27	112	95	2015.7053	15.9895	0.8342
4	fear of falling	3	41	431	276	2015.9674	28.7935	1.3781
5	frailty	3	31	143	82	2018.2317	13.2439	1.2048
6	older adults	3	41	930	609	2017.5074	20.5041	1.3569
7	physical activity	3	34	184	94	2015.2128	26.1915	1.379
8	quality of life	3	31	141	69	2016.4928	20.9855	1.0987
1	aging	4	43	504	274	2014.781	25.6095	1.097
2	balance	4	39	589	286	2014.2832	42.4406	1.3213
3	gait	4	39	370	173	2014.3931	44.3526	1.8055
4	mobility	4	34	149	61	2013.459	39.3934	1.199
5	muscle strength	4	26	98	50	2012.98	38.96	1.0992
6	postural balance	4	25	155	81	2016.0247	19.3457	0.9945
7	postural control	4	20	94	51	2013.0392	31.3529	0.908
8	rehabilitation	4	35	288	143	2013.3706	49.7832	1.2351
1	accidental falls	5	40	943	631	2014.7924	31.1743	1.1011
2	aged	5	40	746	418	2014.3971	31.2273	1.1699
3	dementia	5	25	104	61	2014.2951	22.3607	1.1569
4	depression	5	27	119	56	2014.2143	26.4107	1.3004
5	fear	5	25	111	50	2015.76	22	0.7889
6	risk factors	5	39	469	240	2013.4208	39.7542	1.2968
7	systematic review	5	29	155	64	2016.9531	57.25	2.9294



## The On-the-job Training (OJT) Program: Students' Future Careers and Personal Development

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**Abstract:** In Vietnam, some universities develop a similar program to a practicum or an internship called an on-the-job training (OJT) program. However, this concept appears to be quite new to students, and its impacts on students' learning and growth remain under-researched. The current study explores how OJT programs impact students' future careers and personal development. The study used mixed research methods and data obtained from 150 students' responses at a private university in Vietnam via a 34-item questionnaire and semi-structured interviews. The results indicate that OJT programs significantly influence students' future professional and personal development as well as personal capacities. Spending a whole semester in enterprises arouses students' interest in intending what jobs they will take after graduation since they form a clearer orientation for their future careers. Besides the strengths observed, choosing a variety of firms, organizations, and job training positions and responsibilities for students is considered the program developers' great concern. The findings of this study show that learning that incurs during the OJT or practicum may emerge from students' social interactions, communications, and observations of their peers, supervisors, and others. Learning, in this sense, is both personally and socially constructed.

**Keywords:** On-the-job (OJT), Social learning theory (SLT), Personal development, Professional development

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### Introduction

After graduating from university, students enter a professional environment where they work as either permanent or temporary employees. This will be a challenging period for students as every job responsibility can be new to them. At many colleges and universities, students are required to attend an internship semester in order to integrate their theoretical knowledge and the skills learned from university into their jobs. At some universities in the Mekong Delta of Vietnam, students participate in internship programs that usually start at the

end of their fourth year.

However, a private university in the region which the authors chose to be the research site employs a similar program called the on-the-job training (OJT) program. This kind of internship model begins in the 6th semester (out of 9 semesters) and lasts from 4 to 8 months. The standard duration is 4 months (one semester). In case some students continue their jobs at OJT after they have finished, they can choose to either defer the next academic semester (the 7th semester) or work and study at the same time. The primary principle of the OJT is to connect the university and students with businesses, assisting students to enhance their professional skills and personal development in the future. Students, educational institutions, and businesses are considered the three primary parties involved in this internship model. It is more likely that discrepancies among the three parties should never be ignored as they consider the benefits differently, and have different needs and expectations. The differences may cause apprehension about the standard of a successful internship program that can have great effects on students' professional skills and their personal development.

Further, research on practicums, internships, or OJT programs often concentrates on exploring the experiences of practicum program developers and administrators (e.g. Bernado et al., 2014; Ducan et al., 2011; Trianasari & Rahmawati, 2021), the effectiveness of evaluative frameworks (e.g. Billet et al., 2016; Wilt et al., 2019), and learning processes (e.g. Jackson, 2014; Nguyen & Thach, 2022). The body of extant research is solid, depicting various landscapes of the OJT management and students' learning experiences. However, most of these studies do not deal with the influences of OJT programs or practicums on students' choices of future careers. This gap is addressed in this paper. Further, within the context of the OJT programs deployed in Vietnam, this stream of research is limited. Within this limited body of research, Nguyen and Thach (2022) explored the authentic experiences of students taking OJT programs and confirmed that they can only have a sense of authentic experiences once they are able to make sense of their learning within their OJT programs. The authors of this paper continue to advance Nguyen and Thach's (2022) arguments. Instead of examining the authentic experiences of students like Nguyen and Thach (2022), we take the social learning theory that views students' learning processes as the outcomes of their engagement in the working environment with others in which they observe, imitate, and learn from these people.

Whilst numerous attempts have been made to investigate how internships affect students' future professional and personal development, only a few studies have explored this area on the OJT program in the Mekong Delta in general and in Vietnam in particular. Additionally, a terrible internship experience can change a person's conception of the internship and create a distance between them and businesses. Unexpectedly, internship programs are often reflected as unstructured and poorly organized so students generally complain about the quality (Jenkins, 2001). As these issues were addressed, this study aims to provide practical insights into this program. It points out the strengths and weaknesses of the OJT program as well as discusses the impacts of the program on students' professional skills and self-development. The results of this study are expected to help students realize their essential professional skills that need to be enhanced so that they can seek the most appropriate future job while universities have an opportunity to review and re-design their OJT program if

necessary. For such purposes, it is worth an investigation that is guided by the following questions.

- 1) To what extent does the OJT program influence students' future career and personal development?
- 2) What are the strengths and weaknesses of the OJT program?

### **The nature of the OJT program**

An OJT program is depicted as an educational module for undergraduates to approach actual working environments. Not only does it enhance students' academic knowledge and social skills for preparing for their future careers, but it also helps create an intimate connection between students and firms from the program (Alex, 2013). However, in many universities in Vietnam, not every single major develops such a program for its students to have this experience. In some institutions, it is often the case that just students of pedagogy are supposed to participate in the internship program which lasts about three months whilst students studying other fields of study are not required to do so. For students who would like to enhance their social skills in a real working environment, they have to seek an internship program organized by firms (Tovey, 2001). It means that not every student has a chance to take part in such a program created by their institution.

Anjum (2020) has proved that by integrating conceptual knowledge into the academic OJT model, students are able to simplify to apply their understanding of the concepts at the workplace. This type of practicum is sometimes structured, e.g. program developers plan the concepts and lessons that students or interns are supposed to study from their engagement in work. Some are non-structured by nature as universities expect students to learn from their experiences collected from real working environments that academic contents and lessons cannot always cover equally in class. The program as such brings students an opportunity to grasp professional training and save the business' observation and training costs by providing them with skilled workers' guidance. The OJT program, which is usually non-structured, is believed to create great contributions to improving students' principal skills, abilities in utilizing technology, and personal characteristics (Valdez et al., 2015). Additionally, as students perform tasks in real work settings, they will be able to realize and assess themselves after having made mistakes. In the same vein, they can reflect on their individual strengths and weaknesses to promote or realize their shortcomings (Felicen et al., 2014).

According to Ho et al. (2017), the OJT program is a relatively new name for an internship program commonly referred to as a specialized and compulsory OJT model that is carried out from 4 to 8 months at subsidiary companies or partners of FPT University. After finishing their 6th semester at the university, students are required to get involved in real working environments since they have prepared adequate knowledge and necessary skills along with a general view of their major. The ultimate objective of an OJT program is to allow students to learn from professionals and others. The chairman of the board of FPT University Le Truong Tung stated that in their point of view, studying only two-thirds of the curriculum is adequate for students to perform at businesses while the remaining semesters are upper-learning processes aiming to support students' exploration of their upcoming career paths (*Dan Tri Newspaper*, 2017). Therefore, it is worth mentioning that

the OJT program is more likely to contribute to bringing students great opportunities to approach authentic working environments. Nguyen and Thach (2022) also pointed out that students encounter authentic experiences in taking OJT programs through their learning that is embodied by their interactions with peers, supervisors, and friends. They experience and acknowledge learning as growing in terms of professional knowledge, social skills, and working attributes that are envisioned to be important for their future jobs. This type of learning emerges through their observation of role models, attempt to reproduce the correct professional and social behaviors that are recommended by higher supervisors, and reproduction of those sets of behavior. In this way, Ho et al. (2017) and Nguyen and Thach (2022) implicitly acknowledged the role of social learning that happens during the OJT program.

### **Social learning theory**

Social learning theory (SLT) was approached since there is an interrelation in how students learn through observation, imitation, and modeling. Developed by Bandura (1977), SLT is defined as the process of perception based on the thought of changes in self-efficacy, expectation, and skills, and improved academic and personal development via participation in a practical environment. This theory builds on the concept that individuals learn through their communications with others in a social background. From others' behaviors, people can form, fix, and reproduce the behavior that is deemed as correct and standard through imitation and observation (Harinie et al., 2017). This theoretical perspective holds that people tend to form social bonds with the ones they think have appropriate behaviors through productive communication with them, though some bonds cause differentiation from other social groups and internal drifts within a community (Pritchett & Moeller, 2022). By imitating more experienced coworkers' performances regarding solving arising problems, trainees can learn how to deal with problems in the same direction. In the same vein, Bandura's theory asserted that imitation and modeling befall if an individual perceives a progressive result. Learning, as such, occurs in both formal and non-formal modes (Alam, 2022).

In the light of SLT, the program aims to create such chances for students to engage themselves in practical training so that they can develop their skills and absorb new knowledge needed for their future careers. Similarly, they can see how the theories or knowledge they have learned from the university match businesses' expectations for real work. The review of SLT and related studies lies in its ability to provide insights into exploring how the OJT program affects students' future career paths and self-development. Through the literature, the authors of this paper find that social learning can allow students to develop their profession, professional competencies and skills, personal enrichment, and personal capabilities.

### **The impacts of the OJT program on students' social learning**

#### **Professional development**

As students enter into their professional stage, they have to cope with a number of challenges. It has been suggested that internships give students pathways for their improved professional skills (Kapoor & Gardner,

2019). The study by Sutrisno and Lubis (2022) similarly showed that online practicums can allow knowledge absorption to happen smoothly when social distancing caused by preventive measures against the Covid-19 pandemic were deployed. Internships may provide students with opportunities to reconsider the career they have chosen before (Nghia & Duyen, 2018). Also, it is indicated that such programs can help learners understand the world of work and identify an acceptable career path.

Besides, the program places great emphasis on professionalism which is not a natural quality, but a product of experiencing, learning, and observing surrounding things (Nguyen & Thach, 2022). The most valuable lesson that students learn while joining internships is activeness. Proactively getting to know people, actively exploring work at internships, proposing, and working with everyone, all help students integrate more quickly in a new environment. Activeness helps students not only to master the work they do but also to recognize their own problems to avoid negative things that frequently occur at work. Furthermore, an issue that many students need to address is being punctual since punctuality is considered one of the most crucial principles at workplaces, which requires workers, especially trainees not to be late for work. Working as employees, students are required to follow strict regulations of the companies or organizations. Therefore, the program has been suggested to be a great opportunity for students to learn how to adjust themselves in terms of punctuality and responsibility.

Moreover, regarding professional skills, students realize that internships provide them with business contacts, better knowledge of the job market, and greater job satisfaction (Gault et al., 2000a). Students can gain practical experiences through the working process. They will experience the operating processes of firms or organizations to better understand the corporate protocols, as well as accumulate more personal experience for themselves. At school, students are taught a great deal of knowledge about their major, but when working in businesses, students will be exposed to the guidance of experienced staff or mentors. They can gain ample practical knowledge and hone new skills that they cannot learn from books and teachers. These core values will become solid luggage for their future journey.

More importantly, students can get involved in a lot of work, tasks, or even projects during the OJT program. This may cause them to face certain problems as well as work pressure. However, once they overcome such challenges, they will be able to learn how to cope with the pressure and have a better mentality to solve problems more effectively. This plays an important role in boosting students' professional development for their future careers.

### **Professional skills**

Novotorov (2001) stated that students value the experience they have from participating in internships since these programs are designed to help students evolve their professional skills that are congruent with changing practices of the workplace. Through their work process, students can not only improve their practical professional skills but also have workplace environment feelings. In addition, honing professional skills is also one of the foundations of any given career and is a prerequisite for the continuous survival and growth of any profession (Ebiye et al., 2015). Internship programs help students improve their communication and

interpersonal skills. In their workplace, students can meet many kinds of people daily and need to communicate with colleagues more regularly. As a result, students have a chance to connect and participate in shared activities, assist each other, exchange knowledge, and create relationships that allow them to learn from each other (Nguyen & Thach, 2022).

Also, learning workplace conduct is an integral part of the OJT program. Students learn how to expand relationships to facilitate daily communication as well as an exchange about work, which results in their improved skills by working with others as a team. Moreover, once assigned group work or team projects, students will improve the spirit of cooperation as well as the ability to unite with everyone around them. Because of that, students are more likely to dedicate themselves to the work first. Even if negative things happen, every individual will show professionalism by focusing on a common goal to accomplish their tasks brilliantly. One of the other important professional skills is computer skills. In most businesses, students are about to spend most of their time working with computers and even can experience the high technology of these working environments. In some companies and organizations, students can approach new working systems or software uniquely employed in their work, fostering their performance and computer skills, which is essential in the 4.0 era.

As students work in firms, they can integrate themselves by participating in many internal meetings. By joining meetings and training sessions, students improve critical thinking skills and learn decision-making and problem-solving skills from other employees. From there, students will be able to gain more confidence and a clearer view of procedures for dealing with arising problems and tasks. Consequently, they will know how to adjust themselves as well as their work so that they can become a better version of themselves.

### **Personality**

The hands-on experience in complex real-world contexts provided by internships is becoming an integral part of the curricula and syllabus in many undergraduate and graduate degree programs, and this connection between academia and the world of work has been greatly appreciated not only by employers, but also by students who have reaped many benefits of this unique opportunity, including the enhancement of their academic, professional, and personal development (Calvo, 2011). Thereby, intense experiences and stress, especially if accompanied by reflection and emotional support during the internship, may promote greater self-awareness and result in personal development. Regarding the benefits of internships, Mihail (2006) indicated that internships help students advance the critical core skills demanded by international contexts such as communication, time management, self-reflection, self-confidence, and self-motivation, and identify their professional skills perspectives while they are still in university. Students not only learn further practical views on the subject, but they also improve their overall academic performance in real-world situations.

Barrick and Mount (1991) addressed the five personality traits namely extraversion, emotional stability, agreeableness, conscientiousness, and openness to experience that students can form by taking part in the OJT

program and other internships. Through exploring this aspect, the researcher perceived the effectiveness of internships in helping students to acquire and improve their personal development. These personality traits are formed only when students experienced the OJT program. These are the experiences that students have been honing, learning, and interacting with many strangers in a completely new environment during their OJT period.

### **Personal capabilities**

The OJT program helps students develop their personal capabilities that students have learned theory in class and activates the possibilities of jobs of which students are not aware themselves. It may be students' first introduction to the professional world and no matter how limited their expertise and professional skills are, this program is an opportunity to develop themselves even further. Nguyen and Thach (2022) argued that capability is an integration of knowledge, skills, personal qualities, and understanding used appropriately and effectively - not just in familiar and highly focused specialist contexts but in response to new and changing circumstances.

It is suggested that participating in an OJT program results in improved personal capabilities and interpersonal skills, such as professionalism, cultural sensitivity, time management, and integrity, that are not generally part of the formal tertiary education curriculum (Shoenfelt et al., 2013). The program creates satisfying experiences that motivate students to continue to follow their career path and have realistic expectations about the world of work and help clarify students' career intentions. Furthermore, the opportunity to acquire capabilities and experience through the program reinforces self-efficacy, developed self-understanding, self-discipline, maturity, and confidence. These competencies can help students create their learning goals from the program that will serve their profession well after graduation.

Communication skills are essential for people in the workplace on a daily basis. According to Khambayat (2017), there is overwhelming evidence that proficiency in communication skills can make any individual more versatile and more competitive in the workplace. Employees need to communicate well with others to transfer their messages, thoughts, feelings, thinking, and ideas so that their work can be done. Thus, as trainees, students need to improve their communication skills to be efficient workers in the future. Moreover, through the OJT period, students can greatly improve their interpersonal skills (Nguyen & Thach, 2022). It is obvious that students need this skill every day when they communicate and interact with other people in their office, both individually and in groups. In a personal setting, it refers to an individual's ability to build a relationship with others. Guirdham (2002) regarded interpersonal communication skills as essential interpersonal skills that realize effective interpersonal relationships and interactive behavior. Chatting with people at work will enable students to perceive when to speak and when to listen so that they can adjust their way of interacting with others.

Furthermore, another essential aspect is that students will be able to hone problem-solving skills by participating in the program. Problem-solving is generally regarded as the most important cognitive activity in everyday and professional contexts. Most people are required to and rewarded for solving problems. However, learning how

to solve problems is a rare requirement in formal educational settings because students' understanding of its processes is somehow limited (Jonassen, 2000). Therefore, the OJT program is an ideal environment to enable students to get closer to real workplaces where students frequently encounter problems that need proper solutions.

Lastly, the OJT program is more likely to boost students' teamwork skills. Teamwork is an essential part of workplace success as teamwork relies upon individuals working together in a cooperative environment to achieve common team goals through sharing knowledge, skills, and experience. Harris et al., (1996) explained that a team has a common goal or purpose where team members can develop effective, mutual relationships to achieve team goals. Teamwork is an indispensable skill for students to help them learn experiences from real work environments. It also involves building a number of important characteristics such as working cooperatively, contributing to the group with ideas, suggestions, and effort, a sense of responsibility, and especially respect for the various opinions, customs, and individual preferences. As aforementioned, teamwork skills are an essential skill not only applicable in the classroom but also useful for students' professions.

### **Participants**

150 students were invited to participate in this study. They were studying at many different faculties at a private university, including English language, Japanese Language, Business Administration, Software Engineering, and Graphics Design. They had already completed their OJT programs in various businesses in their 6th semester after they had finished the compulsory subjects in their majors and attained certain necessary skills namely working-in-group, resume writing, problem-solving, computing, and other office skills. The 150 students first completed the questionnaires, and then 15 out of them were randomly selected for semi-structured interviews.

### **Research instruments**

This study employed 2 instruments: a 4-item questionnaire and semi-structured interviews. The quantitative data were obtained through the participants' answers to the questionnaire. The items were adapted from the questionnaire of Anjum's (2020) study to be suitable for the context of the current study. The questionnaire consisted of 34 items clustered into six parts: demographic information, reasons for the OJT participation, career development, professional skills, personal development, and personal capabilities. Following a 5-Likert-scale design, the questionnaire was first translated into Vietnamese before it was sent to the participants since not all of them were English major students. Being piloted with 40 samples for its reliability, the questionnaire was checked by using SPSS to calculate its Cronbach's coefficient alpha. The value of Cronbach's coefficient alpha of the piloted questionnaire is 0.854 (See Table 1). After this piloting stage, the questionnaire was officially employed to gather the quantitative data as Cronbach's coefficient alpha is above 0.7, and the questionnaire is reliable (Bland & Altman, 1997).



Table 1: Cronbach's Coefficient Alpha

<b>Reliability Statistics</b>	
Cronbach's Alpha	N of Items
0.854	24

To obtain the qualitative data, semi-structured interviews were conducted with 15 randomly-chosen participants who had completed the questionnaires. All the questions for the interviews were first made in English version, which was then translated into Vietnamese once the researchers interviewed the participants. Each interview was audio-recorded, transcribed, and subsequently translated into English. All the participants were also informed that their information was used for research purposes only and kept confidential.

### Results from the questionnaires

Table 2 shows the central tendencies of the responses for all the items of Part III of the questionnaire by 150 participants of the study. The highest mean for professional development (PD) is 3.72 and the highest standard deviation (SD) is 1.283. However, the lowest mean and lowest standard deviation (SD) for professional development (PD) are 3.23 and 0.854, respectively. The range of mean 3.23–3.72 shows positive responses from the participants for all the items of professional development (PD).

Table 2: Measurement of Central Tendencies on Professional Development

Variables	Items	Mean	Standard deviation (SD)
Professional Development (PD)	PD1	3.68	0.854
	PD2	3.33	1.230
	PD3	3.23	1.283
	PD4	3.61	1.153
	PD5	3.54	1.232
	PD6	3.72	1.169

It can be seen from Table 3 that the highest mean for professional skills (PS) is 3.96. Meanwhile, the lowest mean for professional skills (PS) is 3.33. The range of mean 3.33-3.96 shows the participants have good responses for the items of professional skills (PS). In addition, the highest standard deviation (SD) for professional skills (PS) is 1.329, and the lowest standard deviation (SD) for professional skills (PS) is 0.901.

Table 3: Measurement of Central Tendencies on Professional Skills

Variables	Items	Mean	Standard deviation (SD)
Professional Skills (PS)	PS1	3.90	1.038
	PS2	3.85	0.901
	PS3	3.38	1.216
	PS4	3.33	1.088
	PS5	3.96	1.174
	PS6	3.42	1.329

The results of Table 4 indicate that 150 participants of this research showed their responses to the OJT's impact on their personal growth from "neutral" to "agree" for the items surveyed. The results show the highest mean and highest standard deviation (SD) for personal growth are 3.84 and 1.335, respectively. Meanwhile, the lowest mean in a total of personal growth (PG) is 3.13, indicating that the numbers tend to increase unevenly between questions in the questionnaire on problems related to personal growth (PG), but the standard deviation (SD) was the highest of all, at 1.335.

Table 4: Measurement of Central Tendencies on Personal Development

Variables	Items	Mean	Standard deviation (SD)
Personal growth (PG)	PG1	3.84	0.878
	PG2	3.53	1.283
	PG3	3.28	1.079
	PG4	3.70	1.205
	PG5	3.13	1.335
	PG6	3.74	1.064

Table 5 shows that the mean range from 3.96 to 4.20 implies positive responses from the participants for all the items of personal capabilities (PC). On the other hand, the lowest standard deviations (SDs) are 0.934 and 1.049, respectively. Comparing the two results, it can be seen that the mean from 3.45 to 3.65 was the lowest in personal capabilities (PC) items, it is more likely that participants have "neutral" thoughts on what they had experienced from the OJT program. Meanwhile, the mean range from 4.09 to 4.16 shows positive responses from the students for all the items of personal capabilities (PC).

Table 5: Measurement of Central Tendencies on Personal Capabilities

Variables	Items	Mean	Standard deviation (SD)
Personal capabilities (PC)	PC1	3.96	1.049
	PC2	4.20	0.960
	PC3	3.45	1.242
	PC4	3.65	1.069
	PC5	4.09	1.081
	PC6	4.16	0.934

### Results from the interviews

In terms of professional development, a majority of the interviewees responded that the OJT program helped them have a clear orientation for their professional skills. Reversely, only one interviewee emphasized that the OJT programs had no impact on their career orientation. This interviewee once shared that:

*"Although I did not work in the area that I set out before, I learned a lot to adapt to the working environment and did not want to change my job at all."*

Regarding professional skills, there were 14 out of the 15 interviewees shared that after the OJT program, they improved professional skills such as office skills, teamwork skills, and time management skills. However, there

was an opposite opinion from an interviewee as follows:

*“I feel that I have not developed much in professional skills. When I joined the OJT, I only learned simple skills such as printing skills, document scanning, and how to prepare procedures and files arrangement. These office skills I had not learned before.”*

Students also showed feedback on the impacts of the OJT program on their personal development. Particularly, once asked about their changes after the OJT, most students responded that their personal development did not change significantly. However, nearly one-third of the interviewees said that the OJT program helped them change their personal development in a positive way. Student A said:

*“The OJT program forged professionalism in my expertise. There was a change related to my major as my vocabulary became wider. Moreover, I find out my own shortcomings, and proactively improve my strengths.”*

Similarly, student B emphasized that:

*“I think my professional and personal development has evolved a lot because I did many different translation documents so that I changed positively in using grammar and vocabulary.”*

Furthermore, a few students felt that in addition to personal development changes, they experienced some changes in career goals as they decided whether the position they took after joining the OJT program would be suitable for them or not. One student in this group expressed:

*“There was a change in my previous career goals. I learned skills that I have never experienced. This has significantly contributed to my personal development.”*

Meanwhile, another student responded:

*“After completing the OJT, I realized that I wasn't suitable for the receptionist position. I think my future job will not be related to the service industry in general and the receptionist in particular.”*

It is worth mentioning the impacts of the program on students' personal capabilities. Information from the interviews has contributed to deeply understanding students' thoughts on this issue. More specifically, a great number of students personally showed their perspectives on the progress of joining the OJT regarding their improved personal abilities. There is a likelihood that students who participated in this program tended to change and develop positively in their personal capabilities of creating relationships with the people they worked with. One participant stated his opinion:

*“I had more social relationships and I also learned a lot from colleagues who are older than me. Joining the OJT helped me to form a habit of punctuality and reasonable work arrangement.”*

More importantly, the OJT program not only offers students chances to develop their strengths in personal capabilities but also assists them in forming good habits about skills related to it. Two-thirds of the 15 participants interviewed said that after joining the OJT, they learned to manage their time properly and improved their social relationships. One participant said:

*“Disciplinary habits like always being on time and completing assigned tasks are two skills that greatly*

*affect my personal capabilities during the OJT period. More importantly, I also have more social relationships.”*

As a result, one-third of the participants said that in addition to developing skills related to personal capabilities, it also helped them to have respect for others, to listen, and gain input from colleagues. Moreover, the students learned to forge themselves to be responsible at work. One participant expressed:

*“My personal capabilities have changed remarkably, I am self-aware of the conscientiousness and responsibility for the job.”*

A number of different perspectives on the benefits of the OJT program were expressed in the interviews. First, the OJT program shows its superiority in offering a wide range of firms for students. A student responded to the question about the difference between the OJT program and other internship programs in other universities as follows:

*“As far as I am concerned, students from other universities have to find companies by themselves, while at FPT students are given a list of suggested companies for them to choose from.”*

Flexibility is regarded as a major advantage. The program allows students to commence the OJT course at the end of their 6th semester or at the end of their 3rd year so that they can have enough time to reflect on their on-campus studies and enhance their skills. Talking about this advantage, Student D reported:

*“This university lets students participate in the OJT program in their third year, and it helps to create opportunities for them to review their professional skills and know what they need to develop further in the future.”*

Furthermore, a number of students were satisfied with the length of the OJT program. One participant expressed that:

*“The OJT course at this university is about 2.5-4 months, which is long enough for students to experience the practical work compared with other universities in the region where their internship courses last only 1-2 weeks.”*

The working environment in the OJT program is fairly professional. A number of opportunities were offered to students in order to access practical experience. It is proved by the answer of one of the respondents as follows:

*“I find the OJT quite good because students are practically exposed to businesses and attain experience when working in such authentic working circumstances.”*

Although the OJT program brings the benefits of improving students' knowledge and skills, it has certain limitations in terms of lack of job positions, inadequate organizational structure, and job field limitations. First of all, the respondents identified a variety of industrial fields that are taken into consideration. One interviewee said:

*“I find the OJT quite good because students are practically exposed to businesses and able to learn experience when dealing with tasks assigned at businesses. However, I have some suggestions that there should be more areas for students to select.”*

Both the quantitative and qualitative findings pointed out that the job positions inadequately meet students' expectations. Therefore, they are not assigned to participate in projects or a specific position while being trainees. For such a circumstance, one of the participants reported:

*My supervisors in the company assigned small jobs like data searching, so I could not learn much from the program”.*

In addition, another interviewee emphasized:

*“I feel that I have not developed much in professional skills. When I joined the OJT, I only learned simple skills such as printing skills, document scanning, and how to prepare procedures and file arrangement.”*

Some issues were identified concerning the relationship between the university and the companies, leading to the difficulty in arranging the job positions for students. One of the respondents once commented:

*“The preparing process of the OJT program is unorganized. If firms arrange particular positions for students by themselves, it will probably lead to a mismatch between the position characteristics and the student's aspirations.”*

The students emphasized that they had to join a firm that did not relate to their major. This could be the reason why they reported that they did not develop their skills as much as expected during the program. Student E said:

*“There is a shortage of human resources in the Relations Affairs of the university. In the end, due to lack of time, students were sent to businesses that were not on the firms' recommendation list.”*

## Discussion

Regarding the reasons for participating in the OJT program, most of the students felt interested to participate in such a program and reported that even if it is not required in the school's curriculum, they still wish to experience it once. Marks and rewards are considered inspirational aspects of the program; however, they are not the most important factors affecting students' decisions on whether or not they want to work in businesses as interns. Although students have various reasons for taking part in this program, all of them perceived OJT as one of the significant reasons to study at this university.

Surprisingly, a comparison of the quantitative and qualitative findings reveals the opposite opinions concerning the expected achievements before attending the program. Participants mostly expressed that they were of great concern of their academic credits whilst their responses in the interview indicated that the OJT was the best opportunity to practice and apply their learned knowledge and theories in a real working environment. Nevertheless, in the interviews where respondents have more time to think carefully about all the reasons, they all agreed that the biggest one for joining the program refers to the benefits it brings to students' permanent jobs. It is indicated that the OJT program offered students a good chance to practice what they have learned at the university. None of the participants expressed that assessment from the mentors in terms of giving scores was their apprehension of its impacts on their academic results at school. Therefore, it can be concluded that they

preferred immersing themselves in what they have experienced as a trainee to attaining high scores given by the trainers.

The results of this study were consistent with those of previous studies that the students' top priority in choosing an internship program is an environment to practice theoretical knowledge (Anjum, 2020). In terms of the impacts of the OJT program on students' current and future employment, most participants believed that the OJT program helped increase their chances of advancement and promotion in their future jobs rather than the present training. It is indicated that the program will be a good opportunity for students to equip themselves with better professional skills for their future occupations.

Moreover, different from the studies by Anjum (2020) and Nguyen and Thach (2022), it is remarkable in this study that awards from businesses are extremely significant to inspire students during the OJT time even though receiving the awards is not their ultimate goal. Conversely, most students wish to work in a company where they could receive rewards after an outstanding performance as they appreciated the company and the motivation to overcome the difficulties encountered at work. Meanwhile, only half of the respondents reported that they received awards from firms they worked for during the OJT course. Only a few companies have awards for trainees in the OJT program, which might deprive their great satisfaction of their expectations. Therefore, it can be suggested that this result has not previously been described in other related studies. More importantly, it is emphasized that the awarding policy and other forms of appraisal should be taken into great consideration as an integral part of encouraging students to work more effectively while giving awards is believed to be necessary for most businesses in the context where workers' devotion and the quality of work are addressed to be the priorities.

The findings are in line with those of the study of Anjum (2020) as the OJT program has positive impacts on students' career development and personal growth. It is indicated that most students experiencing the program have improved their professional skills, which is also consistent with the results of the study of Novotorov (2001) that by joining the training team, students learned how to work professionally as it is considered a prerequisite for graduates to be employed. More importantly, students could apply what they have learned from the university, resulting in their reinforced concepts and knowledge. Furthermore, besides gaining more practical work experience, students could realize what job duties interest them most so that they can learn how to adjust their learning styles and goals when they return to the university for the remaining subjects. From the qualitative results, it is asserted that after entering the OJT program, students have a clearer orientation for their future careers, which is the ultimate goal of achieving a degree. Also, the results of the study are more likely to support the perspective of Gault et al. (2020) that the internship is a bridge to help students narrow the gap between career expectations established in the classroom and the actual working environment. It can be concluded that the findings of the current study significantly contribute to confirming that albeit its drawbacks, the OJT program has very positive impacts on students' professional development and future career paths.

## Conclusion

This research aims to evaluate the impacts of the OJT program on students' professional skills and personal development of students at FPT University. There are two research questions investigated in the research in which the population comprised 150 undergraduates from different majors. It is apparent that the OJT program has a positive impact on the students' professional skills and personal development of students at FPT University, greatly affecting their personal development, skills, and capabilities. As students' professional skills and personal development are improved, they can gain confidence and become well-organized with the skills they have learned after joining the program. Thereby, students will have good preparations of expertise as well as professional skills to avoid being bewildered by the real-work world in the future.

Furthermore, there is a difference in terms of exploring students' positive changes in both personal development and personal capabilities from the results of quantitative data and qualitative data. More importantly, students acknowledged that the OJT program helps them develop their strengths in personal development and enables them to form good habits and essential skills related to personal capabilities. In the same vein, it is suggested that the OJT program has a considerable influence on students' professional skills goals, improving personal development and forming professional skills.

## Recommendations

Future research can be conducted by gathering personal students' opinions to analyze the impact of the OJT program on intrinsic motivation and student career choice. Furthermore, future studies can also be carried out in other areas to gain deep insights into the OJT program and other internship modules.

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## The Role of Collectivity in Saudi Females' Success

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**Abstract:** This paper argues that black women become community leaders and influencers that help others envision a better future by examining the ways that a film featuring African American women, specifically *The Help*, has affected me and how my personality is changed before and after majoring in African American Literature. More specifically, this paper highlights black women's voices in terms of defining themselves as women who should have role in their society, and their influences on my personality's development as one of Saudi women spectators, in terms of understanding my subjectivity, desires, and abilities of making a change within the social life, through the use of autoethnography. In doing so, I use a research method known as autoethnography, in which I am the subject of this study, which allows me to connect my personal experiences to a wider group of women who share my same culture, politics, and society. With the experience of black female activists' narration in mind and through my experience with the support of the strong message of *The Help*, I am able to show how my personality and view toward the role of patriarchy has impacted and changed by black women's activism and how they think of making a change within their social lives. By the end of this paper, I approve that the importance of collectivity is important in females' successful activism that can extend beyond the boundaries of social, economic, and political situations.

**Keywords:** Collectivity, Black Women, Saudi Women, Feminism, Social Change

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### Introduction

*“Educate yourself. Be good mothers. Bring up perfect Saudis. Build your country.”*

*Queen Iffat Al Thunayan*

*“If you stand still, you give them the power to push you down. If you keep walking, they have to follow you.”*

*Princess Reema bint Bandar Al Saud*

*“I am honored that I'm in history, but I don't think it would mean anything if it doesn't change anything.”*

*Raha Moharrak*

I highlight the legacy of black female activists by examining the ways that the film adaptation of *The Help* has affected women of Saudi Arabia, through the ways in which black women's lives, experiences, society, and

politics have been portrayed, either by themselves or by others. The film version of *The Help* was translated into Arabic language in 2011, and it has been shown on one of the most popular Arabic television channels many times. In this project, I examine the impact and influence of black women's voices on Saudi women spectators, especially in terms of how Saudi women react to black women's challenges, achievements, and activism in the film. I argue that the film extends the legacy of black women to other women from other nations and argue that the importance of collectivity can extend beyond the boundaries of social, economic, and political situations.

This project is a continuing work to previous research. So, while I have talked about black women's writings in the previous research works where they center on their subjectivities, an understanding of themselves, and their activism. The black female activists in the previous research works have a chance to narrate their stories in their works, such as Maya Angelou who narrates her particular experience, in her book *The Hear of a Woman*, with an obstructive husband and activism. In addition, in *The Long Shadow of Little Rock*, Daisy Bates shares her story of her collective work with her supportive husband L.C., that adds much to the power of African American literature and women's studies. In this project, I continue the conversation in different way and context. Here I will narrate my own experience of watching Tate Taylor's *The Help* and writing about my story of being impacted by the legacy of African American women activists.

Using Tate Taylor's *The Help* as a primary text in this project is essential for three purposes. First, I have decided a different method in this project, which is an autoethnography, that leads me to examine Saudi women's responses about my personality before and after my majoring in English Literature. I have chosen the film instead of the novel because the film is more widely distributed and seen amongst Saudi females. Further, most Saudi women are not able to read a novel-length book due to the level of their English language; thus, watching the film would be easier because an Arabic translation is available and in circulation. The film also illustrates the visual performance and attitudes of black women actresses. Through the film's scenes, many cinematic elements and film techniques can help the Saudi female spectators to understand the plot, think critically, and to connect personally to the affective elements of the film.

Second, I believe that the film's main argument of conveying the struggle of the black women's in defining themselves and achieving their goals has surpassed the borders of the United States and has extended to other regions such as Saudi Arabia. I analyze *The Help* film by making connections between black females in the U.S. in the 1960s and contemporary Saudi women in terms of the importance of collectivity in achieving goals and making the change. Given these themes, my analysis focuses on their similarities with Saudi women whose lives are controlled by the patriarchal authority that prevents them from pursuing their dreams. This lifestyle is not a wrong structure if that is a woman's choice, but it becomes problematic when this lifestyle is imposed upon them by their husbands or the society. Some Saudi husbands practice the same authority and tools of oppression as those used by white authority in the U.S. at the time period that is the setting of the film. Therefore, in both the film *The Help* and in Saudi viewers' real lives, there are connections between the functions of patriarchal and white authority.

Finally, this film allows me to argue that the role of collectivity is important in women's activism. Since writing is a transformative activity as an activism, using an autoethnography method where I compose a piece of prose through using the participants' responses. Reading the black women's self-narratives, and fictional texts and watching the film Tate Taylor's *The Help* create a transformation in me, in which it leads me to define activism differently. Activism can be defined as an activity of making a change and raising the people's awareness. Activism does not need to be connected with politics, but it can be connected to societies and communities. As the way of making a change is various, I see myself as an activist regarding to my ability of showing the importance of collectivity's role to Saudi women. In other words, any Saudi woman can be a successful if she just shares her dreams with people around her, so they aim to help her. A Saudi woman can be an activist, if she shares her story to inspire others to be strong and brave to make the change and have a better present and future of their lives and people around them. Moreover, this film allows me to view the role of collectivity in different context and way. Since I have connected the black women's experiences with the white authority to Saudi women's experiences with the patriarchal authority, so the role of collectivity in this research can be redefined. Collectivity does not need to be amongst female bonds, but it can be achieved between males and females as well. As Saudi women are discriminated by males in their society, this research approves that a woman can be successful as a result of the collectivity that happens between her as a female and her male supporters such as: fathers and husbands.

Adapted from Kathryn Stockett's 2009 book, *The Help*, the film of the same name was produced in 2011. It portrays events in one community, Jackson, Mississippi, during one of the most important time periods in America, the 1960s. Stockett spent her childhood in Jackson, Mississippi and was raised with the help of a black woman named Demetrie who was her grandmother's maid. When she moved to New York, she noticed that the norms are different from those she experienced in the south, especially regarding the role of domestic workers in the white home. When she felt homesick in New York, she remembered Demetrie, the person who helped her in her childhood, and felt that she had a story to tell. Stockett studied the historical realities of the 1950s and 1960s, and she stayed with her grandmother to hear more about the black domestic workers employed by the family. In her interview with Motoko Rich, she says that she was thinking of portraying only black women, but since she is a white woman, she thought that her book would not be read unless she added white characters to create a balance between the voices and perspectives. Since her novel, written in 2009, refers to events in the Civil Rights era, she continues raising black women's consciousness of and struggles for their rights in the current era, so that the work of the Civil Rights era continues to the present.

The main actresses of the film are the white journalist, Miss Skeeter, and two black maids, Aibileen and Minny. The film is set in 1960s in Jackson, Mississippi. Skeeter, the white journalist, comes back from her college studies with a dream to be a great writer, so she gets hired by a newspaper to write a small column. When she comes back, she finds out that the black maid Constantine, who raised her, has disappeared. Constantine was not like any regular person for Skeeter; Skeeter respects and loves her as her mother. She keeps asking her mother Charlotte about Constantine's disappearance and the location of Constantine's house, but her mother does not tell her that Constantine was fired to please her mother's white friends. The other important characters are two

black maids in the film: Minny and Aibileen. Their stories concern their work in the white families' houses, and address the discrimination and the treatment that are presented in the film. Minny can barely hold a job because she is a talkative person. When she gets fired from a very racist white lady who is named Hilly, Minny returns back to her under the impression that she wants to apologize, but in fact, she wants to revenge for losing her job by giving Hilly a "special pie," which is laced with feces. Then, she works for a white lady who is named Celie, a job for which she is asked to be a friend of Celie's and to teach her how to cook. The other black maid is named Aibileen, who raises seventeen white children. All through the film, Aibileen works for a white lady who is named Elizabeth Leefolt to raise her white child, Mae Mobley. Throughout the film, Skeeter witnesses the life of black maids in the white family's house, so she aims to help them through writing a book where they can share their stories. The women working as the help all tell of the challenges and struggles black women face when they work as babysitters and housekeepers for white families. In the film, with Skeeter's assistance, the domestic workers are able to raise up their voices to demand their rights, respect, and appreciation although they insist on the stories being anonymous to avoid any attack or risk from the white authority. These actresses are able to achieve such an end by giving the people of the town a way to see their struggles and experiences of harassment, fear and danger in white homes.

Kathryn Stockett's *The Help* was a best seller book for more than 100 weeks according to the New York Times; therefore, the book has received a great deal of attention and criticism in many fields. Some critics criticize the book for how the author represents the stereotype of black women as "mammies and domestic workers," instead of portraying them as individuals who can have different roles in the society. Suzanne W. Jones presents in her article, "The Divided Reception of *The Help*," how black and white viewers read the book, and how they respond to "a text individually, socially, and culturally"(23) which leads to readers having different perspectives and views on the text. What is interesting in her article is that some black people criticize the book negatively because of Stockett's portrayal of African American women as domestic workers, which "may end up reinforcing old stereotypes" (Nzegwu, quoted in Jones, 9). According to Jones, she argues that publishing this novel in a time period that is called "post-racial" has a significant impact on the feelings of African Americans. N. Gargano, a black woman who gives her response about the film to Jones, says, "This book gave me so much to think about and brought up so many feelings, so many good, and so many not so good" (Jones, 10). Similarly, Valerie Smith in her article, "Black Women's Memories and *The Help*," insists how the text returns black women's racialized experiences and white authority over blacks to the American cultural memory. As a result, Smith argues that the plot of the text makes it "more accessible to the contemporary readers and viewers" and that it raises "an awareness of Jim Crow protocols through these texts" (Smith, 36). On the other hand, Agata Szulkowska in her article, "The Problem of Racism in Kathryn Stockett's Novel *The Help*," examines the novel in order to present the racial issues that were experienced by African American maids. In doing so, she provides an analysis of the white and black characters' personality and their relationship with their community, as they are depicted in the novel to demonstrate the working and living conditions. By the end of her article, she argues that the novel works as "as an eye-opener to racially prejudiced white Americans helping them discern a huge number of problems dealt with by the Blacks which were largely ignored or glossed over by the Whites over the centuries" (52), which helps readers to open their eyes to current racism in reality, so they can fight against it.

Although the novel has received much criticism, there has been little scholarship produced on the film, though film critics and reviewers have had much to say. Tate Taylor, director of the film, *The Help*, was criticized by some significant journalists in magazines and newspapers for the techniques used in making the film. Melena Ryzik discusses in his New York Times article, “A Director’s Kinship with the Deep South,” how the director chose the setting of the film. He suggests that Mississippi was a perfect setting for the film, where it represents “The heat, the bugs, the fried food, the history, the religion, the roadkill everywhere” (Ryzik). Finally, Ryzik sheds light on Taylor’s main concern that he wanted to show that black women are courageous, beautiful, and strong in which it can relate to redefining the images of black female actresses in films. Taking a different perspective in “Is ‘The Help’ Racist? It’s a Loaded Question,” Nsenga K. Burton explains that asking this question to the black actresses is not fair because they already have it hard in terms of trying to get roles in Hollywood, and to ask them if the film is racist puts them in a difficult position, where they can not answer truthfully. Furthermore, the author concludes by pointing to the irony that those who perpetuate systems of racism in the Hollywood industry are not being asked these tough questions, so it is unfair to put all of that responsibility on the black actresses, who have much more to lose, such as job opportunities and entire careers. While other critics criticize the film regarding its education usage, Eun-Kyoung Othelia Lee and Mary Ann Priester use the film “to stimulate discussion about racism and intersectionality” (92). In their article, “Who Is *The Help*? Use of Film to Explore Diversity,” they argue that film like *The Help* can be a good tool to teach students “the importance of gender, race and social class” (92). In that sense, Lee and Priester argue that using the film like *The Help* can help people to reveal their personal opinions toward some cultural beliefs because of the film’s impact on the educational environment where learners can feel comfortable and free to discuss the diversity issues in the community.

Scholars and film critics also often debated and raised concerns about the historical accuracy of the novel and film. The Associations of Black Woman Historians published a statement in 2011 that *The Help* “distorts, ignores, and trivializes the experiences of black domestic workers.” They continue, “such distorted images are misleading and do not represent the historical realities”(Rivas). Similarly, Martha Lott argues that “films such as *The Help* focus solely on the White protagonists of the civil rights movement when in reality it was organized and led by African American women and men” (333). These kinds of criticisms indicate that the film is not accurate historically. However, other scholars, such as Amy Curtis, believe that spectators should focus on the entertainment value of the film and the performances of the actresses without criticizing or focusing on the historical accuracy. Though it is important to enjoy the work of the actors, it is important to examine these questions about the film’s historical accuracy because what a Saudi audience should or should not know historically is not crucial for this project. Overall, examining this film through the lens of how it impacts Saudi women will not affect how Saudi women understand African American history, because both Saudi women and others should not learn the real history from films and media. Instead, history should be read through books with different genres, as well as through historians who are responsible for narrating history to us. In other words, whether Saudi women know the history of black women in the U.S. accurately or not, they are impacted by black women’s representations in the films and how they may see themselves as social change agents with the

patriarchal authority. With all this criticism to the book, the film and its accuracy, using the film as a primary source of this project will have a great impact on the readers, especially, black women readers, in terms of observing how the extension of their legacy, stories, and history can be extend/impact other women from different nationalities such as Saudi women. Black women's collectivity in achieving their dreams, goals, and in valuing themselves and their humanity is really worthy to influence other women from different nationalities.

Furthermore, beside all the reasons that I have mentioned earlier regarding the connection/relationship between black women and Saudi women in this project and the selection of the film as a genre, it would be great to mention why Tate Taylor's *The Help* is a good choice for Saudi women to watch, as well as to do my autoethnographic study. First, the film succeeds in presenting the transformation of black women's stereotypical image from being passive in their community to be active roles. This transformation of their roles/images was clearly represented in the film, in which it would impact significantly Saudi women spectators regarding to developing their roles in their society. This feature will help them to answer the study questions toward evaluating and observing my personality. Second, the strategy that black women use to show their activity, intellectuality, and positivity for making the change is really interesting and valuable to Saudi women spectators. However, the process of narrating the stories is hard and difficult for some people in terms of revealing all feelings and emotions inside the person, it is still workable for other people who could hold a pen and paper and just write freely. This strategy in film will show the significance of the story's narration for ourselves, our community, and the whole world. This feature will help them to make connections between black women's ability of making change through telling their stories, and my abilities of narrative my own story. Most importantly, watching a film like *The Help* will make my autoethnographic study more understandable for Saudi women regarding the connection that they will make between me and black women in the film.

Generally speaking, the black women's subjectivities in the film have been shaped by their experiences in domestic work. Their experiences were terrible and sad because of how whites looked at black women and how they were treated as "other" through the intersections of race, gender, and class. In one scene, Minny advises her daughter in her first day of domestic work, saying, "You cooking white food, you taste it with a different spoon. They see you put the tastin' spoon back in the pot, might as well throw it all out. Spoon, too." This kind of act from white people toward blacks degrades, dehumanizes, and devalues them for not letting them feel they are normal humans. Black female maids are always treated as "the 'Others' of society who can never really belong, strangers [who] threaten the moral and social order" (Collins, 77). Through the black female maids' experiences in the film, the film represents a dialectal language between whites and blacks where black maids were the objects of white's families to be controlled and manipulated. Also, most of the black maids' experiences show how "the dominating 'I' relies upon "the 'Other' to function" (Snead, 4). *The Help's* plot is based on the relationship between the black maids and the white families to insist on the dialectical language between the superior and the inferior (Snead, 5).

The film starts with a short cut of conversation between a black maid, Aibileen, and the white journalist, Skeeter. Skeeter interviews Aibileen to talk about her story in domestic work. The camera angle is steadily

focused on Aibileen's face, and the viewer only hears the voice of the journalist. Skeeter asks, "Did you know as a girl, growing up, that one day you'd be a maid?" Aibileen replies "Yes, ma'am. I did." Skeeter asks, "and you knew that because?" Aibileen replies "My momma was a maid. My grandmomma was a house slave." Aibileen's answer shows the level of her consciousness toward her gender, class, and race, in that she feels that her work should be as a maid because of the white authority and the patriarchal laws that limit the access of black women to job opportunities. Ian F. Haney- López links the individual's choices to the community, saying, "in every circumstance choices are exercised not by free agents or autonomous actors, but by people who are compromised and constrained by the social context" (47). Aibileen is aware of other black women's experiences, such as her mother and grandmother, and she deals with these experiences as social norm although she feels inside that whites and blacks should be equal. For example, in one scene of the film, Aibileen gets fired by Elizabeth, while the little girl, Mae Mobley, starts to question her, "Are you going to take care of another little girl?" Aibileen with tears on her face, tells her, "No, that's not the reason. I don't want to leave you, but...it's time for me to retire. You my last little girl." When Aibileen farewells the little girl, she does that as she is her real mother and she asks the little girl to remember what she has taught her that "You is kind. You is smart. You is important." These words show that Aibileen is really aware that blacks and whites should be equal and she wants to teach the little girl that no matter your race, what is important is your smartness, kindness, and value.

Another experience portrayed in the film is through Minny's experience which is quite different from other black maids in the film. For example, Minny can not handle the humiliation that she faces from Miss. Hilly when she refuses to let her use the guest bathroom. This scene in the film sends "signifiers of certain coding of race" (Snead, 6) where the black woman should not use the whites' bathrooms for any reason. In response to how Ms. Hilly treats her, Minny decides to fight back by making "a terrible awful pie" that was made with her "shit." When she discovers what has happened, Miss Hilly fires Minny, telling people that she is a thief to give her a bad reputation and to prevent white people from learning that she ate a pie with a black woman's feces in it. The story stems from Minny's strong personality, and how she rejects white society's humiliation. In the scene where Minny gives her the pie, the camera angle moves closely between Hilly and Minny to show each one's facial expression, as well as to "match the dramatic force" (Bogle, 318) between a white lady and a black maid. The camera angle is close up to Miss. Hilly eating the first piece of pie while licking her fingers to show how she enjoys it. Minny can barely contain a smile as Hilly swallows another mouthful. Miss. Hilly keeps asking Minny what she added to the pie that makes it so delicious. During their conversation, Miss Hilly bothers Minny when she talks in a very humiliating way by saying that she would cut five dollars a week from her pay if she hires her again. At this point, Minny reveals the truth of the pie by saying suddenly "eat my shit." Miss Hilly's facial expression changes to looking like she would throw up. She seems to immediately understand that if white people knew that she ate that pie, she would be embarrassed and lose status.

The film adaptation of the book certainly also seeks to shed light on the idea of racial consciousness. The filmmaker, Tate Taylor, succeeds in redefining the images of the black female actresses in 20th and 21st century films. James Sneads, in his book *White Screens/Black Images*, establishes three types of codes that are often



found in African American films, which send codes of racial discrimination to the viewer, and the viewer can interpret these messages based on his social conception and position. These codes are metaphysical stasis, mystification, and marking. Despite the fact that some black females in the film portray the passive and subservient stereotype, by the end of the film, the audience can notice an obvious change in most of the named characters. The film represents black women's journey from being passive to active in their society. To sum up, these codes allow us to examine how the viewers will receive the film, its plot, message, and black history.

As mentioned above, James Sneads outlines three codes of racial discrimination that might be portrayed in the film. One of these codes is called marking, in which it means to make the actresses darken their skin to enhance the difference in the skin color between the white and the black characters, so the viewer can more clearly understand the theme of racial discrimination. What James Snead argues is that the presence of black skin in films to present racial issues is not enough. Film directors should use "the color black repeatedly overdetermined, marked redundantly, almost as if to force the viewer to register the image's difference from white images" (Snead, 5). This is clear in *The Help*, where the directors ask the black actors and actress "to darken their skins" to show the "negative contrast" (Snead, 5) in order to clarify the real social difference between whites and blacks. In the dining table scene, the viewer can recognize the real difference between Miss Hilly and Minny through their skin color, the camera movement, and their facial expression. As a result, this code or technique impacts Saudi viewers on differentiating between the two races in the film, and that might enhance their understanding of black history, and women's role in the black community, so they can make connections between the social situation of black women in the white house and the Saudi women's own situation within the patriarchal authority.

Another of James Snead's three codes refers to the stereotype of "the black woman is seen as eternal, unchanging, unchangeable" (3) is called a metaphysical stasis. However, the stereotype of black women looks different in Tate Taylor's *The Help*. The film shows how the black female housemaids find Skeeter as an open door and as a chance to fight back through telling their stories to the whole world in order to make a change. They realize they have taken a risk, and that change does not come in a day, but telling their stories is a reaction against the racial discrimination that they experience. Miss Stein, Senior Editor at Harper and Row Publishing in New York, is surprised when she learns that Skeeter found a black woman housekeeper who is willing to share her story and talk about her point of view toward servicing white families and raising their children. Skeeter collects all the stories into a book that is titled *The Help*. That book gives the black women characters more strength and warns the whites on how they should treat the black domestic workers. The black maids' courageous participation in sharing their experiences with a white journalist indicates a new kind of activism where they help to let "the voice of a woman to be heard" (Collier-Thomas and Franklin, 86). Minny and Aibileen decide to speak up, to open the issue of domestic work, and to warn other black women about the mistreatment of black women by white families.

The film gives black audience members a sense of pride to see themselves as powerful figures, who can raise their voices up. The film also shows the significance of women's ability to change if they put their hands

together to empower themselves, express their own identities, and hope for change. As a result, the portrayal of black women actresses in the film shows the opposite of Snead's code in terms of how black women actresses show how much they can adapt and change the bad situations into positive ones with their female bonds.

As demonstrated in discussion of Melba Pattillo Beals' *Warriors Don't Cry*, Maya Angelou's *The Heart of a Woman*, Daisy Bates' *The Long Shadow of Little Rock*, Paule Marshall's *Reena*, Toni cade Bambara's *The Organizer's Wife*, and Tate Taylor's film *The Help*, black women live in a system of oppression due to the intersections of their race, gender, and class. All these factors are the ones that shape their subjectivities, draw out their challenges, and construct their intersectional personalities. Every black female in these literary texts and the film has reached racial, gender, and class consciousness through her life experiences in domestic work, jobs, or schools, where she finds "the shape of [her] power relations changes" (Collins, 293). For example, Melba, Angelou, Bates, Virginia, Minny, and Aibileen's lives were shaped by how they were discriminated against and sexually abused before they started to be activists. So, they began to resist the oppression. They were able to do this by reaching a certain level of consciousness, fueled by their subjectivities as black women, to reject social inequality and injustice through different forms of activism.

## Historical Background of Saudi Women and Society's Structure

Historically, the main obstacle in most of Saudi women's lives has been gender discrimination, and that kind of discrimination is a result of political laws. The government gives men total control over women through the law of guardianship, so it is historically, socially, and politically known that "the man's decision regarding any member of the family or respect of life is a law to be obeyed, especially by women" (Al-Sudairy, 8). That kind of power controls women's choices in many fields, such as: education, employment, and even marriage. For example, Saudi women have to ask their guardians sign an agreement paper in order to be registered in schools and colleges, to accept scholarships, to pursue employments, and to enter into marriage. Dr. Hend Al-Sudairy writes in her book, *Modern Woman in the Kingdom of Saudi Arabia*, that Saudi women are known as "a dependent being who depends upon the man for many things" (8), and this is not because she wants to be dependent, but this is how the patriarchal society and politics construct her role in the society. In addition, Dr. Al-Sudairy suggests that the role of Saudi women in her society is so low that she is not even trusted to hold secrets. Most Saudi women do not even share any kind of consultation with their mothers, or other wives, because women are always known as "weak and emotional" (Al-Khateeb 1996, quoted in Al-Sudairy 2017). As a result, the role of Saudi women is marginalized because the males are always deemed superior over women both physically and emotionally, no matter that women always control everything inside the home.

This kind of struggle is similar to what black women have endured in the Civil Rights era, in which the racist authority of whites' laws and the patriarchal expectation of black controlled black women's life choices. Similarly, since the time of slavery, the role of black women "was dictated by the male supremacist ideology of white society in America; it was also woven into the patriarchal traditions of Africa" to remind black women of

their inferiority through their assigned domestic work (Davis, 115). Gender discrimination and sexism continued into the civil rights era, where most black women activists suffered a lot from men's marginalization of their efforts and participation toward change. Black women's struggles are not only shaped by sexism but by racism, regarding the discrimination they face because of their skin color. All these forms of discrimination cause black women to suffer from sexual harassment, domestic violence, threats, and abduction. Thus, in many societies, the oppression of women has been constructed in one way or another by the superiority of the social hierarchy, regarding to sexism, which is a result of cultural and political discrimination between men and women. Regarding politics, black women in the U.S. were not treated equally in terms of their citizenship, which plays a very important role in paralleling their struggles with other women from different nations.

Many western scholars and intellectuals have stated that "Islam is a major factor that determines women's condition in society" (Alsaleh,123). I aim to clarify that when some people connect the issue of Saudi women's oppression to religion, they devalue the Islam religion. In fact, the Islam religion gives woman all rights and all equal opportunities with men in most fields. The study of the Quran and the tradition of the Prophet Mohammed (peace be upon him) proves that "men and women in Islam are allowed to have equal access to knowledge;" Islam also gives women the right "to participate and contribute in the socio- political system under Islamic principles" (Alsaleh, 125). Yet, Islam was controlled and manipulated by some religious conservative scholars who forbade women from doing anything. The real reason that stands behind the conservative role of Saudi women in Saudi Arabia is that "obstacles and barriers in the path of Saudi female leaders actually stem from cultural and traditional roots, not religious" (Aljowaie, 3). However, because the role of education and awareness was weak in the past, the patriarchal authority, through relying on religious conservative thoughts, found the chance to control and restrict each opportunity that was given to Saudi women toward reaching their freedom and developing their intellect. In short, it is important to note that what controls Saudi women has been patriarchal power, political authority, and gender discrimination practiced over centuries, not the Islamic faith.

Currently, with King Sulman bin Abdel Al-Aziz and his son Prince Mohammed bin Sulman and the vision of 2030, their trend is to change Saudi women's social, cultural, economic, and political position and turn them to be more powerful, intellectual, and strong. Prince Mohammed bin Sulman says, "Our Vision is a strong, thriving, and stable Saudi Arabia that provides opportunity for all" (12). In the report of May 2017, *Saudi Arabia and Political, Economic and Social Development*, it is mentioned that "Saudi women have begun to make their mark on politics, and if rates of education are any indication, they are not yet done shaping the history of the Kingdom alongside the laundry list of political and economic changes transforming the lives of Saudi citizens from all backgrounds" (47). Through using data from an autoethnographic study as my primary source, I am hoping to explore the ways in which the legacy of black American women, specifically the importance of collectivity, can be transferred to other women from different nationalities and cultures through watching the film *The Help* that has influenced Saudi women in terms of not only making them aware of the change that they could make, but also in making them aware of a woman's strength when she holds a goal in her mind. In addition, I aim to explore the ways in which that *The Help* film helps Saudi women trust themselves, their abilities, and desires. I am also interested to learn whether Saudi women spectators/interviewees come to

realize the importance of collectivity, that female bonds are one of the most important elements that extend beyond all the political, social, and economic boundaries in order to tell their stories and make a change. I argue that women can not succeed as activists/leaders until they “fulfill a common purpose through the collective achievement of common goals and objectives” (Aljowaie, 35).

This research paper therefore highlights Saudi women, whose lives are often still controlled by someone else and who need more development to know their rights as women beyond being a wife and mother. Thus, although my Saudi society is changing now more than before, I still believe that there are many women who are still domestic workers, who are just working in kitchens, raising their children, teaching, and doing the home work without being able to develop their intellect because they do not have a choice. In other words, their choices and life’ paths are controlled by the authority of patriarchy. Furthermore, there are many Saudi women who are still oppressed by their men and manipulated by the conservative ideas that ask them to not fight for their rights because they will be outside of their comfort zone if they did. In fact, such women need feminist literature to enlighten them, to show their rights, and to help them think critically toward their lives. They have to think of their lives with their husbands; how do their husbands treat them? What do they have to do if their rights and desires are just ignored and marginalized? How could they fight their husbands intellectually? How could they make their husbands and sons aware of their rights? For situations like these, watching a film like *The Help* would give them some indication of their life conditions, which share traits with that of the women in the film, and then they can think more deeply about their lives. Taylor sends his message at the end of the film to all black women to strengthen themselves, to find their own way toward freedom, and to stand against the social law. All of these things can be achieved through the hope that should be inside the silenced women: the power of sisterhood, the love between the black women, and feminist literature. What I focus on is the influence of feminist film on Saudi female spectators and how feminist film affects how they would understand activism and social change. Tate Talyor’s the film *The Help* is one such feminist film that I aim to argue can work to empower Saudi women.

Research on social change theory and women’s struggles and achievements shows a very clear absence and marginalization of Saudi women’s experiences from the world of academia and feminism. Social change theory scholars have not considered the experiences of multi-cultural, multi-national women, in that they have ignored a major geographical and cultural area of the world--Saudi Arabia. Social change theory and feminism allow me, as a Saudi woman, to account for various criteria or circumstances that need to be in a place for a robust women’s activist movement to emerge. I consider how social change theory has looked at black women’s activism and argue that there are some conditions in place that Saudi women share in common with black activists, despite others suggesting that these similarities do not have a place within a Saudi context. So, an additional goal of this study is to allow people in the English language community and Saudi female community to learn how I am influenced by the legacy of black American women, which will enrich the scholarship of Saudi women’s social position in Saudi Arabia and in the world. This work complements and extends the growing body of research about Saudi women achievements and their new role in the society within the vision of 2030.

This research paper relies on a different method, in that it relies on autoethnography, which is a genre of qualitative research. Carl Henry Dethloff defines this genre as “A highly personalized genre of writing and research where the author uses his or her experience to extend understanding of a particular subculture” (9). Through conducting this method, I talk to Saudi women about their ideas of social change through watching the film *The Help*. As we watch the film, I recorded my notes in my research notebook in order to address these three questions that guide and construct my personal data: 1) What impact does the film have on Saudi women spectators? 2) What kind of change might their responses to the film cause in terms of my thoughts on women’s activism? 3) Is there anything surprising in terms of how Saudi women understand women’s activism? Through this method, my participation in sharing Saudi women’s reflections and experiences of activism and their understanding of it serves as my data for this research, to support certain claims in terms of how other women who share the same characteristics as me would also respond to the issue of women’s oppression and activism against it. Through the genre of autoethnography, I look deeply into my own experiences, history, and responses in order to use them in making connections between me and other Saudi women and to theorize the possible causes and shape that Saudi women’s activism might take. I use my own experiences and vision, as an author of this project, to bring the readers closer to Saudi women’s understanding of women’s activism, specifically in their reaction to the film *The Help*.

As I am the primary subject of this study, my techniques of collecting the data consist of reflexive journal. I had conversations with friends before they watched the film and then recorded their reflections about the changes in my personality in my journals. I also recorded any changes in my personal beliefs that were inspired by the film, and my observations of other Saudi women’s reactions to the film. To further illustrate, Saudi participants’ reactions were interesting and varied. Each one of the participants reacted in a different way due to their level of education. One of the participants who has a master’s degree from The United States in English Literature was really excited in talking about the film, black history, and black women maids. The conversation with her was rich, since we shared some information about black women, which led us to discuss the power of Saudi women. While another participant, who has a bachelor’s degree in Finance, was not aware of black women’s history. She was amazed by the racial issues in the film, as well as by the performance of black actresses in presenting their bonds. During our conversations, we discussed how the Saudi women can work with each other as Skeeter does to the black women when she awakens them toward making the change through telling their stories. In addition, black women get help by one member of the discriminatory group, a white lady.

This point caused us to appreciate each man who is known as a member of the patriarchal authority but goes against that patriarchal authority. Then, we ended our conversations with insisting on telling our stories, and never being afraid because one story can make an impact on other women who should follow their goals and desires, no matter how they are controlled by the patriarchal authority, just as the black women were controlled by the white authority. This recursive method enabled me to (1) connect my experiences to how other Saudi women view female activism; (2) understand more fully how Saudi women who viewed the film understood the possibilities for social change before and after their viewing.

The participants are from different contexts in my life, such as friends, previous colleagues, relatives, family members, or even friends from my current work. When I finished designing and planning for the study, I began to call and text 12 Saudi married women who knew me before my PhD and after. Only seven women were willing and able to participate, and this was my target number of the study. Other women were likely not free enough to volunteer their time watching the film, writing their answers and participating in the study.

Participant' Pseudonyms	Length of Acquaintance
1. Abrar	(15 -20 years)
2. Hayat	(10 - 15 years)
3. Wafaa	(3 - 4 years)
4. Ruba	(6 - 7 years)
5. Noura	(5 - 6 years)
6. Hebah	(10 - 15 years)
7. Sawsan	(6 - 7 years)

Figure 1. Description of the Participants

My research had three stages. The first stage was the data collection, where I completed the interviews with the participants. The second stage was the data analysis in which I read, analyzed, and examined the participant' responses. The third stage was evaluating the prose by the participants in order to consider the ethics and credibility of the study.

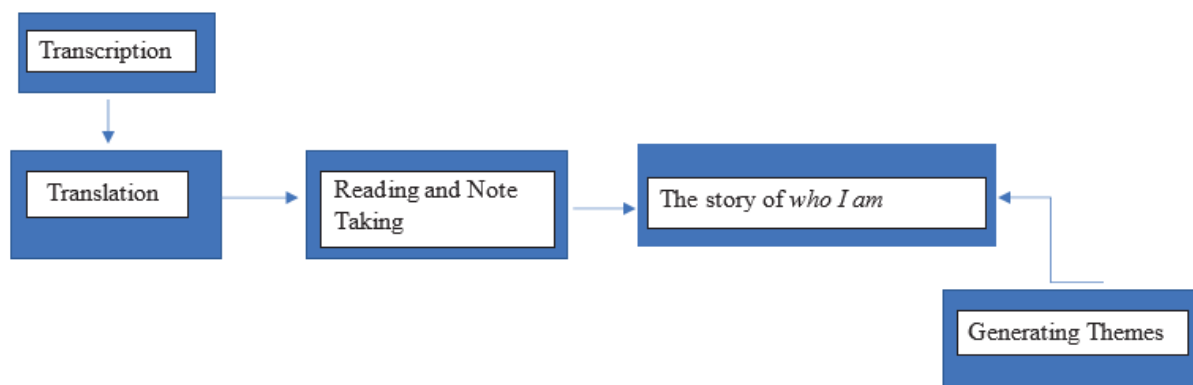


Figure 2. Data Analysis Stage: Transcription, Thematic Organization, and Poetic Rendition

The first stage occurred when I interviewed participants before and after they watched the film. I met with participants via an online video call and gave them a short overview about the study and interview questions. I then asked them to describe my personality and their perceptions of me before I majored in English literature. Then, I let them watch the film on their own and send me their responses. Within one month, all participant's data was received. The questions of the first interview that would guide my analyses of data are:

1. How would you describe me before I began my major in English literature?
2. What is the most striking feature or characteristic of the black American women in the film that has attracted you?

3. Do you see any of these values, characteristics, or qualities integrated in how I am today? Please explain.
4. How have you seen me change after these years of majoring English literature?
5. Why do you think that I am interested in and passionate about black women's narrative autobiographies?
6. Does it surprise you to learn that I have these interests? Please tell me about that.

After collecting all of these responses and discussions, I transcribed them in one Microsoft Word Officer file, in the language of the participant. I translated responses into English as needed.

The second stage occurred when I started to read the interviews carefully to generate a theme for each participant. This required me to circle and underline words that gave a sign of a specific theme. Then, I collected all themes together, grouping and classifying them into main themes and subthemes. Some of participants shared with others' themes, so that helped me to write my reflection on them. As I read, I added my reactions, feelings, and attitudes to their answers in my journal. Sometimes, I added questions, for example, "why did they say that? Why did they think that about me?" When questions arose during my analysis, I contacted the participants again, asking for more details while recording and writing them down their responses. This was the second interview stage.

In my findings, the main three themes were: the innocence, the maturity, and the awakening. I mention "the innocence" because some of the participants talk about my father's role in my life, and how my personality was before majoring in English Literature. However, the theme of "the maturity" covers the moments before and after my PhD study. Also, the theme of "the awakening" covers the moment of awakening with insisting that everyone passes into a stage of adulthood but not everyone passes with the moment of awakening. Due to the responses I collected, and the connection between them and my life experiences, I determined that writing prose in the form of a short story would be a great choice for showing not only my own struggles and achievements, but also those of all Saudi women.

The third stage occurred after I finished transcription, translation, and creating prose. I sent my personal story to the participants through their emails to check for their accuracy and to see if they had other things to add. I also prepared three follow-up interview questions:

- 1- What do you think of the short story? Do you want to add, change or edit any element?
- 2- Do you think this story represents me? Why or why not?
- 3- Do you feel your observations and reflections about the changes in my personality are represented in the story?

During the interview, I tried to take extra notes that might help me develop the story. All of them agreed that this story represented me, my struggles, and my obstacles. One of the participants said, "When I read your story, I remembered all these moments as flashbacks; your beginning, your obstacles, your struggles with being a

mother, student, and wife. It is true that you were far away from our country, but you let us share all your moments.” Another participant said, “If I didn’t know who the writer of the story is, I would tell myself that oh! The personality of this author is similar to Beshaiar’s.” Another participant asked me a critical question: “why do you focus on your PhD study and ignore all the moments before?” I was thinking about her question and if I might change or edit anything, but I found out that what I have done is great that I have written about my PhD study since it is considered the turning point of my path and my personality. PhD study is the stage where I changed and understood myself more fully due to the struggles and obstacles I have overcome.

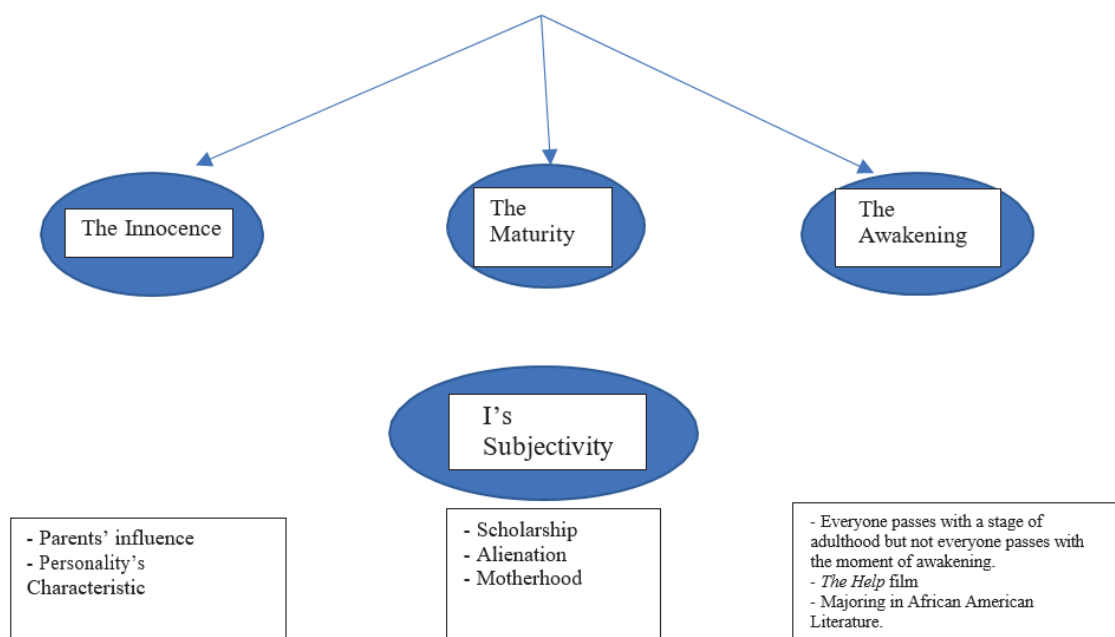


Figure 3. Example of How I Clustered the Emerging Themes

Then, I asked them to check the accuracy of the story; do they see their observations and reactions are written and presented in the story? All of them agree that their observations are well-written with a powerful plot that makes them feel proud and great about it! Finally, one aim of this research is to not generalize but to show an example of a Saudi woman who tells her story of being influenced by other women’s legacy that lead her to change and improve herself as well as to improve the image of Saudi women either locally and internationally.

The first limitation of this study is that it is difficult to remain objective honest, unbiased, and fair toward the Saudi women’s reflections about me. This was especially true for those who are experiencing any kind of outside control over their lives, because some of them would rather not admit their issues or any related issue of women’s oppression, due to a sense of pride and dignity, as they may not want society to sympathize with their weakness. For example, through the participants’ observations and casual conversations, I made sure to not be impacted by their opinions of how they justify the women who are still controlled by their husbands in larger parts of their lives. I have to deal with their opinions, which might not be fair toward these women, in a very objective way. Their opinions toward the film, and their observations on my personality might be impacted by



their hidden stories, which is why I have to be unbiased and objective.

The second limitation is that this genre of autoethnography is related only to one voice and my personal reflections on a social issue, so the results will not be reflective of the general population of Saudi women. However, due to the lack of Saudi women's memoirs and autobiographies, the findings of this study will be useful in conducting further research on Saudi women's activism and the importance of collectivity's ability to go beyond any boundary. In addition, I plan to publish this dissertation and make it widely accessible to Saudi women, which might significantly influence Saudi individuals in building organizations or workshops either in educational institutions or in their public lives to let the oppressed women speak up and share their experiences, as well as to encourage them to show their courage in order to work collectively.

Finally, the third limitation is that the participants are geographically distant, which made it difficult to stay together, watch the film, and talk about it. So, for that case, I asked them to record their written answers or their voices toward the film and how my personality is changed by majoring in African American Literature, and then we had a discussion about it on the phone or a video call. The last limitation is that some of participants preferred to write their answers in Arabic, in which they feel more comfortable, so I spent time translating them so I would be able to use them in my journals. The translation action itself is challenging for me, since my participants have different dialects and different structures of expressing their thoughts, even if they use the same language. So, these factors take more time to be transformed into the formal Arabic and then to translate into English. In addition, I was concerned with losing the clarity and accuracy of the participants' answers, so that is why I made a follow-up interview to check the meaning of some words with my participants.

In the coming pages, I present the short story, which was a product of my autoethnography, or the connection of the Saudi women's experiences with my personal life experience.

## **I's Subjectivity**

Today is a different day! I wake up in the morning with a heart that is full of emotional memories of my parents, and especially my father since he plays an important role in my life and with all the roles I play: a daughter, student, wife, mother, and even a teacher. While I was drinking my cup of coffee, I remembered that he once told me that I have inherited his passion of completing the graduate study. Then, I recalled all dialogues and scenes that happened with him in which these scenes shaped my subjectivity to be what I am now. He was very sure that I could make him very proud of me by making his dream become true and wider. So, since I was a child, he gave me all responsibility and confidence to be an ambitious and influential lady. At the beginning, I felt that confidence was heavy on my shoulders because I was worried of hurting his expectations, but one day after the other, I felt that his confidence was the key to fly in the future.

I was 22 years old when my father just called me to tell me about enrolling in the scholarship! I was not excited

so much because I needed to practice my motherhood with my first boy, since I had just finished my undergraduate degree. I was shocked; how can I leave my country, my family, and why should I do that. But he insisted on the idea, and he told me that “you are still young, you should work hard now, so you can find yourself, and your dream work easily in the future,” I went home, and it was rainy night! I sat down on the bed, the curtains opened, and the drops of rain just fell down into my brain and not on the ground. I spent all night thinking of his advice! It was a step that needed courage and strength because I had never thought of leaving my family. Inside my heart, I believed that he was right! but at the same time, I was nervous and anxious of taking such an influential step! When I remembered my attitude at that days, I realized that my personality was not developed enough to decide on such a decision as this. I was a person who had a limited insight, one angle of perspective, less patient, and limited skills of analyzing or critical thinking. But my father’s insight showed me life from a different angel; an angle that was really full of life chances.

It was late night when my husband came to me saying that “this is our chance of life, we can be close to our dreams, we just need to start, and then everything will be easy.” The day that was full of cries, tears, and sad emotions because I would say “goodbyes” to my family and my husband’s family. I was not sure what will would face in front of us! But, I was sure that the path of success would not be easy. After farewell moments, we travelled to the United States. We faced a new style and routine of life, we had been through new obstacles, and we faced many struggles such as: homesickness, parenting, financial, loneliness, and many others. Whenever I felt stressed and hopeless, I tried to close my eyes seeing my dream in my imagination to empower myself to work hard and to be patient.

Before I had started my PhD, I had been through the experience of delivering my second baby girl alone in America. That experience showed me different angles of my subjectivity and that I am a positive, optimistic, and awesome woman with all people around. I am also a woman who is able to handle all struggles and build a positive atmosphere within the obstacles. During the time of spending the nights taking care of my newborn baby girl, I was watching a film that is called *The Help*. At the beginning, I was really interested watching the film, and then that film just inspired me to ask myself many questions: such as why is there racism? What is a Jim Crow era? What is the problem with the black, female maid’s skin color? What is the problem if they have decided to tell their stories? All these questions were still on my minds until I started my PhD. The feelings that I got from watching this film are just remind me of other women in different nations who really have a story to tell but they are afraid! And this was the first spark of the inspiration!

Since that time, I was really focusing on courses that relate to African American women. In Fall 2015, I have had the first class in my doctoral program with Dr. Veronica Watson that was talking about Civil Rights literature, and she gave us a very clear picture of African American history. Since that moment, which is considered the second spark of my path, I felt that I was connected to their stories because I saw that there was a connection between me and them. First, I am always holding their values and concepts, and I always see my goal in front of my eyes, while continuing to reach for my goal. For example, during my study, I was balancing many roles in my life; I am a wife, mother, and a student. And that is what black women did in the film. They

were taking care of their families, themselves, and the white families' children. So that really reminds me of my own story!

Dr. Watson's Monday class ended at 8:30 pm, so I went back home very quickly to practice my motherhood duties with my children; feed them, help them brush their teeth, read a bed-time story, and get them to sleep! During that night, I decided to stay in my back-yard staring at the stars in the sky while drinking a cup of green tea. I always have a journal book in my handbag because I love writing down everything I do during my day, or everything I have achieved. So, I took the journal book out and started to write my reflections on African American women, and I came up with: "I feel connected to the African American women because I always have the feeling of continuing my goal. I always believe that all people are equal, no matter their race: white or black, or their class: poor or rich. I believe that black women's experiences in America are very inspiring for every woman who is struggling from any oppression or struggle or abuse to take a reaction against any change and to break free from the image of a victim's role. In addition, while I was watching *The Help* film, I felt that my personality is really matching black women characters' personalities in the film. For example, the sense of optimism which means that I am always sure that future will be better, and everything will be fine. In fact, since that time, I have adopted many concepts and principles from the history and struggle of the African American women such as solidarity, creativity, and fighting for women's rights. By solidarity, I mean that I want all the Saudi women to stand together against any misconceptions that could tarnish their image in social media and the whole world. I have the whole courage to fight for the correct positive image of the Saudi women. Then, my creativity in making the African American women activism as a reference and a guide to obtain all the important lessons to create a solidarity between the Saudi women socially. In addition, talking about black women in my project shows how I am passionate about their stories. And, I see how I really care about spreading the awareness of inequality and discrimination through the stories of black women to other nations because it might be natural to notice these discrimination and inequality differences in any place and in any country. Most importantly, I can see my goal is similar to Skeeter's goal in the film in which how she tries to tell black women's stories, and now I want to write my own story and Saudi women's stories. Black women's self-narratives might impact your passion and emotions. And, it attracts your attention, which leads you to read more about them and describes that your project will talk about them." Then, I went to my bed with all peaceful feelings inside!

One night, while my family and I were gathering after dinner and around the fireplace, my father asked me from where I got the passion of holding the issues of black women and to extend this to Saudi women. I told them that through my reading of African American narratives, I saw discrimination, inequality, violence between blacks and whites, and the oppression of black women and that made me sympathize with their struggles and the racial and gender discrimination that they have been through. So, I believe that black women deserve to live with all their pride because whatever is the race, class, or gender of the women, they have feelings and emotions that deserve respect.

My husband asked me if I noticed any of these treatments. I answered him that "Yes. I have seen the

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discrimination in the work position and daily lives; for example, transportation.” Since my family has never heard the term of Black Women’s Narratives, they asked me to explain this, so I answered that “I believe that I am interested in this genre because I want to make it as an example to other oppressed women who are struggling to achieve their rights and to show that nothing is impossible. I want to show them that if the African American women, through their numerous autobiographies, were able to get their rights, these oppressed groups of women are able to do so if they really think of the importance of sharing their powerful and inspiring stories. As a result, I have decided to use my voice in spreading the awareness that people should be proud of their skin color without hurting or discriminating other races. And I want to spread awareness between other nations and cultures such as Arabic nations!” My family’s eyes were moving from one to another as they were shocked of how I would spread that awareness and why. My answer is that “Saudi women’s lived experiences are unique human experience that have never gotten the attention or focus necessary such as in literary criticism and writing, while comparing with black women’s autobiographies. I think I am interested in black women’s stories since they are similar to us regarding their personality characteristics: strength, patience, and the stereotype of the iron women.”

After the family conversation, I went back to my home and to my favorite place which is the back yard to write down my reflections again in my journal book. Due to the inspired and thoughtful family conversation, I thought that I had reached the turning point of my personality, not only in my personality but in my academic and professional path. So, I wrote down that “the process of awakening and growth has taken all stages, so I start to see light on the horizon. The process of awakening shows that my caring of women’s struggles and achievements is not surprising, due to my personality’s characteristics that I don’t feel satisfied about discrimination and inequality between people. In other words, racism and discrimination are manners that should be rejected by every mature and educated persons. If racial discrimination spread, that would kill humanity. damage all societies, and would lead to a loss of great communication between people. Within the process of the awakening, and diving into the field of African American women’s literature, I have decided to send to the whole world a message to stop all kinds of discriminations either gender or racial. Lastly, my interest is that there is no difference between a person and another except his/her good deeds, education. Basically, there are no differences, and this is my personality that aims to raise the justice. In addition, I see that I don’t like to be silent about discrimination, and I always try to be unbiased.” And here is the actual beginning of my path!

While I was writing this short story, I just stopped for a minute to think deeply about what has been changed in Bashaier’s personality. I think that the past five years shaped me differently. If I compare myself before my PhD and now, I didn’t notice any negative change, though I became much better and more developed than before. My personality became stronger because of many things: I am a well-read person, passionate, a good listener, and a creative reader just to learn more things. All these characteristics help me to develop and strengthen my subjectivity. Finally, it is very rare that I see people who spread such awareness in our society, so my step of doing this is great and will make a huge difference especially in our societies. And, yes, I have been surprised a little bit, but of course since I have expertise in African American literature, so I have seen some elements that other people don’t see because not everyone is exposed to this literature. And not every person passes with

through the moment of awakening. People should understand themselves; they should leave themselves in the hard situation to shape them. Understanding themselves will help them to figure their path and their role in the society. Be open to everything around, free yourselves, free your heart to feel, and free your brain to think!

Composing this story with a focus on some parts of my life was inspired by the participants' answers, who highlighted issues in my life that I have never paid attention to. One of the participants reminded me of how I was balancing between my life roles. Another one compared my role to Skeeter's role in the film, which inspired me to open new ways of thinking about showing the extent of African American women's legacy, in terms of Saudi female spectators being able to put themselves in the position of Skeeter in their lives. In addition, some of my participants reminded me of my father's role in my life, and I never thought that they would remind me of my father, since I do not remember mentioning my father often in my conversations with them. When I asked them why they mentioned that point, they told me that when a person is impacted by someone else, they talk about that person without paying attention to it. Prior to my decision to write this story, I drew a timeline of my life where I have passed with the turning points of my life, with the intention of making them is the main plot of the story.

Furthermore, I was thinking a lot on how I could show the role of collectivity in my story. However, some participants who are/were a member of my major in Literature and Criticism knows how I was inspired by one of the inspiring professors in the English Department. Dr. Veronica Watson, a professor and the head of the English department, taught a class in Fall 2015 about Civil Rights Literature. That class was the spark and sign of my path toward recognizing who I was, and who I become. Dr. Watson works with me as a team to get this dream completed for me as well as to get this project done for black women readers, Saudi women readers, and academic scholars. In addition, I soon realized that my collectivity is shown in the encouragement of my husband, since he is considered as a role model husband who really encourages his wife as much as he would himself, in which that takes us back to the argument of the second research that argues for the power of supportive husbands in women's activism. Through my analysis of Daisy Bates' *The Long Shadow* in the second research, Bates portrays her husband as an effective role in her personality and activism. This portrayal of her husband helps the readers, especially the female readers to understand that supporter can be males, and also husbands. In the other words, she tells her story to define her effort and activism within the context of racial discrimination and social injustice for the black school students, through the collaborative work of her and her husband. Analyzing the couple's relationship helps me to "understand the ways the men in the lives of assertive women either assisted or hindered their personal development and political activism" (Adams, 13). If L.C. didn't add a lot of improvements to Daisy Bates' personality and life, she wouldn't talk of him, as it is one of the 20<sup>th</sup> century trends that female activists don't aim to highlight their marriage, husbands, and family such as in the works of Dorothy Height and Ella Barker. When I began this study, I explained that the authority of whiteness that was represented in the film, which controlled the lives of the black women maids, is similar to the patriarchal authority in our society, where husbands think that they have the right to control their wives. In that sense, the role of collectivity is shown in my life amongst my desires, dreams, and goals. I see my husband as a

part of my collectivity, since he is the one who trusts me to find my path. He is the one who sacrifices for me and helps me to achieve my dream, and that makes me feel secured to sacrifice for him and find our collectivity to build our future altogether. The path would not have been easy without him! In addition, the role of collectivity is shown in the role of my father as he was the backbone of my dream; he advises, guides, and supports me either financially or emotionally. That is why, I always feel that it is my responsibility to make him proud of me!

The results of my study indicate an interesting point to me as a researcher and I am sure to my readers as well. In both cases, either Saudi or black women, the one who helps, and secure them is a member of the dominant group. In the film, Skeeter is part of the dominant group, white people, and she rescues black women through letting them share their stories to find people's respect and equality toward them. On the other hand, as I am a Saudi woman, the ones who really help and support me are the people who are considered members of the patriarchal authority: my father and my husband.

Saudi women, as any woman in the world, were discriminated against because their gender. The social expectations and the patriarchy authority locate them in a fixed, traditional role. Nowadays, Saudi Arabia is the most influential country in the Middle East that helps the women to get their rights within the vision of 2030. It can not be denied that the new changes transform and change Saudi women's role to change their social role to be more productive humans. Saudi women contributed to their country to improve themselves and to show that their human presence is important, not only to their country but to the whole world. That contribution never happened easily, but they struggle and work hard to achieve that. They spend their lives changing and improving themselves individually, but now the whole country is supporting them.

Saudi women are never changed themselves but also, they change their males to let them understand what does dream mean to a woman? What does achievement mean to a woman? Saudi women insist a lot on their dreams; they fall down, and then they stand up again. They were attacked by negative attitudes and comments, but they helped themselves to support each other with positive comments. Saudi men (who are like a husband and father) now do not want to see any Saudi woman in a lower position, so they start to help, support, and push her to do what she has dreamed of. They even might sacrifice their time, comfort, and money to help them. Saudi women's solidarity and their insistence on finding their path encourages the importance of collectivity's role that should be amongst male counterparts. Finally, this dissertation approves that the role of collectivity is not only between females but also between males; to achieve each other's goals, we should work collectively amongst our personal or practical life.

In conclusion, after generating the prose, I asked myself to define Saudi women based on my lived experiences. I would define them as a powerful women who go through many struggles and obstacles in the patriarchal system, but with all that, they improved themselves as women who can achieve their goals and dreams, women who can manage the responsibilities on their shoulders; they can be wives, mothers, students, and workers. Saudi women are women who build the history of Saudi Arabia, and because of that their narratives should be mentioned in the academic sphere of feminist literature and criticism. In addition, this study shows that black

women's history parallels Saudi women who become aware of not only the social change that they could make, but also of a woman's strength when she holds a goal in her mind. Furthermore, *The Help's* observations show how Saudi women trust themselves, their abilities, and desires. Overall, this study succeeds in reflecting the instance of Saudi women spectators who are realizing collectivity's influence, in that female bonds – as well as the support of husbands and others -- are one of the most important elements that must extend beyond all political, social, and economic boundaries in order to reach an achievement through working all together.

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# Undergraduate Occupational Therapy Students' Experiences in Online Distance Learning for Skilled-Based Subjects During COVID-19 Pandemic: A Descriptive Phenomenology Study


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**Abstract:** COVID-19 hugely impacted the students' learning, in which experiential learning was not allowed to be implemented to decelerate the spread of the virus. Thus, educators used whatever capacities and abilities they had to ensure that the students learned the skills, especially for certain skill-based occupational therapy subjects. However, studies regarding occupational therapy students' viewpoint of their real-life experiences in learning skill-based subjects via online distance learning were lacking in number. Therefore, a descriptive phenomenological study was used to describe occupational therapy students' personal experiences in studying skill-based subjects via online distance learning during the COVID-19 pandemic. Ten undergraduate occupational therapy students were interviewed, ranging from 45 to 60 minutes on their experiences in learning skill-based subjects via online distance learning. The essence of the student's experiences was described in four main themes: (i) the impacts of COVID-19, (ii) adapting to the COVID-19 outbreak, (iii) the downside and upside of learning skill-based subjects via online distance learning and (iv) perceived supports. Even though they struggled to learn the skill-based subjects without hands-on face-to-face sessions, occupational therapy students felt that few strategies effectively enhanced their learning experiences during the period. This study concludes that occupational therapy students formed impactful memories and described their struggles with online distance learning since the sudden transition to ODL during the pandemic. Thus, the experiences highlight a few learning strategies educators can adopt when it comes to skill-based occupational therapy subjects.

**Keywords:** Occupational Therapy Education, Online Distance Learning, COVID-19, Case-based Learning, Skill-based

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## Introduction

Occupational therapy is defined as the therapeutic use of occupations that provides functional support to equip people by overcoming barriers in the recovery process from injury or illness (American Occupational Therapy Association, 2020). Occupational therapy promotes independence and satisfaction in all aspects of life. Not only limited to didactic education but there are also many ways to prepare students to become skilled in entry-level occupational therapy including laboratory experiences, problem-based learning, case studies and experiential learning (Goldbach & Stella, 2017). Experiential learning involves hands-on experience in a practical setting to test information learned in educative coursework in a real-life practice environment, emphasizing self-directed learning and mirroring the experience (Thomas et al., 2022). Most students valued hands-on learning since it allowed them to practise and apply learned skills more than ordinary methods such as lectures and self-reading (Thomas et al., 2017).

On January 30, 2020, the emergence of a new coronavirus (2019-nCoV) was announced as a concern public health emergency of international concern by the World Health Organization (WHO). An infectious disease has been a major threat to Global public health. In Malaysia, this outbreak resulted in holding back the learning sessions of high institutions during the ongoing semester of pre-university and undergraduate programs (Kamal et al., 2020). To flatten the curve of Covid-19 infection, Movement Control Order (MCO) was imposed starting 18 March 2020. Malaysian Ministry of Higher Education ordered all public and private universities in Malaysia to resume the teaching and learning scheme via Online Distance Learning (ODL) by the end of December 2020. At the edge of July 2021, Malaysia recorded an increased number of cases over the month with the highest of 15,573 new confirmed cases of COVID-19. On that account, face-to-face learning is still not possible.

E-learning has been widely used on account of its accessibility and has been demonstrated to be successful for the past decade. Online learning attempts to provide adaptability to broad-ranging study without its infinite challenges for both the students and instructors (Abe, 2020). However, the whole world quivering with the COVID-19 outbreak and adjusting to the new normal is a challenging process. Obligating to the MCO, higher education institutions must explore online communication platforms to enable interactivity. Even so, this application may be ineffective for certain fields like clinically hands-on or technical education (Moadel et al., 2020). On the 27th of May 2020, Higher Education Ministry in Malaysia declared a must in all universities and higher education centres to administer teaching and learning measures via ODL until the 31<sup>st</sup> of December 2020, while the decision regarding 2021 was held on based on current cases. Standard Operating Procedure (SOP) and only a few exceptions were strictly put in place to halt another COVID-19 outbreak (Al-Kumaim et al., 2021).

Although, unquestionably, ODL is deemed the finest alternative to make certain of continuity in learning in the “new norm” or “during the COVID-19 pandemic”, there may be some hindrances such as lack of human touch, sensing students’ misreading facial expressions, student engagement and interchange, which can be done more productively in face-to-face learning (Chung et al., 2020). The goal of occupational therapy education is to produce occupational therapists with the essential professional competencies for practice (World Federation of Occupational Therapists, 2020). These professional competencies can be achieved mostly via laboratory experiences and experiential learning. However, these learning methods are not possible to be conducted during the implementation of MCO in Malaysia. Thus, students have problems learning skills-based subjects which require them to use and experience conducting a wide range of assessment tools and intervention techniques to obtain psychomotor skills. There are limited studies conducted to describe the experiences of occupational therapy students undertaking skill-based subjects via ODL. Given that, this study aimed to explore occupational therapy students’ personal experiences in studying skill-based subjects via ODL during the global pandemic, COVID-19.

## **Method**

### **Design**

A descriptive phenomenological inquiry was employed to deal with inner experiences in the everyday life of occupational therapy students studying skill-based subjects via ODL. This method helps to identify the meaning behind the human experience as it related to a phenomenon or notable collective occurrence (Sundler et al., 2019). The phenomenon of interest was the students’ experiences in studying skill-based subjects via ODL. The phenomenological foundation of this study aims at attaining a profound understanding of the nature or meaning of students’ daily experiences (Mortazavi & Ghardashi, 2021). Therefore, this study aimed to answer the following research questions; what are the experiences of occupational therapy students studying skill-based subjects via ODL? This study was conducted at the Centre for Occupational Therapy Studies, Universiti Teknologi MARA(UiTM) through one-to-one interviews using semi-structured questionnaires via the google meet platform due to the physical distancing measures imposed to decrease the spread of COVID-19. UiTM Research Ethics Committee approved this study with reference no 600-TNCPI (5/1/6).

### **Participants**

Purposive sampling method was used to recruit the participants in this study. This sampling method offered multiple perspectives both depth and diversity, and the selected respondents were likely to provide information relative to the phenomenon being studied (Creswell & Poth, 2016). Fifteen participants were approached and offered an opportunity to participate in this study based on specific eligibility criteria to obtain rich and thick descriptions of their experiences. Data saturation was not the goal, rather this aimed to get full and rich personal accounts, concepts, and commonalities from the participants. Each person’s experiences are so individual that

true data saturation can never really be fully achieved in a phenomenological study (Hale et al., 2008). Occupational therapy students enrolled in a Bachelor of occupational therapy full-time course who; (i) is currently in the second year or above (ii) have taken any occupational therapy skill-based subjects during the COVID-19 pandemic; (iii) can understand English and Malay; and (iv) provide informed consent were included in the study. They were excluded if have not completed the skill-based subjects and refused to be interviewed.

### **Materials and Instruments**

Data was collected using semi-structured individual interviews via the google meet platform. The meetings were audio- and video-recorded for data analysis purposes. Videoconferencing has been popular as a means of communicating regardless of distance. It is a convenient, cheap and efficient way of communication mode. In this new norm, videoconferencing is gaining traction in qualitative research for interviews. The environments allow real-time communication with both audio and video. This is much like a traditional interview, except the researcher and participant are simply in different locations. A laptop with the google meet application and a stable internet connection was required to record the videoconferencing interviews. An interview guide consisting of demographic and main questions was used to collect the data from the participants. The interview guide was developed based on the literature and research objective. Prior to the data collection, it was pilot tested with an occupational therapy student to ensure the clarity and comprehension of the questions.

### **Data Collection Procedure**

Upon receiving ethical approval from the UiTM Research Ethics Committee, data collection was done via videoconferencing interview. An information sheet was provided to the participants and consent was obtained before the interview took place. Participants were made aware of the videoconferencing interview session being recorded for transcription purposes. One day before the interview, a reminder email was sent to the participants. The time and date were set according to the participant's preferences.

The interview started with warm-up questions consisting of demographic details to know more about the students and to get an overall sense of the skill-based subjects that they took. These questions were geared towards the central questions; however, responses helped with the other prompt and probe questions. The COVID-19 question was designed to understand students' general perceptions of the current covid-19 outbreak. Questions on the occupational Therapy course were designed to solicit students' in-detail descriptions of the skill-based subjects for the current semester by looking deep into participants' personal experiences throughout the semester. Participants were interviewed for approximately 45 to 60 minutes. The interviews were transcribed verbatim before the data analysis. Data transcribing was conducted in a private room using earphones to avoid the possibility of recordings being heard by other people. Any document which contains the participants' detail was kept with no access to anyone other than the research team. Participants were however, notified that their information would be used for reports and publications.

## The Context of the Study

This study explored the experiences of occupational therapy students in learning skill-based subjects via ODL during Movement Control Order (MCO) during the COVID-19 pandemic. The students were enrolled in the Bachelor of Occupational Therapy in the Faculty of Health Sciences, Universiti Teknologi MARA. They have taken skill-based subjects that require hands-on and experiential learning, but it was not possible during COVID-19. Skill-based subjects include pre-clinical and clinical subjects such as occupational therapy assessment, intervention, and practice placement in various areas. During the MCO, face-to-face and hands-on learning were not allowed, which imposed a lot of challenges on the student and educators. The sudden transition required the students and educators to adapt and cope with the new norms.

## Data Analysis

Data were thematically analysed using three steps: (i) achieve familiarity with the data through open-minded reading; (ii) search for meanings and themes; and (iii) organise themes into a meaningful wholeness (Sundler et al., 2019). First, the transcripts were read to familiarise with experiences and explore their meanings by identifying the unique and novel sides of the data. Second, notes on the meaning of experiences were made to the transcripts and the notes were compared to develop patterns and themes. Finally, the findings were written and organised with the explicit name of the themes, which describe the meaning of lived experiences in the actual context. The rigour of the study was enhanced using reflexivity, credibility, and transferability (Korstjens & Moser, 2018; Sundler et al., 2019). The research team compared the derived description with the original data to maintain reflexivity and any changes to the themes were documented and audited throughout the research process (Sundler et al., 2019). Member checking was performed with three participants and the coding was done independently by the two research team members to enhance credibility. The meaning of the experiences was described in the thick description and the context of the study was made clear to ensure the transferability of the findings (Korstjens & Moser, 2018).

## Findings

### Description of Participants

Despite fifteen eligible participants being approached to offer the opportunity to participate in the study, only ten agreed and turned out for the videoconferencing interview. The participants are ten female students aged between 22 and 27 years old ( $24.1 \pm 1.37$ ) residing in different geographical areas during the MCO as shown in Table 1. Five (50%) of them live in rural areas and another five (50%) live in urban areas. The participants were in semester six and eight and were currently taking skill-based subjects as follows; (i) occupational therapy medical-neurological assessment ( $n=1$ , 10%), (ii) occupational therapy intervention in medical-neurological conditions ( $n=4$ , 40%) and (iii) occupational therapy assessment and intervention in geriatric ( $n=5$ , 50%). Despite facing multiple challenges during ODL, almost all participants managed to achieve good to excellent

grades. Participants were also asked to rate satisfaction levels with their performance for the skill-based subjects. The scale ranged from 1 (not satisfied at all) to 10 (very satisfied). Participants rated their satisfaction level from 5 to 8 with a mean and SD of (6.6±1.07).

Table 1. Description of Participants

Pseudonyms	Age	Semester	Geographical Residence	Skill-based subject	Grade	Satisfaction level
NN	24	6	Rural	OT assessment in medical-neurological Conditions	A	8
NI	24	6	Urban		B	7
SZ	24	6	Rural	OT intervention in medical-neurological conditions	B	6
NW	22	6	Rural		A	8
ND	24	6	Urban		B	6
NA	25	8	Rural		B	7
FN	23	8	Rural	OT assessment and intervention	B	7
KA	23	8	Urban	in geriatric	A	7
NL	25	8	Urban		B	5
NH	27	8	Rural		C	5

### Emerging Themes

Four themes emerged from the analysis; (i) the impacts of COVID-19, (ii) adapting to the COVID-19 outbreak, (iii) the downside and upside of learning skill-based subjects via ODL and (iv) perceived supports as shown in Figure 1. The first theme describes the impacts of COVID-19 on the students and their learning process. The essence of this theme describes how students feel about coronavirus and its spreading. Two subthemes emerged under the first theme namely, (i) uncertainty and fear and (ii) impact on the learning process. The second theme encompasses how participants develop their coping strategies to learn effectively. The essence of this theme relates to students' psychological status which influences their academic performance.

There are two subthemes under the second theme; (i) coping strategies and (ii) psychological influences. The third theme describes the downside and upside of learning via ODL and is arranged in four subthemes; (i) the extent of workload, (ii) technical challenges, (iii) access to technology and (iv) time flexibility and expenses. This theme also discovered students' perceptions of ODL compared to face-to-face classes. The fourth theme explains perceived social supports illustrated by participants during unfortunate times and is organized into two themes; (i) stay connected and (ii) self-efficacy. Participants expressed appreciation for receiving family, friends and faculty members' encouragement and support. in maintaining their academic performance and mental health status.

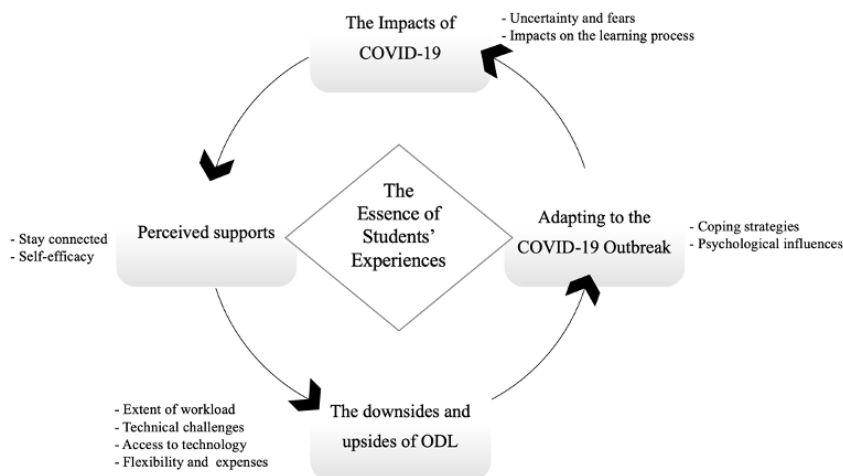


Figure 1. Emerging Themes

*Theme 1: The impacts of COVID-19*

*Uncertainty and Fear.* This subtheme incorporates the personal feelings shared by all participants regarding the experience of a yearlong observation on COVID-19. Respondents realized that COVID-19 is a pandemic where the disease outbreak throughout the whole world not only in Malaysia. It affects all populations no matter what age, gender or status. Students also stated that COVID-19 is currently the leading cause of death worldwide up to millions of cases. NN added value to this subtheme by stating:

“Covid 19 is an airborne disease that cause by a coronavirus that can be transmitted through water droplets when we sneeze or talk. Currently, this disease becoming more dangerous as some sporadic, does not show any symptoms can be tested positive”.

As the coronavirus pandemic demonstrated, life can change very quickly and uncertainty about returning to normal social life might result in fear. Some of the students were residing in red zones. Areas classified as “red zones” indicate that the regions where most cases are reported and where individuals are at a high risk of infection. Participants described deep worries and anxiousness in various ways. Most participants highlighted their concerns about the safety of themselves as well as their family members. Two participants stated:

FN: “I am feeling worried about my parents, nephew and niece because they are at higher risk. If they got infected the symptom will be much worst. I am frustrated because I have not been vaccinated yet but relieved that my parents have completed their vaccination”.

KA: “Covid 19 world widely affected not only our country. It is very dangerous. I think it is so stressful as we have to stay at home and stay away from everyone, by ourselves only with our family and it affected all the entrepreneurs that burden them and cutting off their source of income”.

*Impact on the learning process.* All participants described the values associated with the skill-based subjects. The majority of respondents discussed how they were supposed to be attending lab sessions for the subjects, but they could not. They value the lab sessions as they would be able to physically touch and practice the entire equipment and receive direct guidance from classmates, lecturers and clinical instructors. Participants provided statements relating to what the course plans have changed due to COVID-19. The essence of the students' experiences is exemplified through the following:

SZ: "Lecturers have planned for a face-to-face session for intervention. We usually do it in lab sessions where the lecturer demonstrates the correct way to conduct the intervention and we get to practice to gain the skill, but it was not possible during MCO".

KA: "My lecturer also planning to expose more on the reality of that situation with the elderly so that we can apply the theory we learned to the real environment through clinical visits, but it was just a plan. We could go ahead with the plan".

Participants described their experience in comparison with previous hands-on learning at the campus before the emergence of COVID-19. Two participants exemplified that:

SZ: "For me, the hands-on experience is important because, through that experiential learning, we get to experience how to conduct the intervention physically and how to operate the equipment correctly and giving us confidence when going for clinical placements. For example, some of the interventions require us to use tools such as electrical stimulation so during the lab session it will be really detailed on where to place the electrodes, how to control the electrical impulse, and what intensity to use".

NL: "When in an online session, not everyone can pay 100% attention during lectures and presentations with internet problems, so I think it is difficult to pay full attention. We only get to learn hands-on skills using videos. We don't get to feel the real situation, the experience of doing so is not available".

Participants expressed that COVID-19 has altered their learning process from formal methods to a new norm of using ODL. ODL is an instructive system where students carry out class sessions through video recordings, live video conferencing, or any other audio/visual technology medium. Participants provided value statements relating to the changes. They make the best use of the technology available by implementing miscellaneous teaching and learning modes like social media (WhatsApp, Telegram), live video conferences (Google Meet) and pre-recorded lecture videos (YouTube). Participants stated that:

NH: "My lecturer does google meet sessions or zoom or provided us with recorded lectures. We also do presentations among students online. Most of us use google meet as a medium for classes and group discussion".



SZ: “We were not allowed to go back to campus. So that is why the lecturer provide us with video demonstrations of carrying assessments and interventions”.

*Theme 2: Adapting to the COVID-19 outbreak*

*Coping strategies.* Students learned to adapt to the changes in the learning process with their own coping strategies as that was the only option to complete their studies. All participants have somehow used similar learning strategies to adapt to the changes. The students advocate that staying organized can ease the process. The habitual “structure” of daily life may have been replaced with a new norm, so strategies could help in optimizing learning and managing time effectively. Identifying learning objectives and goals will help to stay on track by taking note of what they hope to accomplish by the end of the course. Besides, developing a study plan and having a written coherent plan allowed them to follow and complete the course. Along with taking time to eat or relax, participants also set aside some specific time for learning. Participants illustrated their coping strategies as follows:

NH: “Whenever the class schedule came out in the early semester, I will plan my schedule for the whole week, what goal I need to achieve for that day, I prioritize which assignments needed to be submitted first. I think I am adapting to it”.

NN: “I used my planner and write down the assignments because sometimes I cannot remember everything. I adapt mainly by trying to complete the assignment earlier. So, I will not be so burdened at the end”.

FN: “I take note of the extra information and do a lot of own reading before class so that I have questions to ask during class on things I don’t understand”.

Apart from staying organized, participants also suggested optimizing learning efficiency by having a dedicated study space. Participants build a distraction-free area where they feel comfortable studying. Participants also merge their learning time into their routines to enhance productivity. This is exemplified by:

SZ: “How I adapt is by having my own personal corner for my online class so that I can fully concentrate. I called mine a ‘battlefield’ because a lot of battles happened there”.

*Psychological Influences.* Although adapting well to the changes in the learning process, most participants agreed that the COVID-19 pandemic has disrupted their lives from multiple directions. Despite coming to the end phase of their education (clinical placements) and progressing to the next level (employment), they were not confident with themselves. NW stated that:

“I am afraid that I could not gain a full understanding of assessment and intervention and will cause a lot of problems during my clinical placement. Hands-on give me experience. So, without experience, I don’t think that I am confident enough to conduct the assessment and intervention on real patients”.

NL: “After the MCO, we get the chance to go to clinical placement at University Malaya Medical Centre (UMMC) where the first day I got really shocked like I have a lot of lacking in experience. Every day was tough for us because if we don’t have those skills”.

In addition to having to cope with a stressful study environment, participants have to fulfil roles while living at home. In comparison to studying on campus, students were responsible for taking care of their own well-being. While living at home, students have to worry about looking after family’s needs. Two participants describe their responsibility other than being a student:

ND: “I divided my time between studies and my family. You know especially as a woman we need to do house chores and a lot more, so I really need to follow my schedule. If not, I will be left behind”.

NW: “Because we are at home, we have other responsibilities, we could not just stay in front of the laptop and do all the coursework from morning until night. We have other things, like living with family. We can't focus only on studying. It is hard to adapt. But of course, I have to, I have no choice so I just go with the flow and do whatever I can”.

### *Theme 3: The downside and upsides of ODL*

*Extent of workload.* Most participants believe that the amount of work in ODL was increased than during traditional classes. Some participants agreed that the increase in workload was due to the replacement of final examinations and lab sessions. Participants described that:

NL: “During ODL, the coursework load increases. Not only a single subject has a lot of assignments, but mostly all. With my home environment, it really gives pressure on me. The workload is increases compared to face-to-face. During face-to-face, there were more classes but fewer assignments. To be honest I prefer the final examination just because of too much workload”

NW: “Many workloads, and I think it is very much compared to face-to-face. I have to do many things at once and I have to cope since there are many subjects so the workload and there are assignments for each subject.”

Participants expressed experiencing difficulties in keeping up with their daily occupational performance due to the unbearable amount of academic workload they carry. Participants recollected:

KA: “When it comes to sleep, it is a problem. I have to stay up late finishing all the coursework. At some point, I cannot sleep because I keep on having and struggling with my negative thoughts. My leisure is also affected as at campus every day after class around 6 pm, I spend time jogging or playing badminton with my friends. During ODL, I rarely continue my leisure activities”.

NW: “During ODL, my eating time was disrupted. Because I want to settle my assignment first because I know that after I eat, I will do something else because I could not focus anymore. So, it is better for me to complete my assignment first and then do other things later”.

*Technical challenges.* All traditional methods operated for direct learning; classrooms, halls, lecture rooms, and laboratories must now be put back and replaced with the high-modernization of online learning. Participants made use of the “network problem” to describe the technical difficulties. Six participants were residing in rural areas during the pandemic. Participants further described the technical challenges causing them sometimes miss lectures or cannot join the live discussion. Participants exemplified that:

NW: “I have trouble with my internet. Some lecturers used recorded video as their medium. I think it is a good alternative for us who are having trouble with the internet because the time is flexible; we can watch the video when we have time or when the internet is stable. But the hardest part is that if we cannot understand something, there is no Q&A session because it is recorded video”.

ND: “The internet depends on the weather. The internet is the main problem in ODL because we cannot control those things and sometimes it takes time for us to complete recording videos or submitting assignments because of the internet connection issue”.

*Accessibility of technology.* Even though participants experienced challenges because of ODL implementation, there were some advantages to them. When asked what the upsides of ODL were, participants seem to be holding back and needed prompting. They stated that they got the opportunity to venture into new knowledge by using various online applications as mediums of discussion and sharing information. Participants described that:

NH: “We get access to new technologies and applications that can be used during online learning such as google meet, zoom, for use during our presentation. Sometimes we also use quizzes, google form and many more”.

SZ: “The good part is students get to assess the learning materials as much as they want until they really understand the topic because it is being recorded. It is cool, right? Because if we don’t understand or forget, we get to revise. In physical class, you did not get the chance because the lecturer only taught in the class”.

NW: “I am satisfied with all the presentations by my friends and lecturers because they are very clear.

The video demonstration from YouTube gave me a better understanding of how to conduct the specific assessment and intervention. I would say that is what helps me during the ODL”.

*Flexibility and expenses.* Participants perceived another advantage of ODL is its flexibility to choose wherever or whenever they want to study. Participants get the possibility of saving a significant amount of money as the expenses for ODL was lesser than face-to-face on-campus. Also saving time by not commuting on crowded buses or local trains. Participants explained that:

NL: “I get to save a lot of money and the most important thing is that I feel safe living at home. If we live on the campus, we are exposed to COVID-19, interacting with people there. I also get to spend all of the time with my family”.

FN: “I can save money from paying college fees, food and leisure bills because I tend to spend much when I am on campus by going out with my friends”.

#### *Theme 4: Perceived support*

*Stay connected.* Participant transcriptions were found to have a consistent thread where all of them were receiving support from their peers, family, lecturers, and university. Participants claimed that online studying leads to feelings of loneliness. In a situation where they no longer have access to a friendly-study environment or the chance to physically unite with their peers. Staying connected can keep the participants motivated. Participants found comfort by interacting with classmates via virtual study groups. These sentiments explain the subtheme:

NL: “I would say my classmates, specifically my groupmates. We helped each other because we understand how this impacted our studies and mental health. Everyone is stressing out but at least by having them, they can listen to my rantings and make me relieved”.

ND: “Whenever I am stress, I tend to cry and express to my sister and friends. They will help by advising and comforting me so I can stand on my feet again. If I did not have support, I will collapse and burn out easily”.

NH: “Our lecturers were helpful. Sometimes they asked about our current situation, whether our internet connection is okay for class, and whether we needed extra help. They channel us to any support provided by the university”.

SZ: “I can see that many webinars have been done to address students’ issues, for example how to manage stress, manage time and so on”.

*Self-efficacy.* Self-efficacy refers to an individual ability to exert control over one's own motivation, behaviour,

and social environment. To boost self-efficacy, social support was found to be the key feature. Most participants expressed receiving support as a significant factor that motivates them to perform better in academics. Two participants stated that:

NL: “It was challenging to adapt to the new norm learning environment. I need a lot of support from others. If I have no support, I believe that my performance will deteriorate because the support motivates me to complete my studies”.

NW: “I believe that if I don’t have good groupmates who are supportive, I don’t think I go through this. I get to achieve good grades too since most of the assignments are in the group. If they did not cooperate, it will be harder”.

## Discussion

This study aimed to explore occupational therapy students’ personal experiences in studying skill-based subjects via ODL during the COVID-19 pandemic. The first theme illustrates the impacts of COVID-19 on the participants’ life and their learning process. The focal point of participants’ experiences is mainly the uncertainty and fear of the pandemic. Most participants are suffering from the uncertainty of returning to normal life and a deep fear of infection, with substantial worry for the elderly of their families. The traumatic feeling is supported by the fact that the number of morbidity and mortality in Malaysia keeps increasing as reported by the Ministry of Health (Din et al., 2021). A study stated that undoubtedly undergraduate students encounter obstacles and psychological stress because of quarantine obligations, finishing-off studies via ODL, and future employment uncertainties (Kassim et al., 2021).

The enforcement of MCO halted the conventional learning process (Rumeli et al., 2022). Thus, ODL is viewed as the best solution for replacing conventional learning methods during this uncertain situation. Most educators delivered the learning content through online platforms such as video recordings, video conferencing, or any other audio/visual technology medium. Professional practice education was applied by the university as recommended by the World Federation of Occupational Therapists to employ virtual teaching in occupational therapy education (World Federation of Occupational Therapists, 2020). Despite adapting to the new norm in their learning process, participants value more conventional learning methods to enhance their skills and clinical competency. Successful learning was established using (1) experience in authentic contexts, (2) a supportive mentor system, (3) structured portfolio use, and (4) formative and summative assessment (Aukes et al., 2008), which are applied during experiential learning.

The second theme describes how the students adapt to COVID-19 during their educational journey. This theme centred on a consistent thread where participants develop any means of coping strategies to adapt to the situation and how it influences the students’ psychological status and academic performance. Participants advocate their efforts to improve their own knowledge, skills, accomplishments, and personal development in learning skill-

based subjects. Participants committed to the efforts by staying organized, prioritizing tasks, practising self-directed learning, and taking a break when necessary. These are among the coping strategies they used to adapt to the situation. Participants employed self-directed learning take control over the conceptualization, design, implementation, and evaluation of their learning process. A study stated that individuals who do self-directed learning will show dedication to learning with increased motivation and engagement in online learning (Sandars et al., 2020).

Participants describe their feeling of distress as the COVID-19 outbreak has affected their lives as students through various means. Participants express anxiousness about having to fulfil other responsibilities at home eventually causing psychological tolls on them. A study found that 67.1% out of 486 respondents of university students in Malaysia feel stress during the COVID-19 pandemic (Al-Kumaim et al 2020). Therefore, a study suggests considering mobile mental care apps as an effective and efficient way to access mental care, particularly during a pandemic because students prefer mobile apps over face-to-face consultation (Marques et al., 2021). Students are also encouraged to practise personal reflection in expectation of guarded exploration and experience, hence developing a sense of the convenience of steady functioning, learning and development (Aukes et al., 2008).

The third theme represents the downsides and upsides of learning skill-based subjects via ODL. Participants revealed that ODL posed several challenges. Students express the unbearable extent of the study workload during the ODL was conducted. These findings align with a study that found 69.5% of respondents felt an overload of work during the COVID-19 pandemic (Al-Kumaim et al., 2021). This was acknowledged by the participants expressing that an increased workload results in the hassle to keep up with day-to-day activities such as disruption in sleep pattern, cessation of leisure activity and physical strains due to prolonged sitting.

Participants, especially those living in rural areas found that trying to stay connected to the internet was challenging. ODL has a growing interdependence with technology. Therefore, common issues in remote areas are a lack of electricity and internet access serve as barriers to acquiring stable internet (Kanwar et al., 2018). ODL relied heavily on modern technology. Participants expressed that poor internet connectivity results in delayed access to learning materials. Network issues were also evidently experienced by the educators, not just the students (Kop, 2020). Weak signals often interrupt the smooth flow during the class session that includes audio broke, video freeze or there was a lag in communication in the online class. Thus, it causes miscommunication and losing focus among the students. These challenges resonate with participants' choice of embracing face-to-face conventional learning.

Some of the participants needed prompting on what went well, showing that the upsides of ODL were underseen as they perceived more challenges in ODL. Regardless of the downsides, participants value and make use of the various technology available. Participants take the opportunity to discover new online applications for online meetings, learning, conference, and others. The convenience of technology allows lecturers to record the class sessions so that students get to review when needed. A study reported that as long as students have access to a

computer, online classes are possible to be attended by students from any location and at any time (Purwanto, 2020). Participants perceived the advantage of ODL is its flexibility and reduce expenses. ODL allows them to plan their learning independently at any location and time. Additionally, studying from home during ODL allows the students to save their travel time to and from the class giving them a chance to use the time for meaningful activities.

The fourth theme evolved around perceived social support. Staying connected with family and friends provides emotional relief during an episode of distress. The general benefits (GB) model of social support proposes individuals' psychological states, such as positive affect and sense of well-being can be enhanced with social support (Rueger et al., 2016). Participants were also grateful for the presence of faculty members with the effort of channelling any emotional or financial support. A study conducted has proved that social support is a pronounced component to foresee university students' academic accomplishment (Alsubaie et al., 2019). Since all participants received strong social support, it was believed that the reason for achieving good to excellent grades. A systematic review with meta-analysis reported a promising correlation between social support with university students' grade point average (GPA). Given that, not receiving social support contributes to the deterioration of psychological health, academic performance and overall quality of life of students (Mishra, 2020).

## **Conclusion**

There were limited studies that explored the experiences of occupational therapy students studying skill-based subjects via ODL. As one of the research team members was undergoing the same situation, the lack of exploration on this matter drove her interest. The findings revealed four themes to represent the essence of students' experiences: (i) the impacts of COVID-19, (ii) adapting to the COVID-19 outbreak, (iii) the downside and upside of learning skill-based subjects via online distance learning and (iv) perceived supports. Although participants adapted well to the ODL, they emphasised the importance of skill-based subjects to be delivered through conventional learning methods. This study concludes that undergraduate occupational therapy students formed impactful memories despite struggling to study skill-based subjects via ODL. The findings of the study highlight the need for thorough learning strategies to ensure better satisfaction and prevent psychosocial deterioration among students.

## **Recommendations**

There are a few limitations of this study. Above all, the sample was relatively small despite having a thick and rich description of data. The findings of the study may not be transferable to other countries given the differences in context, accommodation, and facilities. Thus, transferring the findings of the study should be made with caution. A larger qualitative study is required to explore the issues and should focus more on how the students want to be helped in the learning process while taking skill-based subjects. This study highlights the

need of (i) the university to look at the quality of the online learning platform and resources, (ii) educators to modernize and restructure their teaching schemes according to the new norm and (iii) attending students' psychological distress to promote the healthy learning process.

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## A Philosophical Approach to Critical Thinking and Conflict

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**Abstract :** The phenomenon of conflict is considered as one of the most essential phenomena of human beings and is a part of their existence. Conflicts are social phenomena that have existed throughout the history of human society against the will of the people. Their existence in social life has transformed them into universal and objective phenomena that exist despite our knowledge and attitudes. These characteristics are imposed on man to study his eternal nature for the benefit of life and progress. The sciences of philosophy and critical thinking provide new concepts for conflict management and transformation. Critical thinking offers a new conceptual approach to dealing with conflicts in human society. The essence of critical thinking is the idea and views of philosophers for a rational and reasoned approach to conflicts. The following paper aims to influence the education and formation of beliefs and a dialectical attitude on the importance of critical thinking in the recognition, understanding, and management of conflicts in society.

**Keywords:** Conflict Management and Transformation, Conflict Resolution, Society, Philosophy.

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### Introduction

Recognizing and treating the causes of conflict in human society remains an important and vital objective of human thought. Conflict follows man from birth to death. In addition to the conflict with oneself, a person must also cope with those that arise and appear in the relationships that he creates with others. The creation of this relationship, between oneself and others, is accompanied by the expectation of conflicts of different natures because the closer we get to the individuality of each one, the more conflicts arise that are caused by the existence of differences about what "I" am and what the other is. Human activity is directly related to the thoughts embedded in his psyche and shaped into world views and habits, that guide him to action.

The path described so far, as well as the one expected to be traversed tomorrow, is a product of the ideas of human society. The formation of worldview ideas and concepts aims at the development of individual human capacities, so that the individual fulfills his social mission in his daily activities. Achieving maximum efficiency in this field is closely related to the growth of individual experiences as well as of society itself, which communicate and feed each other. The development of a democratic society requires not only social cooperation

from all its members, but also the training and development of their capacities at contemporary levels. Philosophical thinking is closely related to the formation of reflective thought, which is achieved through the acquisition and application of the method of reflection, which, for each thesis in the philosophical field, starts with the doubt of its authenticity and its application in practice. The only way to improve our theories and experiences remains to learn and philosophize intelligently, which also creates the necessary conditions for the full use of the acquired experience. When dealing with the phenomenon of conflict in human society, the role and nature of human beings remain essential in the recognition, treatment, and resolution of conflict. In the light of philosophical studies, man has abandoned the fatalistic theory of conflict treatment, the black and white attitude, and replaced it with a contemporary point of view, treating and conceptualizing conflicts as an attempt to overcome obstacles to development and coexistence, as an opportunity for communication. In this process we can progress in achieving our goals.

### **Methodology of the study**

The methodology followed in the design of this study is the research work, which is based on the collection of scientific materials, the use of the literature, the relevant bibliography, and the consultation of the selected literature. After the selection of the scientific materials, their translation into Albanian was carried out, as was the systematization of the existing knowledge in order to select only the necessary information. The last stage that followed contained the processing of the material, thereby crystallizing the entire material. During the literature analysis, we focused on the recognition from a philosophical point of view of the nature of the conflict as well as the role of critical thinking in its treatment and management, enabling the acquisition of new knowledge. For the preparation of the paper, we focused on the selection of original materials for the benefit of deepening the content with scientific concepts and facts.

### **Philosophical concepts about conflict: a new approach to critical thinking**

The themes and variety of problems discussed by ancient philosophers also included the substantive nature of the conflicts. Critical and philosophical thought has aimed to provide strong arguments for the very existence of human life. In this sense, the first foundations of living are based on thoughts about the elements of nature and human society. The elements of nature also include man, who abstracts in an effort to live. Socrates' reasoning is based on the fact that man is a rational being and interacts according to the principles he establishes in his life. Socrates focused on developing the thought: How should one live according to the principles of good? Thus, critical thought put the phenomenon of evil in human life and society under its microscope. In this sense, the goal of the development of human society is the result of his thoughts. Therefore, today's arrival point summarizes the spiral of our concepts and ideas, which precede the level and quality of tomorrow.

Man is the only being to whom nature has given the ability to judge and reason. Reason is the basis of the

thoughts that form the elite. The concepts and worldviews of a society are born and formed by the thinkers who build the foundations of the state itself. Thinking is followed by logic, which is precisely what further develops mental activity. Thinking is a psychic process that accompanies man towards new knowledge, generalizations, and the discovery of laws that determine various phenomena in nature and in society. Through thinking, people manage to get to know the phenomena that surround them more deeply, to penetrate into their essence, and to discover the cause and laws of their development. People practice thinking to realize their goals. Through thinking, people not only manage to plan and organize their activities but also to predict their results. The purpose of human existence is closely related to education and the use of human will for the acquisition of new ideas, in the endless path of knowledge and cognition. On the other hand, any knowledge, which is part of knowledge, creates opportunities for man to use the laws of nature and those of different fields of knowledge to his advantage. Our entire existence is connected to our knowledge of the truth and the world around us. An important element of the thinking process is intuition, which guides the process of cognition in the path of research and enrichment of knowledge for the benefit of human society. In principle, philosophers accept the existence of conflict in nature and objectively before the birth of human society. The German philosopher, Emanuel Kant, treated in his conflict studies the complexity of human nature and, especially, the contradictions that accompany it. His concepts about conflict value it as an instrument of nature through which it realizes its purpose, the establishment of justice and the triumph of freedom.

The German philosopher Georg Simmel thinks that the individual in society always remains in a double relationship with society. The individual is at the same time inside and outside society: he exists both for society and for himself. *"Man in society is not partly social and partly individual. More precisely, his existence is shaped by a fundamental unity, which cannot be accounted for in any other way except through the synthesis or coincidence of two logically contradictory determinations: man both in social connection and in being for himself, both of which are products of society and life from an independent center."* (Cose and Ridener, 2005, p. 127). The field of social science investigates what happens to people and according to what rules they behave, not in relation to how they unfold their individual existence in their generalities, but in relation to how they form groups and are defined by the existence of their group due to interaction. Thus, according to Simmel, *"The forms found in social reality are never refined: every social phenomenon contains a variety of conventional elements. Cooperation and conflict, subordination and supremacy, intimacy and distance, can all be operative in a marital relationship or in a bureaucratic structure."* (Cose and Ridener, 2005, p. 123-124). Due to his nature, man is inclined to see and analyze conflict in two aspects; the first, which includes the factors that favor it, and the second, which includes the factors that fight against it and hinder its progress or development. The appearance of conflicts is relatively difficult to assess. Simmel's views start from a dialectical approach and highlight the dynamic interrelationships and conflicts between the social units he analyzed. Throughout his work, Simmel emphasizes the connections and frictions between the individual and society. In these treatments, the argument for the positive role of conflict in the lives of groups and society occupies a prominent place. The social significance of conflicts has never been seriously discussed. Simmel underlines his critical attitude towards the legacy according to which conflicts have been seen simply as a destructive factor in human relations

and as something that should be prevented as much as possible.

People reach this conclusion by observing only the negative consequences of conflicts in certain individuals or social groups and extending them to the entire society, creating an illusory vision that what happens to any individual or group also happens to the whole society. In addition, people forget that it is these conflicts that, among others, keep them bound to each other in a mutual action, which, in one way or another, necessarily increases and facilitates social integration. Quite important remains the perspective of conflict resolution. This avoids the negative result of the loss of human life and material and financial values, of victory or defeat by only one side, and the creation of a reality based on the triumph of peace, which is always more precious than war, as well as the vision of the common victory. This means abandoning forms and methods that rely on the use of threats and violence. In order to resolve conflicts, traditional attitudes of communication that rely on threats and blame should be avoided. Rather, a right approach involving the use of attitudes and communication based on understanding and cooperation should be adopted first. Also non-threat and non-use of violence methods can help to resolve conflicts. It is very important not to cut off communication and dialogue in any way, because in this way, the conflict would only escalate. Simmel's motto consists of his concept of presenting a peaceful alternative for conflict resolution, while also accepting the opinion and platform of the other side.

### **Understanding conflict: its management and transformation**

The history of human society proves the presence of conflicts in all cells of life as an inherent part of human nature. Man is forced to choose only one alternative behavior towards him; managing and resolving conflicts in a timely manner, avoiding consequences that punish society. The studies of the French philosopher, Jean-Jacques Rousseau, on the causes and origin of the conflict have transformed it into a serious reference in the field of philosophical thought. Rousseau developed an advanced concept for the time on the origin and nature of conflict, which he expressed in the work "The Origin of Inequality among Men". Rousseau showed special interest in typology and conflicts with nature; religious, political, ethnic, social, economic, etc. He stopped at one of the causes and origins of the conflict; that between people in human society, continuing with the argument that inequality, exploitation, slavery, poverty, etc. were born from property. *"The first who, after setting the boundaries of a plot of land, said: This is mine!"* (Rousseau, 2008, p. 89).

The essence of Rousseau's views is focused on the stages of development of human society, where the idea stands out, according to which the essence and main source of conflict in society remain the inequality that has arisen. *"Such as was, or should have been, the genesis of society and laws, which gave new constraints to the weak and new powers to the rich (18th century), destroyed natural freedom once and for all, permanently embedded the law of property and of inequality, by a violent and bold appropriation, they derived an irrevocable right, and for the sake of the gain of some ambition, they finally subjected the whole human race to labor, slavery, and misery."* (Rousseau, 2008, p. 109-110). Rousseau managed to arouse attention and argue before the society of the time about the awareness of the natural right of man to live equal and free. This could

not be ensured in a monarchy that stood on the idea of absolutism and the unlimited powers of the monarch, where everything, every wealth, and every right, which included the human life of an individual or group of people, belonged to him. For Rousseau, social inequality and social injustice were the main sources of conflict.

Another source of conflict today remains economic inequality. Because, on the one hand, the wealth of the rich only increases, while on the other hand, the poverty of the poor only deepens. Even this economic inequality between different layers of society remains a source of conflict. Dwelling on the consequences of these inequalities, Rousseau points out: *"As soon as people began to mutually appreciate each other, and the idea of condescension was conceived in their souls, everyone thought he was right about it, and it was not possible to find a single man with impunity who could do without it. From here began the initial obligations of civilization, up to and among the savages, from this, every voluntary injustice was called a disgrace, from which, together with the harm that flowed from the evil, the injured person saw in it the disregard of his own person, often more unbearable than evil itself"*. (Rousseau 2008, p. 97). Arguments and analysis prompted Rousseau to draw the conclusion that *"social inequality and social injustices cannot, just as the rays of the sun have the same source, but are many, because, along the way, they encounter many breaks, even we, although we have many bodies, only have one soul. I cannot separate myself from the worst soul, nor deny identity with the worst."*(Rousseau 2007, p. 133).

Gandhi sees man from his good side and says that those sides can be developed without limit, and by developing them, a better man and a better world are created for everyone. Gandhi's philosophy was inspired by life's problems that needed solutions. And Gandhi gave them solutions, but always the kind of solutions that were compatible with morality. There are many attitudes and ways of solving or approaching a conflict. Conflicts can be handled badly, poorly, or constructively. Even our daily lives are accompanied by a number of small conflicts that we must face carefully. The ways of handling and resolving the conflict are highly institutionalized and dealt with by the courts. But, in many cases, conflicts are handled carelessly, which leads to bloody clashes, because people apply and rely on the law of the strongest. The point of view of conflict resolution that avoids the negative result of the loss of people's lives and material and financial values, victory or defeat by only one side, and the creation of a reality based on the triumph of peace, remains quite important; it is always more precious than the war as well as the vision of the common victory. This means abandoning forms and methods that rely on the use of threats and violence.

Various philosophers have expressed the opinion that reason and human dignity are another factor, apart from power, that ensures the regulation of interests for the establishment of peace. The philosopher John Locke said that people are basically rational. Most people are able to understand that others also have a number of rights, such as the right to live, for the simple reason that they are humans, and that most of them are willing to respect these rights. Therefore, the way the parties reason and communicate, how they express their feelings and emotions to each other affect the outcome of the conflict. Recognizing the respective responsibilities, verifying and correcting the wrong steps that deviate from the peaceful resolution of the conflict prepare the conditions for

the recognition of the rights of the other party in the conflict. When opponents clarify their positions and listen to each other's points of view, they come to understand each other correctly. As a rule, people who share different points of view with each other ensure a healthy and long-term friendship and relationship. The researcher of conflict resolution, Johan Galtung, starts from the fact that we should not look at conflicts as a win-lose situation, where one party must necessarily win and the other must lose. Instead, he looks for ways to create a win-win situation, where both parties benefit from the solution found. *"Finding a solution that fully satisfies both actors in the conflict is naive and impossible, but this does not mean that the conflict is unsolvable."* (Galtung 2007, p.172).

Galtung's main idea consists of recommending the creation of conditions where both conflicting parties emerge victorious from conflict resolution. All other solutions that tend to create imbalance or that offer victory to only one side are evaluated as short-term and without sustainable perspective. Finding a middle ground between hard and soft is a stepping stone to the right path. If both parties understand that reaching an agreement has long-term benefits, we can undoubtedly say that they are closer to a solution. The permanent or long-term solution to the conflict requires concessions from both parties, who have made the necessary concessions. An obvious positive result is the fact that the parties to the conflict have started down the path of cooperation, abandoning the path of violence and conflict. Caught in the whirlwind of the long process of finding a solution to the conflict, the parties understand and feel that they are now collaborators forced by circumstances to overcome common difficulties to solve the problem. This situation is also known as the time when both parties profit. However, it is important that the parties focus on what is common rather than what divides us. For the full effectiveness of this process, it is required that both parties openly raise and present the issues, interests, needs, and circumstances that caused the initial disagreement.

## Conclusion

Philosophical approaches are the product of the selection of ideas in human society. Knowledge of the world and nature that surround us is the philosophical basis of human existence. Elites and philosophers of different eras through which human society passes have made undeniable contributions. In particular, an important place in the philosophical field is occupied by the concepts of critical thinking theorists, which constitute an innovative and contemporary approach to conflict resolution and management. Critical thinking is the ability to think rationally, which criticizes traditional concepts of using force to resolve conflicts, and the use of pressure, aggression, and military attacks to resolve them. The basis of the philosophy of critical thinking is the concept that only dialogue and holding open talks between the parties are the most fruitful and effective paths to a long-term solution and establishing trust between the conflicting parties. According to philosophers of critical thinking, neither conflicting party is deprived of dialogue and communication between them. They underline that conflict transformation is a process that never ends. Old antagonisms can resurface, just as new ones can arise. Achieving a lasting solution is at best a temporary goal. Much more important would be the ability to build a fair ratio so that it is sustainable and acceptable.



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## Investigation of 6th Grade Students' Cognitive Structures Towards the Concepts of Barcode, Banderol, Patent, Piracy, R&D, and Copyright

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**Abstract:** Concepts It is where the foundation of scientific knowledge and thought structures are laid. Thanks to concepts, distinctions or generalisations about an event or an entity are formed and thought structures are formed in our minds. In this study, it was aimed to determine the associations in the minds of secondary school 6th grade students about the concepts of barcode, banderole, patent, pirate, piracy, R&D, copyright in the 4th unit of the 6th grade social studies textbook and to determine the existing misconceptions. In order to determine the cognitive structures and misconceptions of the students, scanning technique was used as a method. The participants of the study were 60 6th grade students studying at Nazmiye Demirel Secondary School in Isparta city centre in the 2022-2023 academic year. After this test was applied to the students, the words obtained based on the concepts were analysed in detail and then a frequency table showing the frequency of repetition of these words was prepared. Based on the frequency table, cut-off points were determined and concept networks were created. According to the results of the research, when the frequency of association of the concepts in the minds of the students was analysed, it was determined that the key concept that produced the most words was the concept of piracy with 269 words. As can be seen from the table, it was also determined that the most misconceptions existed in the words evoked by this keyword. As a result of the research, it was determined that the keyword with the least number of words produced was the concept of banderole with 143 words. It is predicted that students have both misconceptions about the concept of banderole and learning deficiencies due to insufficient associations.

**Keywords:** Word Association, Social Studies, Misconceptions, Cognitive Structure

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### Introduction

Social Studies course is an interdisciplinary and unified version of the subjects of social sciences (Price, 1965, p.

7), which are related to each other (Çetin, 2013; Keskin, 2019; Tay, 2018). Social studies is a course that enables children to discover themselves and the world, as well as to connect with real life (Barr, 1997). The subject of the Social Studies course consists of important social sciences such as History, Geography, Civics, Sociology, Anthropology, Law (Deveci, Köse & Bayır, 2014; Aslan & Safran, 2016; Sönmez, 2010; Tay, 2018). Social studies as a concept in the world was first used in the early 20th century in the USA in 1913 (Keskin, 2019, p.4). Thomas Jesse Jones mentioned the social studies course for the first time in a magazine called Southern Workman (İnan, 2019, p.12.). According to the definition of the National Council for the Social Studies (NCSS) (1992); "Social studies is a field of study that combines art, literature, and social sciences with an interdisciplinary approach to gain citizenship competencies." (Doğanay, 2008, p. 79; Tay, 2018, p. 6).

In Turkey, the most comprehensive definition of the social studies course is provided in the MEB (2005) Program. According to the MEB (2005), social studies is a course inspired by the concept of collective education that focuses on the contents of social sciences and civic knowledge such as history, geography, economics, political science, anthropology, psychology, philosophy and law, and combines these contents in the context of units or themes in order to fulfill the requirements of being an individual and to guide students; where individuals' human relations and their relationship with the natural environment are examined on the common ground of past, present and future; and is prepared with the inspiration of collective education. In essence, social science subjects are organized at a level that students can understand (Şimşek, 2020, p. 3; Koyuncu, 2015, p. 10).

Social studies as a subject was first taught in the United States. All changes and developments about the curriculum are made by the National Council for Social Studies (NCSS), which was established in 1921 (İnan, 2019, p.14; Aslan & Safran, 2016). In our country, the first time a course called social studies was started to be taught in 1968 (Akpınar & Kaymakçı, 2012, p. 608; Çatak, 2020, p. 24; Kalaycı & Baysal, 2020, p. 108; Yalçın & Akhan, 2019; İnan, 2019, p. 12). Subsequently, some changes were made in the program in 1998, 2005, 2017 and 2018 (Kalaycı & Baysal, 2020, p. 108).

In the content of the social studies course, there are various concepts in the context of being an education-training program (Joubish & Khurram, 2011), whose main theme is human and society, blending social sciences and serving multiple purposes (Çetin, 2003; Sönmez, 2010; Deveci, 2014; Safran, 2008; Tay, 2018; Tokcan, 2015). The most commonly agreed definition of what a concept is that it is the most basic form of knowledge and abstract images that live and are represented in our minds (Beyer & Penna 1971; Braisby, 1999, p. 321; Carey, 2009 p. 220; Fancett, 1968, p. 4; Klausmeier, 1992; Malatyalı & Yılmaz, 2010, p. 321; Yazıcı & Samancı, 2003, p. 158). Bruner stated the concept not as an entity but as a relationship (Matsumoto, 2017, p. 132; Richard, 1968, p.10). Bourneun stated that by combining and classifying concepts with experience, new concepts are born and existing concepts change and develop (Tabachnickh, 1970 p. 9).

By perceiving, interpreting, assimilating or rearranging a newly encountered event, object or idea, the new concept is either added to the existing concept or a different new concept is created. Concepts are the

foundation of scientific knowledge and thought structures (Çaycı, Demir, Başaran & Demir, 2007, p. 624; Yılmaz & Çiviler, 2012, p. 2). Thanks to concepts, distinctions or generalizations about an event or an entity are formed, thought structures are formed in our minds and certain categories are formed, but it would be incomplete if we define concepts only as a category or classification process (Fancett, Johns, Hickman & Price, 1968, p. 4). Because concept learning is the beginning of all cognitive processes and classification is only one of the many functions of concepts. Considering that concepts are in constant interaction with each other, it is a necessity to examine concepts in relation to each other (Solomon, Medin & Lynch, 1999 p. 99).

In the study conducted by Kalaycı and Baysal (2020), when the general objectives of the social studies course are examined, it is seen that concept teaching is included as an objective and always maintains its importance according to the 2005, 2017 and 2018 programs, but compared to the 2005 program, the other programs are a little behind in guiding the teacher in concept teaching. In MONE (2018), in the section of the issues to be considered at the point of implementation of the social studies program, in Article 5, it is emphasized that concept teaching is important directly in the course, for this reason, generalizations and different concept teaching strategies should be used in concept teaching, and attention should be paid to identifying and eliminating concepts, confusion and misconceptions.

Concept learning starts in childhood and continues throughout life (Akçay et al., 2023; Antonio & Prudente, 2022; Bertiz & Kocaman Karoğlu, 2020; Cakir, Ozturk, Unal, 2019; Hwang et al., 2021; Kim & Anderson, 2023; Maddah, 2021; Ozturk, 2023; Ozturk, Kinik, & Ozturk, 2023; Ozturk & Susuz, 2023; Peifer & Taasobshirazi, 2022; Rogti, 2021). The primary and secondary school period is very important in the learning of concepts. Because the child starts his/her first concept learning at school together with the environment (Yılmaz & Çiviler, 2012). While there are concepts acquired spontaneously and randomly in the environment, there are concepts taught purposefully with certain rules at school. For this reason, sometimes the concept learned spontaneously and the concept learned at school may conflict or the concept learned at school may be incorrectly structured in the student's mind. This situation is called misconception. In other words, misconception is when a concept is constructed and learned differently from valid and commonly accepted scientific knowledge (Demirkaya & Karacan, 2016, p.40). The most common problem in concept teaching is misconceptions, which are a problem for both the learner and the instructor (Yazıcı & Samancı, 2003).

It is seen that misconceptions are named differently in domestic and foreign literature and some of them are as follows: Primitive beliefs, erroneous ideas, alternative concept, preconceptions, instant reasoning, persistent traps, spontaneous ideas, alternative frameworks and children's science (Ercan, Taşdere & Ercan, 2010, p. 137). According to Novak (1987), misconstruing the context between two concepts and the conflict between what is perceived and what is a real cause misconception (misunderstandings) and if they are not corrected, they cause incompatibility in new learning. When students encounter some problem situations, they will need to understand and use concepts to solve them (Yazıcı & Samancı, 2003). If these concepts do not have the meaning agreed upon and determined by experts, misconceptions will emerge and students will resist the change of alternative concepts used (Schmidith, 1997; Sözen & Bolat, 2014, p.506). Therefore, teachers should recognize

misconceptions in students and correct them immediately (Novak, 1987, p. 359).

Children begin to form concepts from an early age and if the newly learned concept is compatible with the old concept, the new concept is formed. In this process, there are two other possibilities; either mislearning, i.e. misconception, occurs or the knowledge cannot be formed at all. Concepts and misconceptions occur in two ways. The first one is the spontaneous, environment-based mislearning that the child learns spontaneously before formal education; the second one is the misconstruction of concepts while in formal education with a conscious education at school (Bozoran, 2008; Erdener, 2009). Concepts can be concrete or abstract. The fact that they are abstract necessitates the correct and adequate learning of these concepts. In order for students to internalize the Social Studies course, it is important to learn these concepts well and not to allow misconceptions (Çetin, 2013; Karakuş, 2009; Tokcan, 2015). The social studies course, which includes various subject areas, can be perceived as a mass of verbal and abstract information and may lead students to memorization. In order to realize meaningful learning, attention should be paid to the correct and real learning of concepts. The teaching of the course should start with easy-to-perceive concepts and then move on to difficult and complex concepts (Sözer, 1998, p.76-77).

### *Purpose of the Study*

In this study, it was aimed to determine the words that middle school 6th grade student's associate with the concepts of barcode, banderole, copyright, piracy, R&D and the existing misconceptions within the scope of Science and Technology learning area in the 6th grade social studies textbook 4th unit.

### **Method**

In this research, which aims to determine students' cognitive structures and misconceptions, word association test was used. Word association tests are one of the various methods used to identify misconceptions (Çelikkaya & Şarlayan, 2019, p. 1; Yılmaz & Çiviler, 2012, p. 3). Word association was first proposed by Gal-Ton. Then, Carl Gustav Jung developed word association tests to use individuals' associations between concepts in research. According to Jung, people's thoughts, feelings, experiences and knowledge are interconnected through associations ( Kostova & Radoynovska; 2010).

With this method, the word association test was used to determine the students' associations of the given concepts and the misconceptions that exist in the individual and the cognitive structures of the individuals towards the concepts (Tokcan, 2015, p. 144).

According to İstifçi (2010, p. 360), the term association is the state of making a connection to a certain idea, entity or phenomenon that exists in the human mind, and the shortest way to reveal associations is the free association test. Word association tests provide clues about the associations of these concepts, their level and the

relationships between words.

Word association tests are one of the most widely used methods for determining associations between concepts. In addition to purposes such as diagnosis, diagnosis, measurement and evaluation, word association tests can also be used in different disciplines such as science and mathematics (Ercan, Ercan & Taşdere, 2010; Deveci, Köse & Bayır, 2014; İstifci, 2010).

It has been stated in various studies that the most appropriate time interval for word association tests is 30 seconds (Karaca & Yalçinkaya, 2019; Polat, 2013, p. 104). In this study, students were given 6 key concepts and given 30 seconds for each concept. On the first page, the implementation instructions are given on the second page. Each key concept was written 10 times in a row and distributed to the students and 30 seconds were given for each concept (Bahar, 1999, p. 46; Tokcan, 2015, p. 144). Then, with the teacher's guidance, the students moved on to the next concept and the process continued in this way. For the application of the word association test, students were asked to produce ten words that the concept evoked in their minds for each key concept in order and differently. The aim here is to minimize the risk of chain response. Because if the student does not turn to the key concept again, he/she makes associations according to the word he/she responds to, that is, the word he/she produces, which harms the purpose of the test (Açıkgöz, 2019; Bahar & Özatlı, 2003; Demirer, Ören & F. Ş., 2020; Özdemir, 2016; Tokcan, 2015).

### ***Participants of the Study***

The participants of the study were 60 7th grade students studying at Nazmiye Demirel Secondary School in Isparta city center in the 2022-2023 academic year. The reason for choosing 7th grade students in the study is that they have learned 6th grade concepts. The word association test, which was planned to be applied to 65 students, could be applied to 60 students due to the absenteeism of 3 of the students and the unacceptable answers of 2 students.

### **Data Collection Tool**

In the study, a word association test was used as a data collection tool to determine students' cognitive structures and misconceptions. Word association tests are a practical and time-saving method (Bahar, Nartgün, Durmuş & Bıçak, 2006; Clark, 1970, p. 286; Yavuz, 2019, p.14). Word association tests are also a well-known and frequently used method with a wide range of applications (Bahar, Johnstone & Sutcliffe, 1999). In this study, 6 key concepts belonging to Unit 4 (Science and Technology in Our Lives) of the 6th grade Social Studies textbook were included. These 6 key words were chosen because there was no previous study in the literature, to determine the misconceptions of these words and to obtain information about what these concepts evoke in the minds of students. The concepts are given below with their explanations:

**Barcode:** A system used in all areas of the industry, represented as a black and white line of different thickness, containing detailed information about the product, used to distinguish products from one another, and enabling

the transmission of product characteristics to other media by scanning the product information with some devices without any inaccuracy (MONE, 2019; Peker & Caner, 2006, p. 39).

*Patent:* It is a document registered by the patent office to prove who legally owns an invention and given to the owner for 20 years. With the patent, it is aimed to protect the right to use the invention by preventing the product from being made and used by another person or organization (MONE, 2019, p. 152).

*Copyright:* The right to own, use and reproduce a product of knowledge or ideas is called copyright. In this way, unauthorized use and reproduction are prevented and kept under control. Law No. 5846 "Law on Intellectual and Artistic Works" serves the purpose of copyright (MONE, 2019, p. 152).

*Banderole:* It is a kind of label on most of the products sold, such as electronic goods, food products, books, etc., which cannot be restored to its original shape when damaged, and which shows that taxes are levied by the state and that the products meet the necessary conditions for sale and use (MONE, 2019, p. 151).

*Piracy:* Products (books, movies, DVDs, etc.) that are sold and reproduced in violation of the law, without banderoles, without control, without permission are called pirated. Since it is unauthorized, taxes are evaded and copyright and patent rights are violated. This situation causes losses to the national economy and the owner of the original product (MONE, 2019, p. 140).

*R&D:* R&D is the planned activities carried out to improve the existing knowledge and to make new productions by utilizing the existing knowledge. In this way, the accumulation of knowledge constantly renews itself and progress is achieved in social and economic development (MONE, 2019, p. 140).

### **Data Analysis**

After the word association test was applied to the students, the words obtained based on the concepts were analyzed in detail. Words that were unrelated to the given keywords and words written repeatedly were not included in this evaluation (Akman & Kocoglu, 2016; Kostova & Radoynovska, 2010).

It is assumed that the sequential answers that a student gives to a keyword from long-term memory show the relationship and semantic distance between concepts in the cognitive structure that exists in the individual's mind. The greater this semantic proximity between two concepts, the greater the relationship between concepts and the faster the recall of the concept (Karaca & Yalçınkaya, 2019). If the student's connotation of one keyword is given as an answer for another keyword, it can be said that the student has established a relationship between these words; on the contrary, it can be said that the student is unrelated (Clark, 1970, pp. 271-279; Bahar, Johnstone & Sutcliffe, 1999).

Then a frequency table showing the frequency of repetition of these words was prepared. Based on the frequency table, cut-off points were determined and concept networks were created. Breakpoints show how often the words are repeated in a certain range. In the concept networks, words derived from the key concept were also included and the concepts were associated with each other through common associations. In this way, both the existing relationship was revealed and the existing misconceptions were identified.

In this research, which aims to determine students' cognitive structures and misconceptions, word association test was used. Word association tests are one of the various methods used to identify misconceptions (Çelikkaya & Şarlayan, 2019, p. 1; Yılmaz & Çiviler, 2012, p. 3). Word association was first proposed by Gal-Ton. Then, Carl Gustav Jung developed word association tests to use individuals' associations between concepts in research. According to Jung, people's thoughts, feelings, experiences and knowledge are interconnected through associations (Kostova & Radoynovska; 2010).

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## Results

The findings of the study are presented in tables and figures. Table 1 shows the frequency of the concepts in which the students' associations of the keywords barcode, banderole, copyright, piracy, patent and R&S are specified.



Table 1. Frequency of the words identified for the key concepts

	Words	Barcode	R&D	Piracy	Patent	Copyright	Banderole
1	Advertisement					11	
2	Artist				10	5	
3	Ban					4	
4	Bandit			11			
5	Barcode	5					
6	Black And White Line	10					12
7	Book	7		10			12
8	Brand				4		
9	Captain			3			
10	Code	9	9				
11	Copyright				5		3
12	Counterfeiting			8			
13	Development		15				
14	Discovery		7		6		
15	Experiment		7				
16	Forbidden Broadcast			23			
17	Fugitive			24		8	6
18	Game			5			
19	Illegal			15		12	
20	Internet		10	6			
21	Invention		10		13		
22	Inventor					3	
23	Jurisprudence					9	9
24	Label	6					4
25	Labor					3	
26	Market	23					
27	Money	4		4	3	7	6
28	Movie			25		14	
29	Music					7	
30	Number	10					3
31	Online	3					
32	Ownership				24	20	
33	Pirate						5
34	Pirates Of The Caribbean			27			
35	Price	9					
36	Product	30	11	14	16	9	20
37	Production	7	12		9		
38	Project		6				

39	QR Code	15				
40	Receipt	4				4
41	Research		20			
42	Right			24		28
43	Scan	15				
44	School	6	12			7
45	Science		22			
46	Scientist		26		6	
47	Seafarer			28		
48	Shopping	24				10
49	Social Media					11
50	Social Studies	3	3	3	3	4
51	Song					13
52	Square					11
53	Stolen					8
54	Sword			8		
55	Tape	5				
56	Tax					11
57	Technology		31		7	7
58	Telephone		6			
59	Theft			10		5
60	Trade	10				
61	Unauthorized					5
62	Food And Beverage	23				
63	Law			7		
64	Publication			15		
65	YouTube					15

According to Table 1, it was determined that a total of 228 concepts were produced for the keyword Barcode; 204 concepts for the keyword R&D; 246 concepts for the keyword piracy; 130 concepts for the keyword patent; 192 concepts for the keyword copyright; and 138 concepts for the keyword Banderole. According to Table 1, it was determined that the most frequently responded association was the concept of technology (f=31) associated with the keyword R&D.

In the concept networks given below, the concepts that are included in a certain cut-off range depending on the keywords and their relationships with other keywords are shown. In other words, the frequency of the words associated with the keywords, for example, the concept network for the words whose frequency of repetition is in the range of 20-30 and which are also associated with other key concepts is shown. In the concept network, the arrows were drawn by thinning from high to low frequency.

*Breakpoints and colors set for the generated words*

- The 20-30 frequency range was determined as the first cut-off point and shown with an orange arrow in the concept network.
- The 15-19 frequency range was determined as the second cut-off point and shown with a green arrow in the concept network.
- The third cut-off point was determined as the 10-14 frequency range and shown with a burgundy arrow in the concept network.
- The fourth cut-off point was determined as the 6-9 frequency range and shown with a blue arrow in the concept network.
- The fifth cut-off point was determined as the 3-5 frequency range and shown with a black arrow in the concept network.

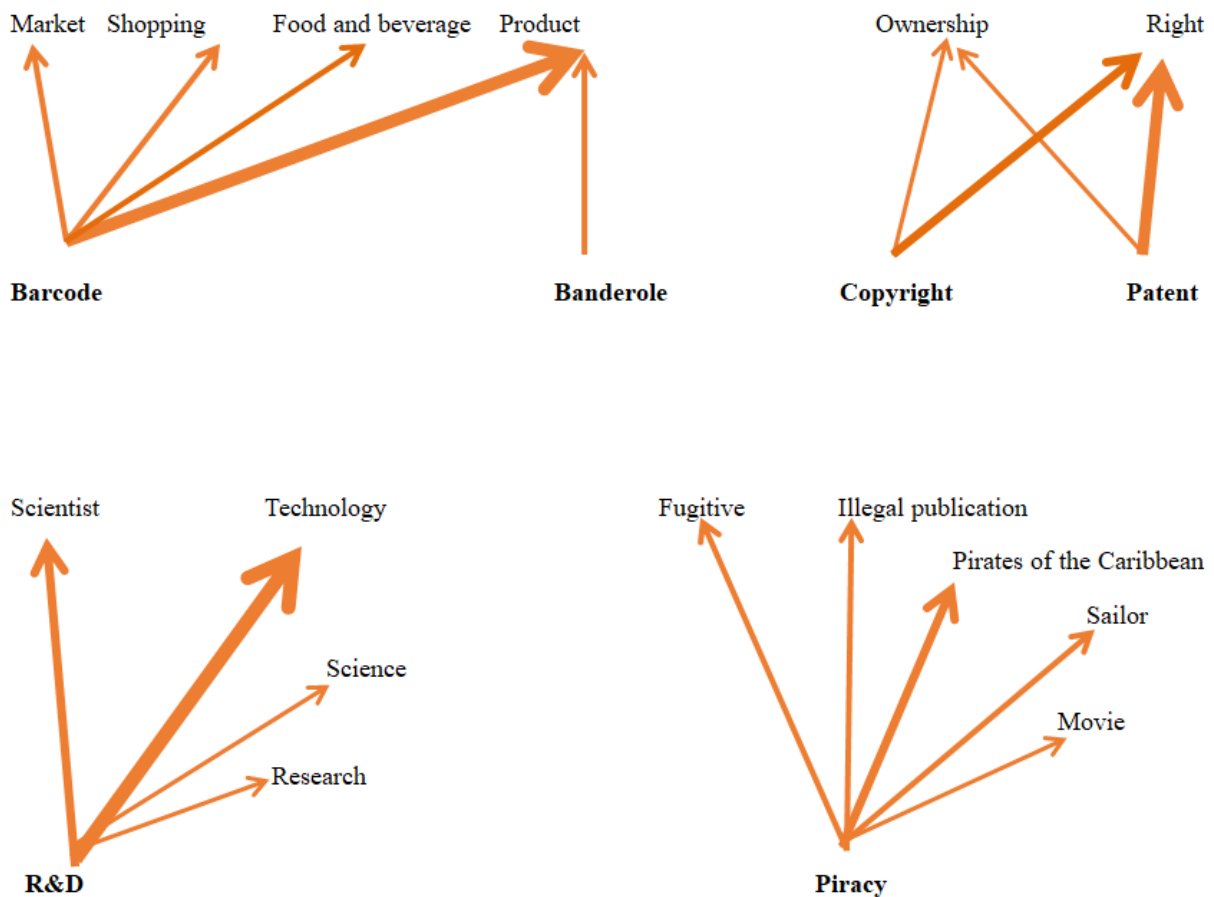


Figure1. Concept network of words with a breakpoint in the range of 20-30 words

According to the concept network given in Figure 1, it was determined that the words in the 1st cut-off range: market (f=23), shopping (f=24), product (f=30), food and beverage (f=23) associations were produced for the barcode keyword. For the keyword R&D: research (f=20), science (f=22), scientist (f=26), technology (f=31). Regarding the keyword pirate: sailor (f=28), movie (f=25), pirates of the Caribbean (f=27), fugitive (f=24),

illegal publication (f=23). Regarding the keyword patent: ownership (f=24), right (f=24) associations were produced. Regarding the keyword copyright: Right (f=28), ownership (f=20) and connotations. It was determined that product (f=20) connotations were produced for the keyword banderole.1. among the words derived in the context of the intercept interval, the word product is the concept with common connotations for barcode and banderole keywords. The words ownership and right were common associations for the keywords copyright and patent.

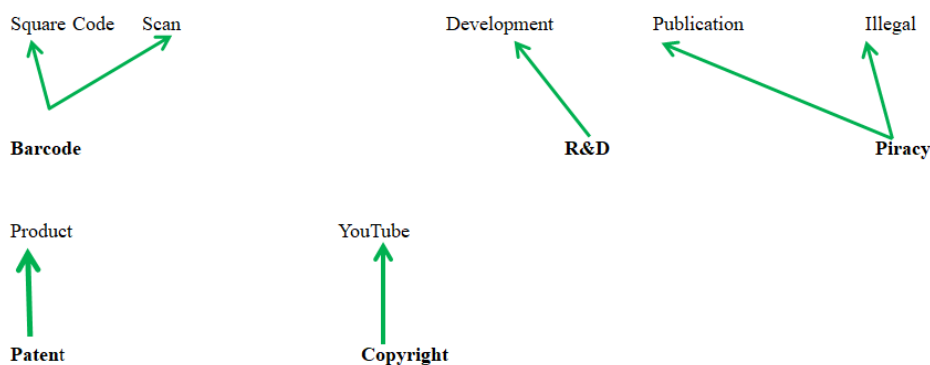


Figure 2. Concept network of words with 15-19 words at the breakpoint

According to the concept network given in Figure 2, the words derived at this cut-off point are: square code (f=15), scan (f=15) associations were produced for the keyword barcode. For the keyword R&D, only the connotation of development (f=15) was produced at this breakpoint. For the keyword piracy, the connotations of publication (f=15) and illegal (f=15) were produced. For the keyword copyright, YouTube (f=15); for the keyword patent, product (f=16) associations were produced. At the 2nd cut point, no associations were produced for the keyword banderole at the 2nd cut point. According to the concept network given in Figure 2.

Words produced based on keywords according to the concept network given in Figure 3: For the keyword barcode, it was determined that black and white line (f=10), number (f=10) and trade (f=10) associations were produced. Regarding the keyword R&D; Internet (f=10), school (f=12), production (f=12), product (f=11), invention (f=10) associations were produced. For the keyword "piracy", associations of product (f=14), book (f=10), bandit (f=11), thief (f=10) were produced.

Regarding the keyword patent, the concepts of artist (f=10) and invention (f=13) were produced. Regarding the keyword copyright: movie (f=14), social media (f=11), advertisement (f=11), song (f=13), illegal (f=12). For the keyword "banderole", connotations of book (f=12), technology (f=12), tax (f=12), square (f=11), shopping (f=10), black and white line (f=12) were produced. At the 3rd breakpoint, it was determined that the product connotation was the common derived concept in the keywords R&D and piracy. The book connotation was derived jointly for the keywords pirate and banderole. It was concluded that the black and white line connotation was the common derived concept for the keywords banderole and barcode. The concept of invention is a co-

produced connotation for the keywords patent and R&D. In the words derived from the keyword copyright, no association with any keyword related to the 3rd breakpoint was detected.

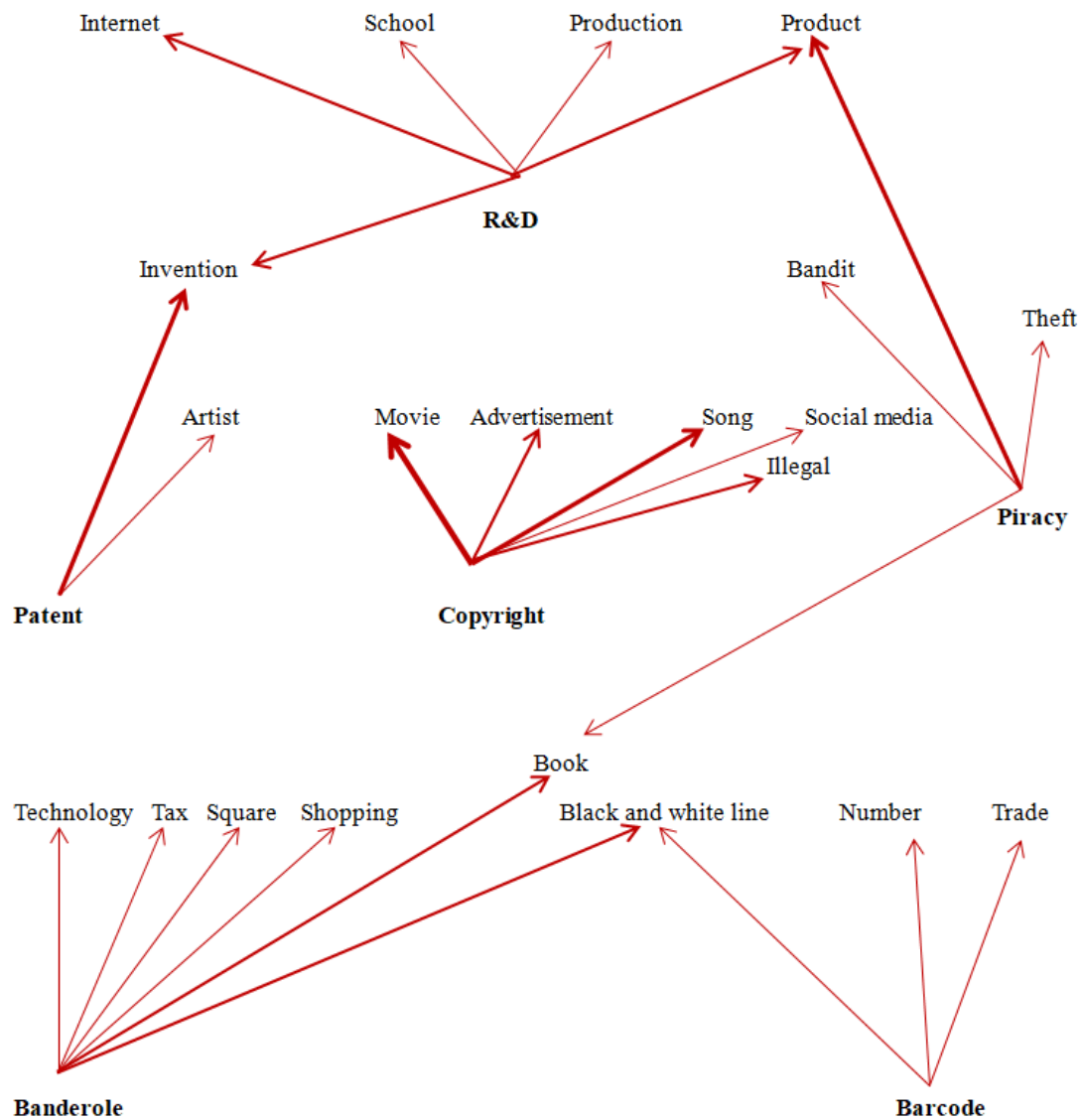


Figure 3. Concept network of words with a breakpoint of 10-14 words

According to the concept network given in Figure 4, the words determined depending on the keywords: for the keyword barcode; label (f=6), price (f=9), book (f=7), code (f=9), school (f=6), production (f=7) associations were produced. Regarding the keyword R&D: discovery (f=7), experiment (f=7), code (f=9), project (f=6), telephone (f=6). Production connotation is the common concept for the keywords barcode and patent. Associations produced for the keyword piracy: Internet (f=6), sword (f=8), counterfeiting (f=8), law (f=7). For the keyword patent: scientist (f=6), discovery (f=6), technology (f=7), production (f=9). Regarding the keyword copyright: stolen (f=8), Jurisprudence (f=9), fugitive (f=8), music (f=7), money (f=7), technology (f=7), product (f=9). For the keyword banderole: Jurisprudence (f=9), fugitive (f=6), school (f=7), money (f=6).

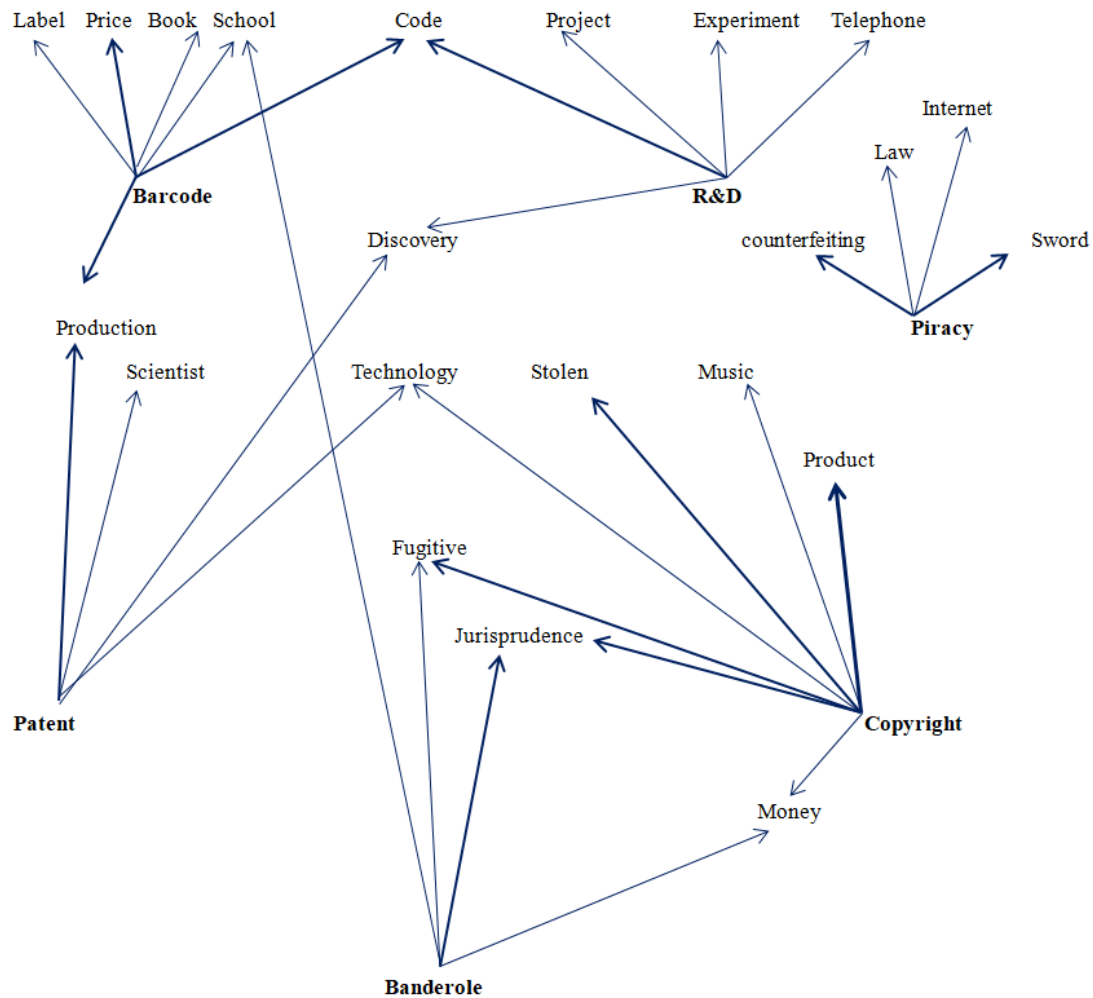


Figure 4. Concept network of words with breakpoint between 6-9 words

It was determined that the connotations of money, law, and illegal were co-produced for the keywords banderole and copyright. The connotation of technology was co-produced for the keywords patent and copyright. Code connotation was co-produced for barcode and R&D keywords. The relationship between the concepts associated with the keyword piracy and the keywords given in this interval could not be determined.

The derived words belonging to the breakpoint given in Figure 5 are as follows: the associations related to the keyword barcode were determined to be the concepts of tape (f=5), barcode (f=5), receipt (f=4), online (f=3), money (f=4), social studies (f=3). Associations related to the keyword piracy were determined as the concepts of captain (f=3), game (f=5), money (f=4), social studies (f=3). Associations related to the keyword patent were determined to be the concepts of brand (f=4), money (f=3), social studies (f=3), copyright (f=5). The connotations related to the keyword copyright were determined to be the concepts of unauthorized (f=5), ban (f=4), social studies (f=3), thief (f=5) inventor (f=3), artist (f=5), labor (f=3). It was determined that the associations related to the keyword banderole were label (f=4), receipt (f=4), copyright (=3), social studies (f=4), number (f=3), piracy (f=5).

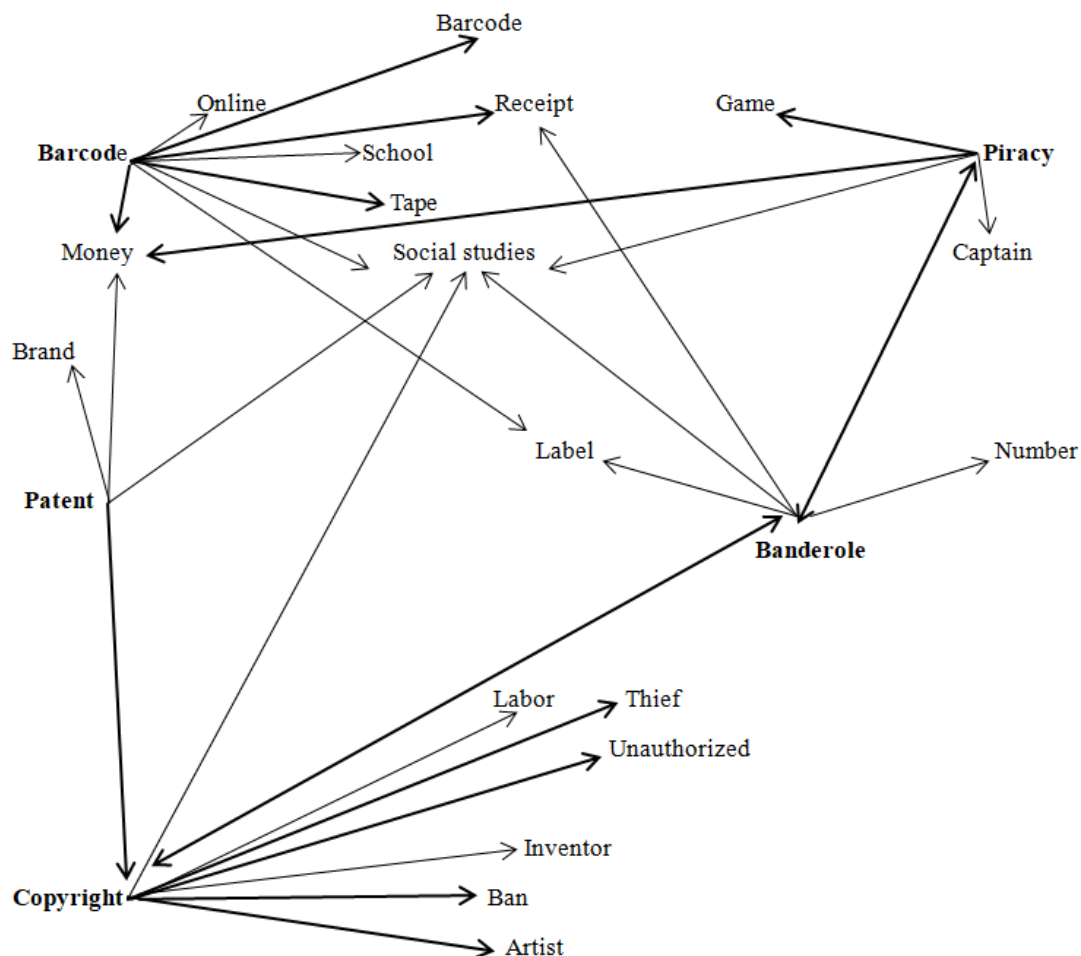


Figure 5. Concept network of words with breakpoint between 3-5 words

At the 5th cut-off point, it is seen that the frequency values decreased, but the words diversified and at the same time the relationships between concepts increased. Except for the keyword R&D, the association of social studies was the concept with which common associations and relationships were established in all other keywords. At the 5th breakpoint, the connotation of label and social studies was the common derived concept for the keywords barcode and banderole, while the connotation of money was the common derived concept for the keywords patent and piracy. It was determined that patent was associated with copyright and learning deficit and misconception were identified. It was determined that banderole was associated with copyright and misconception was determined with learning deficit. It was determined that a direct relationship was established between the keyword banderole and the keywords copyright and piracy. For the R&D keyword, no concept was identified at the 5th breakpoint.

Red arrows were used for barcode keyword, blue arrows for R&D keyword, purple arrows for piracy keyword, green arrows for patent keyword, orange arrows for copyright keyword, and black arrows for banderole

keyword. In the created concept network, arrows were drawn by thinning from high to low frequency.

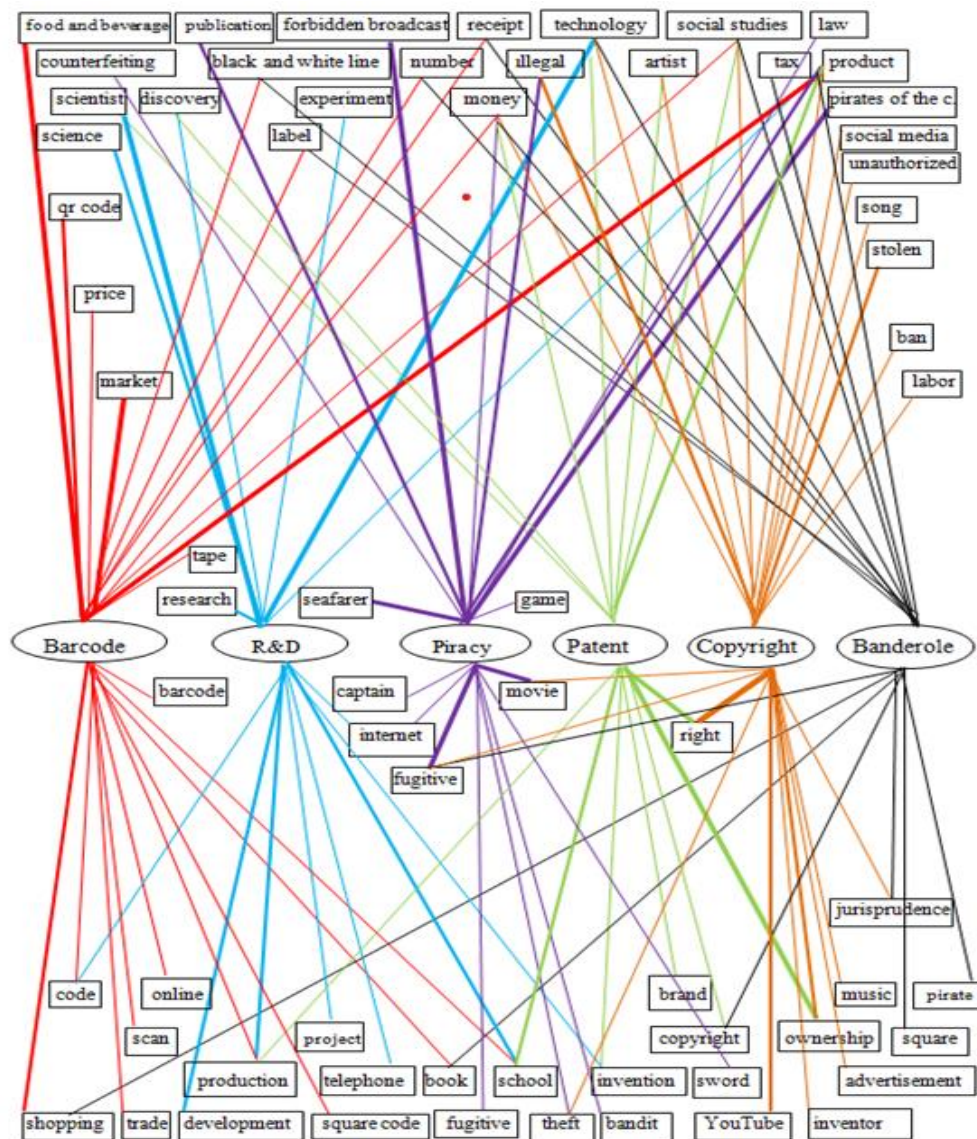


Figure 6. Concept network of associations for the concepts of barcode, banderole, R&D, copyright, piracy, patent

A total of 228 words were produced for the barcode keyword. The word that the students repeated most frequently was the connotation of product (f=30) in the barcode keyword. Then, shopping (f=24), market (f=23), food and beverage (f=23) were the concepts with high frequency. The number of words generated for the keyword R&D was 199 in total and the most frequently associated concept was technology (f=31). Following this concept, the most frequently repeated concepts were scientist (f=26), science (f=22) and research (f=20). It was determined that a total of 246 concepts were produced for the keyword pirate and the most frequently associated concepts were sailor (f=28) and pirates of the Caribbean (f=27), movie (f=25), smuggler (F=24), forbidden publication (f=23). According to Table 1, it was determined that a total of 130 words were produced



for the keyword patent and the most frequently associated concepts were the words ownership ( $f=24$ ) and right ( $f=24$ ). This is followed by the words product ( $f=16$ ) and invention ( $f=13$ ). According to Table 1, a total of 233 words were produced for the keyword copyright, and the most frequently associated concept of right ( $f=28$ ) was followed by ownership ( $f=20$ ), YouTube ( $f=15$ ) and movie ( $f=14$ ). It was determined that a total of 152 words were produced for the keyword banderole and the most frequently associated concept was product ( $f=20$ ). The concept of product was followed by black and white line ( $f=12$ ) and book associations ( $f=12$ ).

### Conclusion and Discussion

According to the results of the research, when the frequency of association of the concepts in the minds of the students was analyzed, it was determined that the most word production was the key concept of pirate. In addition, it was determined that the most misconceptions existed in the words associated with this keyword. It was concluded that the abundance of word associations did not indicate that the concept was learned as it should be. It is assumed that the fact that the word pirate has an abstract meaning in the social studies course and that its use in the concrete sense is popular in daily life and that the lack of sufficient, correct and permanent learning in the social studies course in the abstract sense increases the misconceptions.

As a result of the research, it was determined that the keyword with the least number of words produced and associations made was the concept of patent. It was concluded that students have both misconceptions and learning deficiencies regarding the concept of patent.

It was seen that the concepts with a cut-off range of 3-5 had the most inter conceptual relationships. It was concluded that the concepts with a cut-off point in the range of 20-30 were not related to each other. The key concept with the least misconceptions was determined as R&D. It is seen that the students associated the given keywords with the social studies course, albeit at low frequency values. As a result of the research, it was found that the students had some ideas about the keywords, albeit insufficient, and that they generally used the concepts of barcode and banderole interchangeably with the concepts of copyright and patent, and that they could not adequately construct the abstract concept of piracy in their minds and that they experienced misconceptions.

When the studies were examined, word association tests were mostly used in the field of science course (Akman & Koçođlu, 2016). When the literature is examined within the scope of social studies course, various word association test studies applied to pre-service teachers and students come across. These studies are as follows. grade students' cognitive structures on Atatürk's Principles with word association test (Akman & Koçođlu; 2016), Pre-service teachers' cognitive structures related to the concepts of social sciences and social studies: A word association test application (Bayır, Devenci & Köse, 2014); Analysis of pre-service social studies teachers' perceptions of natural disaster concepts through word association test (Karakuş, 2019); Determination of pre-service social studies teachers' perceptions about the first Turkish states through word association test (WAT)

(Balci, 2019), Analysis of pre-service social studies teachers' cognitive structures about Ottoman and conquest concepts through word association test (Demirkaya, Köç & Ünal, 2020), Analysis of secondary school 8th grade students' cognitive structures about landforms. grade students' perceptions of landforms through a word association test (WAT) (Özkara & Yiğit, 2021), Seventh grade students' perceptions of various occupational groups through a word association test (WAT) (Karaca & Yalçınkaya, 2019), Examining the Cognitive Structures and Conceptual Development Processes of Students with the Social Studies Course "The Adventure of Democracy" Unit (Çelikkaya & Kürümlüoğlu, 2019), Determining the cognitive structures of prospective social studies teachers about Atatürk's Principles through word association test (Er Tuna, 2018), Examining the cognitive structures of 5th grade students about the social studies course (Bozdoğan, 2022), Examining the conceptual development process of students in the social studies course "Let's Know Our Region" unit (Öztürk & Özcan, 2017). Grade students' cognitive structures related to the social studies course (Bozdoğan, 2022), Examining the Cognitive Structures of Gifted Secondary School Students Related to the Concept of Social Studies through Word Association Test (Acar & Arslan, 2022).

In this study, with the word association test, it was aimed to reach the relationships between concepts, associations created by the concepts in students, cognitive perspective and existing learning deficiencies and misconceptions about six concepts within the learning area of science, technology and society. It was concluded that students had deficiencies in making associations about the concepts due to the abstract meaning of the concepts, mislearning and incomplete learning due to the environment or school. Social studies teachers should give the necessary importance to concept teaching in the social studies course, which contains a lot of concepts in order to achieve the objectives of the course, and different concept teaching methods and techniques should be employed (Bozdoğan, 2022).

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## Secondary School Students' Cognitive Structures on the Concepts of Good School and Good Teacher

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**Abstract:** The aim of this research is to reveal the cognitive structures of secondary school students regarding the concepts of "good school" and "good teacher". The survey model was used in this study. The data have been gathered through word association test. The study group of the research consists of 162 secondary school students studying in two different schools (state-private) in Isparta province between 2022 and 2023. According to the research result, it has been observed that students mostly associate the concept of good school with clean, teacher, lesson, student, achievement, environment, and education. On the other hand, the concept of good teacher is associated with the words polite, lesson, love, entertainment, discipline, and information. It was revealed that the students made connections between the concepts of good school and good teacher with the words respect, achievement, discipline, moral, helpful, and student. Finally, when the words associated with the concepts of good school and good teacher are examined by public and private secondary school students, it is understood that the cognitive structures of the students in the two school types are similar.

**Keywords:** Good School, Good Teacher, Cognitive Structure, Word Association Test, Secondary School Students

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### Introduction

Schools, with their own distinctive goals, are institutions where children can gain experiences about life and where they can have peaceful and good time. Schools should not be disconnected from life. Life activities should be integrated with school. Instruction can become regular and consistent if this aim is achieved (Dewey, 2019). One of the factors that make up school culture is the school climate. These two notions can be defined as overlapping concepts. The aim to create positive school climate should be prioritized, especially considering its

huge impact on a student's achievement (MacNeil et al., 2009). Schools have an implicit effect on attitudes of students. These effects are involved within a hidden curriculum itself. Hidden curriculum is an informal program which gives implicit messages in the school culture and which influences the moral structures and attitudes of students (Yüksel, 2004). Implicit messages, which are a part of school culture, have a mission to prepare students for social life as well. Hidden curriculum also affects the quality of instruction activities that are taught at schools. When it has a positive influence on the education process, the attitude of a student towards his school and teachers becomes positive too (Topçu, 2019).

School climate is a set of features that includes physical and social factors that make schools different from other institutions and that affects the psychology of a student and a teacher as well (Grazia & Molinari, 2021). All of these factors that make up school culture play a decisive role in the attitude that a student develops towards his school and teachers as well. There are many variables that are part of the social variables. When all of these variables are made possible, there occurs a positive commitment between a student, a teacher and a school triangle. There is no doubt that everyone who takes part in the education process has a responsibility in building this commitment (Balci, 1988). In order to be effective, schools set goals that they adopt as a principle. Some of these aims are to increase the level of success, develop applications by considering individual differences of students and to provide a suitable learning environment. The schools that fail to accomplish these goals can be defined as ineffective. Schools should organize both their physical environments and educational practices by taking into account the cognitive, affective and psychomotor skills of students. Teachers have responsibilities in organising school and classroom environments. It is the aim and responsibility of a teacher to create harmonious and productive educational environment (Helvacı, & Aydoğan, 2011). An effective teacher should make a classroom environment suitable for learning experiences, involve students in learning process with individual and teamwork, constantly improve herself/himself personally and professionally and should also test students to determine whether their educational activities are efficient enough or not (Seferoğlu, 2004). It should not be assumed that schools and teachers are prepared to develop a single aspect of a student. Providing a multidimensional learning environment in schools also positively affects a student's perception of a school and of a teacher. A good school does not only have a single characteristic. In order for a school to be called good, it must have more than one quality. Being unifying, integrative and not divisive are among the qualities that schools should have. Schools that have contemporary values and that are far from dividing students into groups with stereotypical thoughts as successful or unsuccessful can be defined as good schools that have acquired the right school culture. Good schools are those which are integrated with students, teachers and management (Ball, 1997).

The performance of the teachers in the education process has also been a determining factor on the effectiveness of the process. Teachers' doing their job enthusiastically and playing an encouraging role are effective in adapting students to the educational process. An effective teacher, along with academic competence, should be talented, caring, fair, creative and have a good control over a class (Miller, 2012). A teacher, who is one of the main factors of the education system, is a person who not only conveys information but also has problem-solving skills, acts consistently and follows the developments in the contemporary world, has a good command



of the subject area, and prioritizes the learner (Harrison, & Blakemore, 1992, as cited in Yılmaz, & Güven, 2015, p. 56). Making students active in the process of learning is among the other duties that are given to a teacher. A multi-learning environment should be created and multiple learning methods and techniques should be adopted to achieve this. A teacher should not just be a conveyer of information; she/he should also take a duty as an implementer of what she/he teaches (Dewar, 2002). A teacher's sense of belonging to her/his institution reflects on educational process positively. A sense of belonging is directly proportional to the professional satisfaction of a teacher. The high motivation of a teacher, who has reached professional satisfaction, also increases his/her performance in the education process. These characteristics of a teacher, who is highly motivated and who has made his/her profession effective, will also help to create a positive commitment between a teacher and a student (Güler et al., 2020).

When the literature is analysed, it is seen that the concepts of good school and good teacher are included in various studies. In these studies, the adjective 'effective' is used as a synonym of the word 'good'. Although there are studies involving the concepts of school and teacher (Ada, & Baysal, 2010; Balcı, 1988; Can, 2004; Çobanoğlu, 2017; Güler et al., 2020; Güngör, 2018; Kızıltepe, 2002; Karakelle, 2005; Malikow, 2006; Şahin, 2011; Watkins, & Zhang, 2006), there are no studies that have been carried out to examine secondary school students' perceptions of good school and good teachers. The aim of this study is to reveal the cognitive structures of students regarding the concepts of good school and good teacher.

## **Method**

In this study, the cognitive structures of secondary school students regarding the concepts of good school and good teacher were tried to be explained by using the survey model. The survey model is an approach that aims to describe an existing situation as it is (Karasar, 2009).

## **Participants**

The study group of the research consists of 163 students studying in 5 (n=48), 6 (n=35), 7 (n=35) and 8th grades (n=45) in a private and state secondary schools in the city centre of Isparta. Seventy-eight of the participants are female while the other eighty-five are male.

## **Data Collection and Analysis**

In order to reveal the cognitive structures of the students regarding the concepts determined in the research, the study data were collected through the word association test (WAT). In word association tests, students are expected to produce evocative answer words in their minds about key concepts in a certain period of time (Bahar, & Özatlı, 2003). The first page of the word association test includes an instruction along with an example. Key concepts were arranged in a way that would allow each of them to be on a separate single page

and written ten times one under the other. The students were given 45 seconds for each concept and expected to write down the words that they associate with these concepts. At the end of the time, the students were asked to move on to the next page (Bahar et al., 2008). After having applied the word association tests, concept networks were created in line/in accordance with the frequencies that emerged and cut-off points were determined. Each range of the cut-off points were shown by a separate concept network and symbolized with different colors. The concepts that were in the range of the cut-off points meant that they were repeated as many times as the number of students in that range (Bahar et al., 2008).

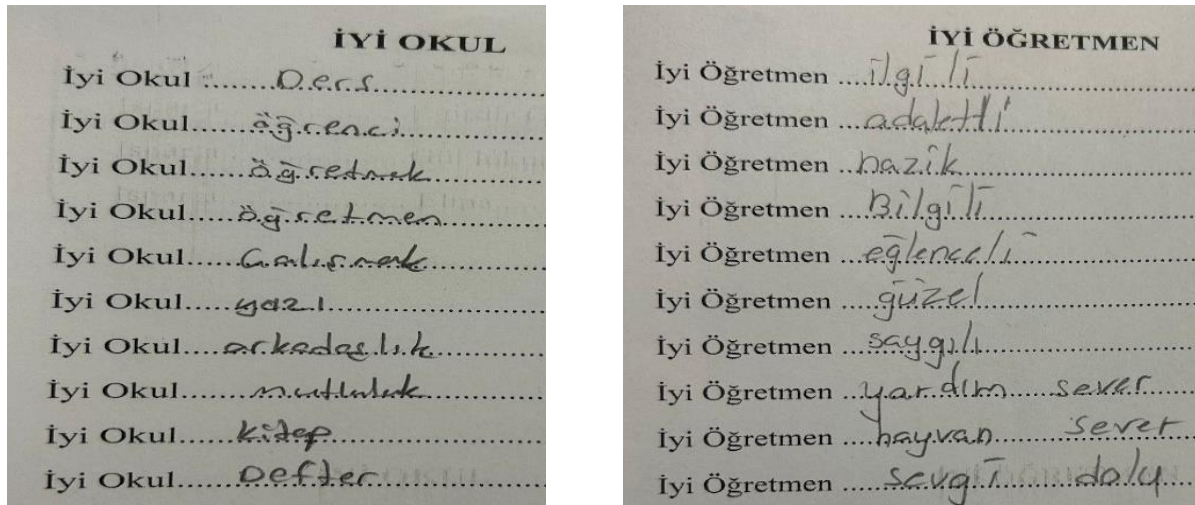


Figure 27. Response sheet of one of the participants

## Results

The results collected in the research are presented with concept networks and figures. The frequencies of the words that emerged in relation to? to the concepts of ‘good school’ and ‘good teacher’ are given in Table 1 and cut-off range is shown with the concept networks. The words that the students of private and public schools associated with key concepts are shown in Figure 1-4.

**Table 1.** Frequencies of words produced related to key concepts

Response words	Key words	
	Good school	Good teacher
Clean	74	3
Teacher	64	-
Lesson	41	51
Student	34	9
Achievement	29	14
Environment	23	-

Education	23	6
Entertainment	21	35
Discipline	19	21
Respect	9	17
Polite	9	52
Food	6	-
Information	5	20
Helpful	5	15
Love	4	50
Interest	3	7
Justice	3	9
Special	1	-
Security	1	-
Moral	1	3
Note	-	1

The words that the students associated with key concepts the most are given in Table 1. The key concept of ‘good school’ was mostly associated with words ‘clean’ (74), ‘teacher’ (64), ‘lesson’ (41), ‘student’ (34) and ‘achievement’ (29); The key concept of ‘good teacher’ was associated with the words ‘polite’ (52), ‘lesson’ (51), ‘love’ (50), ‘entertainment’ (35) and ‘information’ (20). According to the frequencies in Table 1, four ranges were determined for the cut-off points. These ranges are shown by the concept networks below.



Figure 2. Concept network structured for cut-off point 30 and above

Figure 1 was created for concepts with a cut-off point of 30 and above. As seen in the figure, only a word for the concept of ‘good school’ was produced by the students. At this stage, no words were produced regarding the concept of ‘good teacher’.

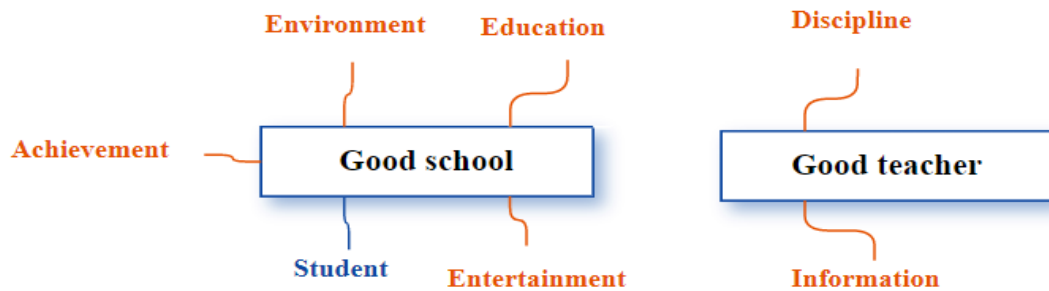


Figure 3. Concept network structured for cut-off point 20 and 29 range

Figure 2 was created for concepts with a cut-off point between 20 and 29. In this concept network, the words ‘achievement’, ‘environment’, ‘education’, ‘entertainment’ emerged for the concept of ‘good school’; the words ‘discipline’ and ‘information’ were produced for the concept of ‘good teacher’. There is no common word that students associate both with the concepts of ‘good school’ and ‘good teacher’.

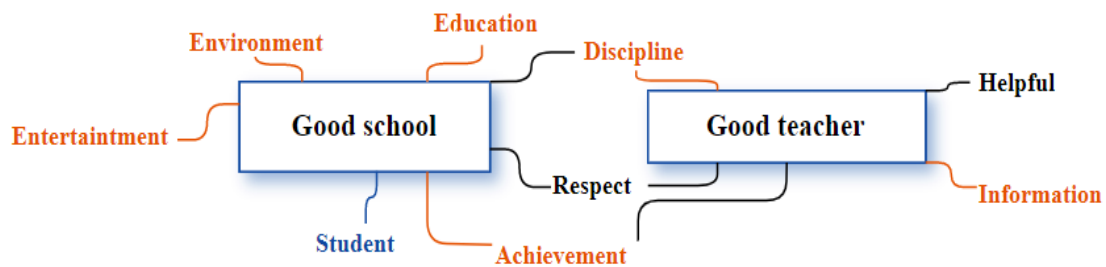


Figure. 4 Concept network structured for cut-off point 10 and 19 range

Figure 3 was created for concepts with a cut-off point between 10 and 19. In this concept network, the word ‘helpful’ emerged for the concept of ‘good teacher’. It is seen that the association between key concepts starts at this stage. As a matter of fact, the association between the key concepts of ‘good school’ and ‘good teacher’ is established with the words ‘discipline’, ‘respect’ and ‘achievement’.

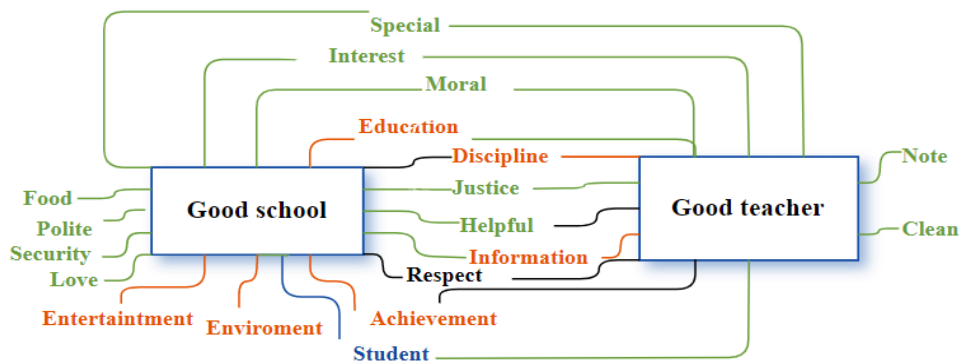


Figure 4. Concept network structured for cut-off point 9 and below

Figure 4 was created for concepts with a cut-off point of 9 and below. The words ‘food’, ‘polite’, ‘security’, ‘love’ emerged for the concept of ‘good school’ while the words ‘note’, ‘clean’ emerged for the concept of ‘good teacher’. At this stage, the words ‘special’, ‘interest’, ‘moral’, ‘justice’, which were associated with both of the concepts emerged. At this stage, the words ‘education’ and ‘student’, which had previously emerged in relation to the concept of ‘good school’, were also associated with the concept of ‘good teacher’. In addition, the word ‘information’ that had emerged in relation to the concept of ‘good teacher’ was associated with the concept of ‘good teacher’ at this stage.

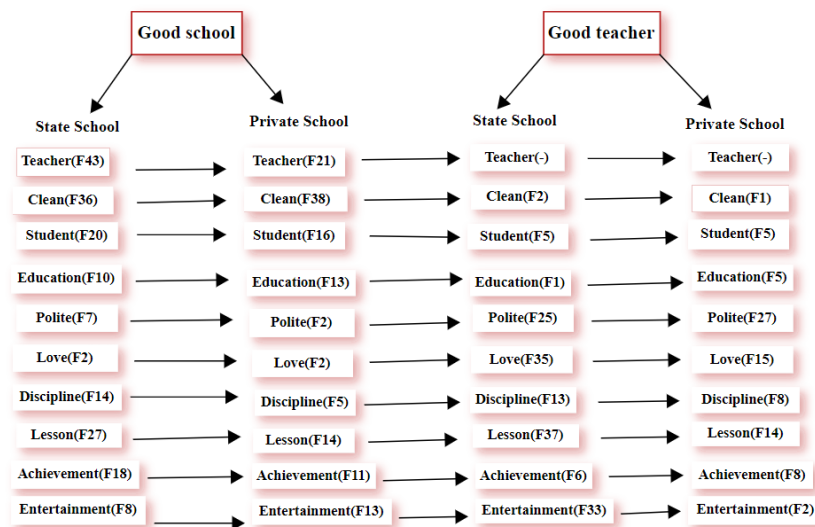


Figure 5. Students' answers to key concepts by school type

In Figure 5, the 10 most frequently repeated answer words related to the key concepts of ‘good school’ and ‘good teacher’ were compared and presented. When the cognitive structures of the students for the concepts of ‘good school’ and ‘good teacher’ are examined according to the school type, it is noticed that the students studying in public and private secondary schools have similar cognitive structures.

### Conclusion, Discussion and Recommendations

In this study, the cognitive structures of secondary school students regarding the concepts of good school and good teacher were examined. As a result of the research, it was found out that the students associated the concept of ‘good school’ with answer words such as ‘clean’, ‘teacher’, ‘lesson’, ‘student’, ‘achievement’, ‘environment’, ‘education’, and the key concept of ‘good teacher’ with answer words such as ‘clean’, ‘lesson’, ‘student’, ‘achievement’, ‘education’, ‘entertainment’ and ‘discipline’. The results of the research have shown that the answer words that students associate with the concepts of ‘good school’ and ‘good teacher’ are generally positive. This case shows parallelism with the literature. Kuyumcu and Özsarı, (2016) in their metaphor study, in which they evaluated the perceptions of 5th and 6th grade students in relation to the concepts of ‘teacher’ and ‘school’, revealed that the general perceptions of the students regarding these concepts were

positive. Students' associating the key concept of good school with the word success is in line with the study carried out by Gökçe and Kahraman (2010). Balcı (1988) emphasized the concepts of success, education, teacher and student while stating the variables that the effective school is associated with.

It has shown that the words discipline, respect, achievement, education, information, student, helpful, justice, morale, interest, special are common investigating the words associated with the key concepts of good school and good teacher. The concept of discipline for the student can also be perceived as the student's behavior in accordance with the school order and taking precautions for all kinds of negative situations (Sarpkaya, 2007). The fact that students see school administrators and teachers as elements reflecting power and authority may have evoked the concept of respect and discipline for students. Increasing success is among the main goals of schools and teachers. It is important to ensure the necessary cooperation between the school administration and the teachers to create a suitable educational climate for the students and make the students feel that they stand by in a possible problem that the student may occur (Döş, 2013). The activities organized to increase school success played a significant role in the emergence of the concept of effective school. Variables of these activities are school administrators, teachers, students and school climate (Ada, & Akan, 2007). In this study, with the students' point of view concepts such as discipline, morale, achievement and respect as the qualities of a good school and a good teacher was supported by studies in the literature. Building a system of values and setting norms at school contribute to the moral and cultural attainment of schools. Success appears as an inevitable product in schools that has a system based on discipline (Şişman, 1997). The fact that school administrators and teachers, who are a part of effective school culture, are sensitive to students' problems, have problem-solving skills and empathize with students, will carry both the school and the teacher to a respectable position in the students' eyes (Yagız, 2016). This study demonstrates that students associate the concepts of good school and good teacher with the concepts of helpful and interest, as they see school administrators and teachers as supporters in problem solving when they need it in school and in the classroom.

Furthermore, the associations with words such as respect, interest, justice, helpful and moral show that students correlate school and teachers not only in cognitive but also affective sense. It has been proved that studies on students' school and teacher perceptions also support this idea. Schools and teachers are not only interested in the cognitive aspect of the student, they want to develop the student in all aspects with a holistic development understanding. The teacher's sense of self, goodness and justice are the affective factors that affect the student (Balcı, 2014). The words they associate with the key concepts of good school and good teacher also reflect the expectations of the students from the school and the teacher. These expectations also constitute the ideal school and teacher model in the minds of students. The emergence of words such as helpful, interest, respect in the study showed that students need school and teachers not only academically but also emotionally. A good teacher is someone who is sensitive to students' social and emotional expectations, respectful of differences and acts fairly (İlter, 2021). Teachers should set an example for students and the environment with their attitudes and behaviors. A teacher who draws the framework of justice and equality correctly and acts in accordance with the adopted moral principles will be accepted as ideal teacher in the eyes of both the student and the environment (Kulaksızoğlu, 1995). Another result of the study is that the perceptions of the students towards the concepts of

good school and good teacher are similar according to the distinction between private and public school types. Based on these similarities, it can be confirmed that private school and public school students have similar cognitive structures.

Based on the results of the research, the following suggestions can be made:

- A similar study can be applied to students at other education levels in order to see the similarities and differences in students' perceptions of a good school and a good teacher.
- Interviews can be conducted in order to obtain more detailed information about the students' perceptions of the concepts of good school and good teacher.
- The study was carried out in a private school and a public school in a city center. The working group can be expanded by including schools in districts and villages in subsequent studies.

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## Competency-Based Education To Teach Translation: Jordan's Graduate Employability

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**Abstract:** Youth make up over half of Jordan's population, and almost half of them are unemployed. Young people experience apathy and frustration due to a lack of employment opportunities and an education system that does not prepare them for the workforce. In Jordanian Higher Education Institutions, student success is our focus. However, we still follow a traditional way of teaching and delivering knowledge. This study aims to promote operating more of a personalized learning approach to increase graduates' preparedness to meet workforce needs in the translation industry. For the purpose of assessing the efficiency of the standing teaching approach in the Translation program, Al-Balqa Applied University (BAU) students were surveyed. With respect to collecting data on the employability skills needed in the market, translation companies/agencies in Jordan were also surveyed. To remedy the gap between academia and industry and to prepare graduates for the market needs, the study proposes reforming the curriculum and teaching methods of the Translation Program to align with the competency-based approach in education.

**Keywords:** *employability skills; translation industry, competency-based education, translator's ethics and visibility.*

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### Introduction

It is essential that the market is provided with competent translators. As highlighted by Daniel Gouadec (2007), universities should award translation credentials only to those who master the translation competencies. Students at Jordanian Higher Education Institutions go from one course to another without being fully competent.

Using competency-based education (CBE) model terminology, a student who receives 50% of the total grade can pass the course and enter the workforce. It is my understanding of CBE that it connects student achievement in the classroom with workforce readiness. To increase employability skills, the Jordanian education system needs to adopt a more personalized approach. Figure 1 below shows what it means by competence. It is a combination of skill, knowledge, and attitude.

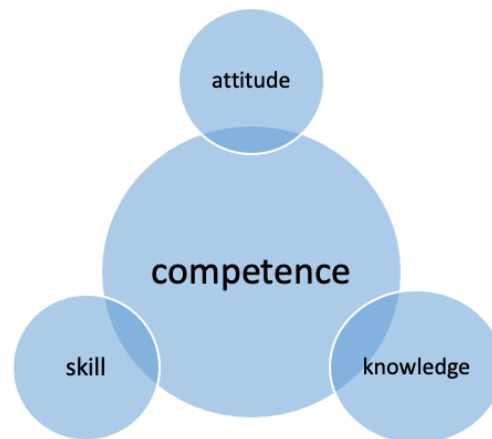


Figure 1. Competence

Despite differences in competence among institutions, learning expectations remain constant. In order to demonstrate competencies, students must engage in activities and experiences aligned with clearly defined programmatic outcomes. Faculty members provide proactive support and guidance to students. CBE is different from self-paced learning in that faculty are still involved, there is some sort of substantive interaction. In order to earn credentials, students must demonstrate mastery, which will differ from institution to institution, so assessment and curriculum design are key considerations. With CBE, the focus shifts from how time is allocated to whether the students can demonstrate well-defined competencies. Through this approach, students can take advantage of their past knowledge, build on their experience, and customize the learning process according to their needs. Instead of advancing to the next level when the semester or term is over, students are measured when they demonstrate proficiency in the material they have been assigned. Ultimately, CBE is about improving the learning outcomes that matter. CBE is an outcome-based approach to earning a college degree or other credentials. Students demonstrate competencies specific to the course at the program level through a structured curriculum and genuine assessment.

How to implement CBE? By making competencies explicit, teachers can help students monitor their progress throughout the semester and steer their learning toward those competencies. Competencies are assessed continuously rather than in a single summative test. Moreover, objective tests may or may not measure what students can do. They may measure knowledge, but do they really measure what they can do? Rather than simply reciting, the CBE assesses whether the student can apply and do. This approach could be applied to assess whether students/alumni have the competencies needed in the workforce and whether they can produce an adequate translation that meets market needs.

## Method

This study, which has two surveys, one for the employer and the other one for the alumni, aims to enhance the Translation graduate employability skills. The population of the study consists of associate diploma (two-year

program) alumni of Translation for three years (2021, 2022, and 2023), taking into consideration that the program has been established recently in 2019. To reach the largest sample possible, the researcher sent out two online surveys of 22 questions each, most of which are closed-ended questions. The first survey form was sent out to BAU alumni of the associate diploma Translation Program while the other one was sent out to various local translation companies/agencies in Amman, Jordan. Alumni and employers were asked to participate in those two web-based surveys; the link to those online surveys was sent to the participants via WhatsApp (a communication app). Of the 70 questionnaires sent to the alumni, 32 were returned, and of the 20 questionnaires sent to the translation companies/agencies, 8 were returned, all the surveys were filled in properly, so all of them were considered and no one was eliminated. The data used in the research were evaluated over 40 questionnaires received from the two samples (alumni and employers).

The return rate of the alumni survey was 46% while the return rate of the employer survey was 40%. It is seen that this rate is sufficient to represent the population. In order to measure the participants' employability competencies, multiple choice questions with multiple answers are formed and scales (from 1 to 5) are used to rate the necessity of using technology in translation and inevitability of work ethics. In the questionnaire form, the purpose of the study was first explained to the participants and then they were asked to fill in the questionnaire form. The average time of the employer form is 7 minutes and 45 seconds while of the alumni form it is 8 minutes and 17 seconds.

## Results

Table 1 shows the findings of the employer survey. All the companies/agencies are local establishments located in Amman (the capital of Jordan). Looking at the number of translators in each establishment, we notice that the size of those establishments varies. Half of those establishments (50%) have only 1 to 2 translators, whereas 25% have 5 to 6 translators. This is reasonable considering the size of the company, especially if we have a look at Talal Abu Ghazaleh Translation Company, one of the largest translation agencies in Jordan. More than 10 translators working for Talal Abu Ghazaleh as full-time and part-time translators, including freelance translators.

It goes without saying that translators could do their work remotely. Translators of written content do not need to commute to the office if they have all the resources and material they need at home. The survey results show that most companies (88%) offer written translation services, with a focus on legal translation (88%). Their focus on written translation gives room for translators to work from home. This explains why 75% of the employers under question prefer translators to work remotely while the rest of the employers (25%) prefer translators to work in a hybrid mode (in-person and remotely). This is valid especially when 63% of the study sample confirm that they hire freelancer translators.

To investigate the skills needed in the translation industry, we need to look into the tasks a translator is

responsible for. A translator does not only render a text into another language but also proofreads that text and sometimes manages the whole translating project. The majority of the employers under question (63%) suggest that a translator is responsible for editing along with translating. 38% of the total employers propose also creating subtitles while another 25% of the total employers propose that a translator is responsible for project management.

To be able to implement those tasks efficiently, a translator needs to master a certain skill set. Within the scope of the research, we use the term employability skills to cover this skill set. The questionnaire divides those skills into five groups (critical thinking skills, interpersonal skills, personal traits, translation skills, and project management skills). When it comes to critical thinking skills, we find that 87.5% of the employers propose that a translator should be able to think creatively, and half of the total employers support the need for problem-solving skills. Likewise, 75% of the total employers agree that organizational skills are essential. For interpersonal skills, the majority of the employers (87.5%) suggest that clear and effective communication is of high priority, the next priority skills are responding to client needs and teamwork with percentages of 75% and 62.5% respectively. For the personal traits category, all employers surveyed believe that a translator should demonstrate a willingness to learn. Whereas the majority, with a percentage of 62.5%, suggest that demonstrating professionalism and flexibility is of high importance.

It is obvious that project management skills are highly needed in the market. 87.5% of the study population (employer survey) suggest that the use of tools and resources efficiently as well as the search for terminology or necessary information are the top needed skills (among the project management skills). Moving into the translation skills group, linguistic competence is the most selected skill with 87.5%. Cultural competence and subject or domain competence come next with a percentage of 62.5% for each. When it comes to linguistic competence, English and Arabic language proficiency should be in high demand in the translation industry. Most employers (75%) advocate for an advanced level of language proficiency (Arabic and English), while some (25%) see that the translator should be a native bilingual.

Along with the multiple-choice questions, the questionnaire contains two scales to rate the need for technology and the necessity of ethics. Half of the employers highly appreciate the use of technology and the possession of work ethics. Speaking in numbers, 50% of the population rate the use of technology and work ethics as high-priority needs on a scale of 1-5. Ultimately, the last set of questions examines the need for translators in the Jordanian Translation market. The findings show that most employers (63%) see that currently there is a real need for translators, while half of the total employers see an increasing need for translators over the next five years.

Table 1. Employer Survey

Question	Options	Percentage
Your translation company/agency is .....	local	100%
	international	0%

	regional	0%
The Translation services you provide:	oral translation (interpretation)	13%
	literary translation	50%
	legal translation	88%
	medical translation	38%
	localization	13%
	content creation	25%
	audiovisual translation	13%
	written translation	88%
Number of translators you have:	1-2	50%
	3-4	13%
	5-6	25%
	7-10	0%
	11 and more	13%
I prefer the translator to work ---- .	from the office	0%
	remotely	75%
	both	25%
What does a translator do?	translating	100%
	proofreading	38%
	creating subtitles	38%
	editing	63%
	project managing	25%
	localizing	13%
I am expecting the need for translators to ----- --- over the next five years.	increase	50%
	decrease	38%
	remain stable	17%
Is there a need for translators in the market?	yes	63%
	no	17%
	maybe	25%
The majority of translators who work for you are...	full-time translators	63%
	part-time translators	25%
	in-house translators	50%
	freelance translators	63%
	male translators	63%
	female translators	75%
What kind of translation is the most needed?	audiovisual translation	12.5%
	literary translation	12.5%
	content creation	25%
	transcreation	12.5%
	non-literary translation	37.5%
	other	37.5%
Competent translators are in---demand	high	37.5%
	average	50%
	low	12.5%
Are the translators at your company competent?	yes	75%
	no	0%
	maybe	25%
What critical thinking and problem-solving skills are needed in the translation industry?	thinks creatively	87.5%
	thinks critically	37.5%
	solves problems	50%
	plans/organizes	75%
What interpersonal skills are needed in the	teamwork and collaboration	62.5%

translation industry?	responding to client needs	75%
	professionalism/work ethics	12.5%
	clear and effective communication	87.5%
	other	37.5%
What personal traits are needed in the translation industry?	demonstrate responsibility and self-discipline	25%
	adapts and shows flexibility	62.5%
	works independently	0%
	demonstrates a willingness to learn	100%
	demonstrate integrity	12.5%
	demonstrate professionalism	62.5%
What English language skills are the most needed in the translation industry?	takes initiative	50%
	speaking	37.5%
	writing	100%
	reading	62.5%
What level of English and Arabic proficiency is needed in the translation industry?	listening	12.5%
	native	25%
	advanced	75%
	intermediate	0%
How do you rate the need to use technology in the translation industry?	fair	0%
	1	12.5%
	2	25%
	3	0%
	4	12.5%
How do you rate the need for work ethics?	5	50%
	1	0%
	2	12.5%
	3	12.5%
	4	25%
What project management skills are the most needed in the translation industry?	5	50%
	meets deadlines	75%
	uses tools and resources efficiently	87.5%
	looks for terminology or necessary information	87.5%
Translation skills needed:	organizes data	37.5%
	cultural competence	62.5%
	linguistic competence	87.5%
	subject or domain competence	62.5%
	transform competence	37.5%
	textual competence	50%
other	12.5%	

Table 2 reveals the data collected from the alumni population. The first question in the survey specifies whether they work in the field of translation or not. 68% of them say yes, they are working in translation -related areas whereas 53% say “no”, they do not work in the field of translation. Here, let us list the most apparent challenges in the translation industry as listed by the study sample. The most selected challenge (59%) is the inessentiality of having a diploma or a professional certificate in translation to practice translating; the market is full of too many translators who do not have credentials. Half of the study sample (alumni survey) suggests that ‘there is no legal protection for translators’ as the second challenge in the market. The next three challenges are 'there are

not enough opportunities in the market' (with a percentage of 47%), low-income fare (with the percentage of 44%), and 'the university did not prepare me for the market' (with a percentage of 44%). Given all these challenges, it makes sense that 69% of the alumni under question do not work for any translation agency or company.

Looking into the type of translation the alumni population craft, we find written translation is at the top with a percentage of 69%. The following genre is the audiovisual translation (more specifically subtitling) with a percentage of 44%. This kind of translation qualifies translators to work from home. 37.5% of the alumni under study work remotely. A lot of them could work as freelance translators. Half of the alumni population (50%) state that they work as freelancers. Since there is no need to commute to the office, a translator could work internationally while they reside in their hometown. 16% of the study population (alumni survey) work locally while 12.5% work internationally.

Whether locally or internationally, a translator is responsible for extra tasks other than translating, such as localizing the content and proofreading the translation. 53% of the alumni surveyed propose that a translator is responsible for editing too, whereas 37.5% of the total alumni suggest content creation as well. To be able to perform those tasks adequately, a translator should be skilled and competent. Only half of the alumni surveyed (50%) consider themselves competent translators while 34% consider themselves relatively competent and the rest (16%) as incompetent yet.

In order to judge whether a translator is competent or not, we need to dig deeper into the employability skills needed in the market. In this regard, we use the same classifications we used in the employer survey as we categorize the skills into five groups (critical thinking skills, interpersonal skills, personal traits, project management skills, and translation skills). Most alumni population under study (84%) agree that a competent translator should be able to think critically. When it comes to interpersonal skills, 72% of the population vote for teamwork and collaboration skills. For the personal traits, I do not see it as a coincidence that the majority of the employers (in the other survey) and the alumni agree that demonstrating a willingness to learn is the most needed personal trait. It goes without saying that project management skills are needed, especially in terms of the search for the right terminology and information with a percentage of 78%. Of course, translation skills are of high importance, cultural competence resides as the most needed one with a percentage of 75% followed by textual competence with a percentage of 69%. It is unquestionable that a translator should be bilingual or fluent in the languages they are translating from and into. Most BAU alumni under study see themselves as native speakers of Arabic (66%) and fluent speakers of English with a percentage of 47%.

With respect to technology use and work ethics, the majority of alumni surveyed give the highest rate for the use of technology with a percentage of 44%. Likewise, most of the total alumni under study (63%) rate work ethics as a highly needed skill as they choose the highest rate (5) on the rating scale from 1 to 5. The last portion of the survey examines the need for translators and the appreciation of translators in the market. Most of the alumni sample (75%) suggest that there is a need for translators in the market. However, translators do not receive the deserved recognition or appreciation. Half of the study sample (50%) indicates that translators are not well

appreciated.

Table 2. Alumni Survey

Question	Options	Percentage
Do you work in the field of translation?	yes	68.5%
	no	53%
What year did you graduate?	2023	62.5%
	2022	19%
	2021	18.5%
What are the challenges in the translation industry?	low-income fare	44%
	inflexible schedule	25%
	not enough work opportunities in the market	47%
	too many translators who do not have a diploma or a certificate in Translation	59%
	copyright issues	22%
	no legal protection for translators	50%
	The university did not prepare me for the market.	44%
I work for a(n) ..... translation company/agency.	local	16%
	international	12.5%
	regional	3%
	none	69%
The type of translation I do:	oral translation (interpretation)	41%
	literary translation	41%
	legal translation	41%
	medical translation	22%
	localization	19%
	content creation	28%
	audiovisual translation (more specifically subtitling)	44%
	written translation (umbrella term)	69%
I work ----.	from the office	12.5%
	remotely	37.5%
	both	31%
What tasks do you implement as a translator?	translating	81%
	proofreading	34%
	content creation	37.5%
	editing	53%
	Project managing	25%



	localizing	31%
Is there a need for translators in the market?	yes	72%
	no	3%
	maybe	25%
I work as a .....	full-time translator	19%
	part-time translator	19%
	in-house translator	31%
	freelance translator	50%
The translators are ..... appreciated in the market.	highly	25%
	relatively	50%
	not	25%
Are you a competent translator?	yes	50%
	no	16%
	relatively	34%
What critical thinking and problem-solving skills do you have?	thinks creatively	37.5%
	thinks critically	84%
	solves problems	62.5%
	plans/organizes	12.5%
	I do not have any of the listed critical thinking skills	16%
What interpersonal skills do you have?	teamwork and collaboration	72%
	responding to client needs	59%
	professionalism/work ethics	56%
	clear and effective communication	62.5%
	I do not have any of the listed interpersonal skills	16%
How do you rate your use of technology?	1	6%
	2	6%
	3	19%
	4	25%
	5	44%
How do you rate your work ethics?	1	3%
	2	16%
	3	6%
	4	13%
	5	63%
What personal qualities do you have?	demonstrate responsibility and self-discipline	66%

	adapts and shows flexibility	59%
	works independently	53%
	demonstrate a willingness to learn	69%
	demonstrate integrity	44%
	demonstrate professionalism	47%
	takes initiative	47%
	I do not have any of the listed personal skills	19%
What is the level of your English proficiency?	native	6%
	fluent	47%
	intermediate	31%
	beginner	16%
What is the level of your Arabic proficiency?	native	66%
	fluent	19%
	intermediate	12.5%
	beginner	3%
What project management skills do you have?	meets deadlines	72%
	uses tools and resources efficiently	56%
	looks for terminology or necessary information	78%
	organizes data	59%
Which of the following translation skills do you have?	cultural competence	75%
	linguistic competence	56%
	subject or domain competence	53%
	transform competence	50%
	textual competence	69%
	other	0%
Extra remarks:	what is best to regulate the translation industry in Jordan?	3%
	not enough translation BA programs in Jordanian universities.	3%

## Discussion

This study aims to bridge the industry-academia gap by enhancing the graduates' employability skills and fostering engagement with the industry. The research findings indicate that there is a need to reform the curriculum of the Translation Program to align the competencies with the market needs. Looking into the market needs revealed in the data collected from the employers, we notice that translators are asked not only to translate but also to perform editing, create subtitles, localize websites, and manage translation projects, sometimes they also proofread others' translations. This is the norm in the Jordanian translation industry, especially when those companies offer translation for various text types, including legal texts, technical texts, literary texts, and others.

In order to craft adequate and efficient translation, the translator needs to master the skill set needed for those genres of translation. Analyzing the alumni responses on the employability skills they were asked in the survey, are BAU alumni competent enough to produce adequate translations for such texts? To address this question, we need, first, to navigate the curriculum of the Translation Program at BAU to check if it covers all those genres of translation, and second, to check if the market-needed competencies are embedded in the curriculum.

Let us start with the legal translation that ranked as the most frequent type of translation. The current curriculum of the Translation program at BAU offers only one course of legal translation in which students are supposed to learn how to translate local documents, such as marriage and divorce certificates as well as leases and business contracts, and international documents, like international agreement, UN releases, and other international official documents. In this sense, they are supposed to be introduced to the legal terminologies and glossaries and to the language used by official bodies like the government or the NGOs. They should also be briefed about the linguistic, cultural, and textual variations of the legal systems. To make the best of the course, students are expected to practice translating some legal excerpts and texts. Could not this be overwhelming and too much for one course? Since the focus of the industry is on this type of translation, would it make more sense to offer two courses, ‘Legal Translation 1’ to translate local documents and ‘Legal Translation 2’ to translate international documents? This same argument applies to technical translation. The program currently offers only one course in technical translation where students are supposed to be able to translate scientific texts, financial texts, business texts, and so on. Would not be of more value to offer two courses in technical or non-literary translation where students have more time and resources to look up technical vocabulary and learn more about technical writing in English and Arabic.

Not to mention that some text types are not part of the curriculum like medical translation or localization. Localization is understood to be taught within the course of audiovisual translation. However, due to the ubiquity of technology and the prevalence of audiovisual mediums, we would suggest localizing websites to be an independent course. The same suggestion could also be applied to the course ‘Technology in Translation’. The findings of the study rank the use of technology as of high priority. Therefore, to meet the expectations of the employers and to be of more added value, we would suggest offering two courses in this field: the first one could cover the basics of general technological tools, electronic resources, and machine translation while the other one is more advanced (on CAT tools and e-translation.). Another online source that could be examined in the advanced Technology in Translation course is ChatGPT, which is a short term for “Chat Generative Pre-Training Transformer”. It is an artificial intelligence software that was developed by OpenAI and released on May 24, 2023. It has demonstrated that it can be of added value and an effective tool for translators as it generates translations with remarkably high accuracy. Students could be taught how to optimize the use of ChatGPT by learning how to write a translation prompt that would enhance the quality of the translation.

Another course that could be suggested to meet the market needs is ‘Translator Ethics’. Strong work ethic skills are highly rated by both groups (the employers and the alumni under study) because they show the translator’s intrinsic motivation for their outstanding performance. If a translator has a strong work ethic, they are more

likely to have efficient organizational skills as well. Accordingly, it is essential for students to orient themselves with the local market code of ethics and the international codes of ethics. Though accountability, impartiality, professionalism, and accuracy could be common principles across various linguistic communities, there could be a disparity in other concepts like adequacy, confidentiality, and fidelity. For example, the American Translator Association envisions collegial behavior, which means a translator does not release negative or offensive remarks on their colleagues' translations but insightful and productive comments instead, as part of its code of ethics and professional practice. Is collegial behavior part of the Jordanian translation market code of ethics? To orient students with various codes of ethics in various countries and sometimes different organizations within the same country, Translator ethics and (in)visibility could be a standalone course. In that course, students would be able to read through different perspectives of translation and look into the literature built around those two rich concepts: translator's ethics and translator's visibility. Translator's visibility, which is thoroughly investigated by Lawrence Venuti in his book *Translator's Invisibility* changes our conception of translation to consider it as an "ethical attitude towards a foreign text and culture, ethical effects produced by the choice of a text for translation and by the strategy devised to translate it" (2008). Venuti as a theorist looks into translation from a different angle. He does not consider translation as a transference neutral unmediated process but rather as a construction of a certain image of the text (2008). By learning such theories and digging deeper into the theoretical frameworks, we put translation theory into practice, widen the scope of translation in the Jordanian market, and get the students to explore different approaches to translation.

Another disparity of the translation norms across cultures is the use of a contract or some kind of agreement tool to regulate the communication between the translator, language service provider, and the commissioner.

One of the key challenges the translator faces, as suggested by the alumni under study, is the lack of legal protection for translators. If a freelance translator receives a translation task and puts a lot of effort into the task, then the commissioner refuses to pay the translator making fake excuses, what could be the options for the translator? Is there some sort of legal measures to protect translators from such commercial fraud commissions? Given all these challenges that translators face, is the translation work well systemized in Jordan? To give a clearer picture of what a systemized framework should look like, let us ask ourselves whether there is a unified national code of ethics in Jordan and whether there is legal protection policy, especially for freelance translators.

Moving to the competencies needed by the translation market, are BAU alumni ready for the workforce? The survey findings reveal that 84% of the alumni population under question are critical thinkers. Likewise, 72% of the study sample appreciate teamwork and collaboration (the most selected interpersonal skill) while 69% demonstrate a willingness to learn (the key personal trait). Are these numbers sufficient to call the alumni population under study competent translators? How about the 16% of the alumni who do not see themselves as critical thinkers? This also applies to the other sets of skills, which are interpersonal skills and personal traits as the percentage of the lack of those skills is 16% and 19% respectively. To enhance the graduates' employability skills, which is the core of this research, the curricula and course description of the Translation program should be reformed to match the needs of the industry. For example, to integrate teamwork and collaboration skills into the curricula, the school could run translation workshops that are separable from the theoretical courses. In the

translation workshops, the focus would be on translation practice and the students would be the leading participants where they form teams and sit in groups. This kind of workshop course would equip the students with not only teamwork skills but also proofreading skills in which they review each other's translations and provide insightful and productive comments.

Another reform technique to cover those employability skills could be having a sustainable partnership with local and international employers. One way to secure this kind of partnership could be to form an advisory committee where stakeholders and translation agency staff sit on the committee along with the academic staff at BAU. Surveys and questionnaires are great tools to collect data from the employer around those skills; however, they are time-specific inputs. In other words, the data is not dynamic. However, the advisory committee could deliver frequent productive insights. To establish that committee, one needs to establish connections with the industry and build pipelines of communication with the employers locally and internationally. This could be done through collaborating with partners who could help facilitate contact with the employers. We should not limit our work to the local market because, according to the data from the alumni survey, there are not enough job opportunities in the local market. To prepare the students for the international market, we need, first, to build linkages with international employers in the field of translation, second, to equip the students with the right skills needed in the international market, and third, to elevate the alumni credentials by linking the academic diploma to an international certificate of translation.

## **Conclusion**

This study contributes to the field of Translation and Education by providing an in-depth and thorough discussion of the competencies needed in the Translation market and by suggesting a novel approach to Translation pedagogy. The competency-based approach suggested in this study embraces all the skills needed in the Translation market. Employers and stakeholders from academia and the private sector should be involved as equal partners in building competency-based education with students and instructors involved. Translation curricula, training, and assessments should be reformed to align with the competencies needed in the workplace. The study findings indicate that there should be a focus on advanced technological tools like translation memories to enhance the quality of translation and to keep the students up to date with all the modern trends in the field of Translation as it is constantly evolving.

## **Recommendations**

This research paper could be expanded to analyze other variables in the data collected by the surveys. For instance, gender variation could be examined. In the Jordanian market, the female translators are more than the male translators. Is this also the case with the global market? Is the Translation industry dominated by women? What could be the reasons? Do women make better translators than men? Another recommendation could be to survey a larger population in which we include other universities in Jordan to see the evaluate the program from

different angles.

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## Malaysian In-Service Science Teachers' Conception of Nature of Science (NOS)

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**Abstract:** Nature of Science (NOS) has been enumerated as one of the important elements in education because robust conceptions of NOS is essential for individuals to be considered as scientific literate. As teachers are vital in imparting sound NOS conceptions to their students, they must possess sound NOS conceptions. However, studies have shown that teachers only possess naive conceptions of NOS which could be potentially passed down to their students during science instruction. So far, studies about in-service science teachers' conception on NOS were conducted in the West. The extensive literature search that was conducted on several renowned platforms found that the existing research available to the public focused on secondary school students or pre-service teachers but not in-service teachers. The conduct of this study bridges the gap in literature and informs relevant stakeholders about the current state of science education in Malaysia. This study shares the findings of a survey conducted with 33 in-service public school science teachers in Selangor, Malaysia. Results show that most teachers possess mixed conceptions about NOS. This study has implications on informing relevant stakeholders about the need of including NOS as a part of teacher training programmes and the need to conduct training sessions with in-service science teachers on NOS.

**Keywords:** Nature of Science (NOS), Nature of Science (NOS) Conceptions, In-Service Science Teachers

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### Introduction

Global advancements are occurring every single day. Scientific and technological breakthroughs have continued to allow access to a wide range of knowledge. This creates the necessity for individuals to be scientifically literate to make informed decisions for the benefit of all citizens around the globe.

“Science should be regarded as a basic human right around the globe” (Maqbool et al., 2014, p.2). Science has gained more global attention over the years. Findings show that many countries have begun to place a greater emphasis on students achieving scientific literacy as their curriculum goals. For instance, United States of

America (Fortus et al., 2022), New Zealand (Bull et al., 2010), Singapore (Vinodhen, 2020), Thailand (Yuenyong & Narjaikaew, 2009) and many more including Malaysia (Mohd Syafiq Aiman Mat Noor, 2021).

Teachers play a crucial role for this goal to be achieved. Teachers were identified as the most prominent factor that contributes to learning in the classroom (Demirdogen et al., 2015). Hence, it is important for teachers to have profound Nature of Science (NOS) conceptions. This is because NOS education is essential for scientific literacy and an informed populace (Höttecke & Allchin, 2020). It is clear that one cannot teach what they do not know. This study aims to investigate Selangor lower-secondary in-service teachers' NOS conceptions. Investigating Malaysian in-service science teachers' NOS conceptions is the first step in ensuring that NOS is taught in Malaysian classrooms.

So far, studies about in-service science teachers' NOS conceptions were conducted in the West. The extensive literature search that was conducted on several renowned platforms such as ResearchGate, Academia and many more, did not yield results to Malaysian in-service teachers' NOS conceptions. Moreover, it was found that the existing research available to the public focused on secondary school students or pre-service teachers but not in-service teachers. The conduct of this study bridges the gap in literature and informs relevant stakeholders about the current state of science education in Malaysia.

## **Nature of Science (NOS)**

Nature of Science (NOS) is a hard to define concept. In the past years, researchers and philosophers have been debating on what NOS constitutes but have not reached consensus on a unified definition for NOS. The definitive list of the NOS tenets that will be wholly accepted by all does not and will not exist (Lederman & Lederman, 2019).

To explain it further based on Constructivism, "Constructivists believe that human learning is self-constructed where learners build new knowledge upon the foundation of previous learning" (Jain et al., 2013). Individuals actively develop their own perception of the universe based on their interactions with others and their surroundings. There will be a difference in the researchers and philosophers' point of view on what NOS constitutes.

Notwithstanding the difficulties in defining NOS, philosophers and educators agreed that pupils must comprehend these aspects of NOS, as delineated by Lederman et al. (2002) which includes:

**The Empirical Nature of Scientific Knowledge Science** is at least partially based on observations of the natural world, and "sooner or later, the validity of scientific claims is settled by referring to observations of phenomena" (AAAS, 1990, p. 4). However, scientists do not have direct access to most natural phenomena. Observations of nature are always filtered through our perceptual apparatus



and/or intricate instrumentation, interpreted from within elaborate theoretical frameworks, and almost always mediated by a host of assumptions that underlie the functioning of scientific instruments (Lederman et al., 2002, p.499).

**Observation, Inference, and Theoretical Entities in Science.** Students should be able to distinguish between observation and inference. Observations are descriptive statements about natural phenomena that are directly accessible to the senses (or extensions of the senses) and about which observers can reach consensus with relative ease. For example, objects released above ground level tend to fall to the ground. By contrast, inferences are statements about phenomena that are not directly accessible to the senses. For example, objects tend to fall to the ground because of gravity. The notion of gravity is inferential in the sense that it can be accessed and/or measured only through its manifestations or effects, such as the perturbations in predicted planetary orbits due to interplanetary attractions, and the bending of light coming from the stars as its rays pass through the sun's gravitational field. An understanding of the crucial distinction between observation and inference is a precursor to making sense of a multitude of inferential and theoretical entities and terms that inhabit the worlds of science. Examples of such entities include atoms, molecular orbitals, species, genes, photons, magnetic fields, and gravitational forces (Hull, 1998, p. 146) (Lederman et al., 2002, p.500).

**Scientific Theories and Laws.** Scientific theories are well-established, highly substantiated, internally consistent systems of explanations (Suppe, 1977). Theories serve to explain large sets of seemingly unrelated observations in more than one field of investigation. For example, the kinetic molecular theory serves to explain phenomena related to changes in the physical states of matter, the rates of chemical reactions, and other phenomena related to heat and its transfer. More important theories have a major role in generating research problems and guiding future investigations. Scientific theories are often based on a set of assumptions or axioms and posit the existence of nonobservable entities. Thus, theories cannot be directly tested. Only indirect evidence can be used to support theories and establish their validity. Scientists derive specific testable predictions from theories and check them against tangible data. An agreement between such predictions and empirical evidence serves to increase the level of confidence in the tested theory. Closely related to the distinction between observation and inference is the distinction between scientific theories and laws. In general, laws are descriptive statements of relationships among observable phenomena. Boyle's law, which relates the pressure of a gas to its volume at a constant temperature, is a case in point. Theories, by contrast, are inferred explanations for observable phenomena or regularities in those phenomena. For example, the kinetic molecular theory serves to explain Boyle's law. Students often (a) hold a simplistic, hierarchical view of the relationship between theories and laws whereby theories become laws depending on the availability of supporting evidence; and (b) believe that laws have a higher status than theories. Both notions are inappropriate. Theories and laws are different kinds of knowledge and one does not become the other. Theories are as legitimate a product of science as laws (Lederman et al., 2002, p.500).

**The Creative and Imaginative Nature of Scientific Knowledge** Science is empirical. The development of scientific knowledge involves making observations of nature. Nonetheless, generating scientific knowledge also involves human imagination and creativity. Science, contrary to common belief, is not a lifeless, entirely rational, and orderly activity. Science involves the invention of explanations and theoretical entities, which requires a great deal of creativity on the part of scientists. The leap from atomic spectral lines to Bohr's model of the atom with its elaborate orbits and energy levels is an example. This aspect of science, coupled with its inferential nature, entails that scientific entities such as atoms and species are functional theoretical models rather than faithful copies of reality (Lederman et al., 2002, p.500).

**The Theory-Laden Nature of Scientific Knowledge.** Scientific knowledge is theory-laden. Scientists' theoretical and disciplinary commitments, beliefs, prior knowledge, training, experiences, and expectations actually influence their work. All these background factors form a mindset that affects the problems scientists investigate and how they conduct their investigations, what they observe (and do not observe), and how they interpret their observations. This (sometimes collective) individuality or mindset accounts for the role of theory in the production of scientific knowledge. Contrary to common belief, science never starts with neutral observations (Popper, 1992). Observations (and investigations) are always motivated and guided by, and acquire meaning in reference to questions or problems, which are derived from certain theoretical perspectives (Lederman et al., 2002, p.501).

**The Social and Cultural Embeddedness of Scientific Knowledge.** Science as a human enterprise is practised in the context of a larger culture and its practitioners are the product of that culture. Science, it follows, affects and is affected by the various elements and intellectual spheres of the culture in which it is embedded. These elements include, but are not limited to, social fabric, power structures, politics, socioeconomic factors, philosophy, and religion. Telling the story of hominid evolution, which is central to the biosocial sciences, may illustrate how social and cultural factors affect scientific knowledge. Scientists have formulated differing storylines about hominid evolution. Until recently, the dominant story was centred on the man-hunter and his crucial role in human evolution (Lovejoy, 1981), a scenario consistent with the White male culture that dominated scientific circles until the early 1970s. As feminist scientists achieved recognition in science, the story about hominid evolution started to change. One story more consistent with a feminist approach is centred on the female gatherer and her central role in the evolution of humans (Hrdy, 1986). Both storylines are consistent with the available evidence. Myth of The Scientific Method One of the most widely held misconceptions about science is the existence of the scientific method. The modern origins of this misconception may be traced to Francis Bacon's *Novum Organum* (1620/1996), in which the inductive method was propounded to guarantee "certain" knowledge. Since the 17th century, inductivism and several other epistemological stances that aimed to achieve the same end (although in those latter stances the criterion of certainty was either replaced with notions of high probability or abandoned altogether) have been debunked, such as Bayesianism, falsificationism, and hypothetico-deductivism (Gillies, 1993). Nonetheless, some

of those stances, especially inductivism and falsificationism, are still widely popularised in science textbooks and even explicitly taught in classrooms. The myth of the scientific method is regularly manifested in the belief that there is a recipe-like stepwise procedure that all scientists follow when they do science. This notion was explicitly debunked: There is no single scientific method that would guarantee the development of infallible knowledge (AAAS, 1993; Bauer, 1994; Feyerabend, 1993; NRC, 1996; Shapin, 1996). It is true that scientists observe, compare, measure, test, speculate, hypothesise, create ideas and conceptual tools, and construct theories and explanations. However, there is no single sequence of activities (prescribed or otherwise) that will unerringly lead them to functional or valid solutions or answers, let alone certain or true knowledge (Lederman et al., 2002, p.501).

**Myth of The Scientific Method.** One of the most widely held misconceptions about science is the existence of the scientific method. The modern origins of this misconception may be traced to Francis Bacon's *Novum Organum* (1620/1996), in which the inductive method was propounded to guarantee "certain" knowledge. Since the 17th century, inductivism and several other epistemological stances that aimed to achieve the same end (although in those latter stances the criterion of certainty was either replaced with notions of high probability or abandoned altogether) have been debunked, such as Bayesianism, falsificationism, and hypothetico-deductivism (Gillies, 1993). Nonetheless, some of those stances, especially inductivism and falsificationism, are still widely popularised in science textbooks and even explicitly taught in classrooms. The myth of the scientific method is regularly manifested in the belief that there is a recipe-like stepwise procedure that all scientists follow when they do science. This notion was explicitly debunked: There is no single scientific method that would guarantee the development of infallible knowledge (AAAS, 1993; Bauer, 1994; Feyerabend, 1993; NRC, 1996; Shapin, 1996). It is true that scientists observe, compare, measure, test, speculate, hypothesise, create ideas and conceptual tools, and construct theories and explanations. (Lederman et al., 2002, p.501) .

**The Tentative Nature of Scientific Knowledge.** Scientific knowledge, although reliable and durable, is never absolute or certain. This knowledge, including facts, theories, and laws, is subject to change. Scientific claims change as new evidence, made possible through advances in thinking and technology, is brought to bear on these claims, and as extant evidence is reinterpreted in the light of new theoretical advances, changes in the cultural and social spheres, or shifts in the directions of established research programs. Tentativeness in science does not arise solely from the fact that scientific knowledge is inferential, creative, and socially and culturally embedded. There are compelling logical arguments that lend credence to the notion of tentativeness. Indeed, contrary to common belief, scientific hypotheses, theories, and laws can never be absolutely proven irrespective of the amount of supporting empirical evidence (Popper, 1963). For example, to be proven, a law should account for every instance of the phenomenon it purports to describe. It can logically be argued that one such future instance, of which we have no knowledge whatsoever, may behave in a manner contrary to what the law states. Thus, the law can never acquire an absolutely proven status. This equally holds in the case of theories (Lederman et al., p.502).

It could be seen from the NOS tenets that there is an emphasis whereby science is an ongoing process of inquiry. Scientific knowledge that we have now will be subjected to revision. This is due to the fact that Science is dynamic. Medawar (1982) stated that Science is a social enterprise not an “isolated search of the truth” (p.116). Collaboration and communication between different philosophers, researchers and scientists is evitable. These ideas are well aligned with Constructivism which asserts that individuals construct their own understanding of the world by being actively engaged in the learning process and through interacting with others. It can be inferred that the theoretical basis of the seven NOS tenets is Constructivism as it emphasises that it is necessary for individuals to play an active role when constructing scientific understanding. The development of scientific knowledge relies on communicating and collaborating with one another.

Hence, the various lists compiled by other researchers and philosophers are still accepted and used in various studies. Some lists were delineated by drawing consensus between the findings and conclusions of other researchers and philosophers. For instance, the seven NOS tenets delineated by Chen (2006) which will be discussed in Views on Science Education (VOSE) Questionnaire section.

### **Views of Science Education (VOSE) Questionnaire**

This study, however, subscribes to the NOS tenets delineated by Chen (2006) who drew consensus among different researchers including Lederman.

The NOS tenets delineated by Chen (2006) which includes:

**Tentativeness of scientific knowledge.** On the one hand, scientific knowledge is durable and not easily changed. On the other hand, all scientific knowledge is subject to change. The change could take at least two forms, evolutionary (Popper, 1975/1998) or revolutionary (Kuhn, 1970). New knowledge may arise by refining the old knowledge according to new evidence or interpreting data from a new standard and worldview (Chen, 2006, p.806).

**Nature of observation.** Observations are theory laden due to the existing possibility of the assumptions and preconceived ideas of the observer (Chen, 2006).

**Scientific methods.** A universal scientific method is non-existent. Various methods will be applied by scientists when conducting research (Chen, 2006).

**Hypotheses, laws, and theories.** A hypothesis is generally used to represent an immature theory, a speculative law, or a prediction of experimental results (McComas, 1996). A law is used to express what has been observed and to predict what has not yet been observed (Carnap, 1966/1998). A theory

is defined in many ways by philosophers of science (Carnap, 1966/1998; Hacking, 1983; Radder, 2003; Suppe, 1977). In this text, theory is defined as an explanation of phenomena and associated laws according to Benchmarks for Science Literacy (American Association for the Advancement of Science, 1993). Furthermore, scientists create theories and laws to interpret and describe phenomena. Theories and laws are two different types of knowledge. They both have substantial supporting evidence, and one does not become the other (Chen, 2006, p.806).

**Imagination.** Imagination is a source of innovation. Scientists use imagination, along with logic and prior knowledge, to generate new scientific knowledge. Imagination and creativity are often presented together in documents of science education reforms. However, the pilot study found that students who object to imagination and creativity as aspects of NOS have more doubts about imagination but fewer problems with creativity. Therefore, VOSE focuses on imagination to avoid the mixed results created by these two terms (Chen, 2006, p.806).

**Validation of scientific knowledge.** This issue focuses on how a theory is accepted by the science community. In principle, the merit of a theory is evaluated based on empirical results. Nevertheless, the science community may also choose a theory by conventions like simplicity and the reputation of the theory's proposers. Furthermore, the norm of the paradigm such as a particular way of practising science, a worldview, and core theories may influence the science community's judgement of competing theories (Chen, 2006, p.806).

**Objectivity and subjectivity in science.** Scientific knowledge is empirically based. Scientists try to be open-minded and apply mechanisms such as peer review and data triangulation to improve objectivity. On the other hand, personal beliefs, values, intuition, judgement, creativity, opportunity, and psychology all play a role in scientific activities. Additionally, science and scientists are influenced by the society, culture, and discipline in which they are embedded or educated. This subjectivity may be reflected in their observations, interpretations, use of imagination, and theory choice. In this text, subjectivity is used to represent factors other than objectivity and rationality (Chen, 2006, p.806).

The original questionnaire by Chen (2006) consists of a total of 15 questions. Each question in the questionnaire covers different NOS tenets or a combination of NOS tenets. After reviewing the original questionnaire, the researchers decided to extract questions 1 to 9 for the purpose of the research, which is to assess the teachers' NOS conceptions. This decision is in consideration of the relevance of the questions towards the said objectives of the study. Teachers' knowledge on the seven NOS tenets were able to be tested via the 9 questions extracted.

Table 1.NOS Tenets, Philosophical Positions, and Item Number Tested by VOSE adapted from Chen (2006)

NOS Tenets	Position	Items
Tentativeness	Revolutionary	4A

	Cumulative <i>b</i>	4B
	Evolutionary <i>b</i>	4C
Nature of observations	Theory laden	8A, 8B, 8E
	Theory independent	8C, 8D
Scientific methods	The universal scientific method <i>b</i>	9A, 9B, 9F
	Diverse methods	9C, 9D, 9E
Theories and laws	Epistemology	
	Discovered <i>b</i>	5A,5B (Theory),6B (Law)
	Invented	5D,5E,5F (Theory),6D,6E (Law)
	Discovered or invented	5C (Theory), 6C (Law)
	Comparison	
	Laws being more certain <i>b</i>	7A, 7B
	Different types of ideas	7C, 7D
Use of Imagination	Yes	3A, 3B
	No <i>b</i>	3C, 3D, 3E
Validation of Scientific	Empirical Evidence	1A, 1H
Knowledge	Paradigm	1C, 1F
	Parsimony	1D
	Authority	1E
	Intuition	1G
Subjectivity and objectivity	Subjectivity	
	Parsimony	1D (Actual)
	Authority	1E (Actual)
	Paradigm	1C, 1F, 8Ad, 8B (Actual)
	Personal Factors	1G, 8Ad (Actual)
	Sociocultural Influence	2A, 2B(Actual)
	Imagination	3A, 3B(Actual)
	Methodology	9D (Actual)
	Neutral	1B (Actual)
	Objectivity	
	No influence of socioculture	2C, 2D(Actual)
	Use no imagination	3C, 3E(Actual)
	Based on experimental facts	5B, 6B, 8D(Actual)
	No influence of personal beliefs	8C (Actual)
	Methodology	8E, 9A, 9B(Actual)
	Overall	1A, 1H(Actual)

## Method

This study is a part of a bigger research that examines lower-secondary in-service teachers' NOS conceptions as well as how these teachers integrate their NOS conceptions into practice. The report will focus only on the quantitative data obtained which regards lower-secondary in-service science teachers' NOS conceptions. The instrument adapted for this questionnaire was the Views of Science Education (VOSE) questionnaire by Chen (2006). After reviewing the original questionnaire, the researchers decided to extract questions 1 to 9 for the purpose of the research, which is to assess the teachers' NOS conceptions. This decision is in consideration of the relevance of the questions towards the said objectives of the study.

The questions were then combined into a Google Form with a five-point Likert-scale that can be distributed online to the participants of the study. The questionnaire is available in both English and Bahasa Malaysia (BM), the national language of Malaysia. This allows the participants to answer the questionnaire in their preferred language. The BM version was professionally translated by the Malaysian Institute of Books and Translation to ensure accuracy.

Each question consisted of a main statement and participants were required to rate how much they agree or disagree to the options which represent different philosophical standpoints that is in-response to the main statement using the five-point Likert-scale.

Prior to the distribution of the questionnaire, a pilot test was conducted to ensure the clarity of the questions and also to identify other issues with the questionnaire before putting it into use in the actual study. No issues were identified with the questionnaire during the pilot test.

The study commenced after obtaining the necessary permission to conduct the study. A total of 33 lower-secondary in-service science teachers answered the online questionnaire. Assessing teachers' NOS conceptions is crucial. Inadequate NOS conceptions contribute to misconceptions about NOS.

Teachers are the key players in instilling accurate NOS conceptions to students. Therefore, teachers must have accurate NOS conceptions to teach the right NOS conceptions to students. By answering the questionnaire, data which regard lower-secondary in-service science teachers NOS conceptions can be obtained.

The data collected via the questionnaire were analysed descriptively. Individual results for each participant were calculated. An analysis based on participants' conceptions per tenet was also conducted to provide an in-depth view on participants' NOS conceptions.

## Results

As mentioned, the total number of teachers who answered the questionnaire are 33 lower-secondary in-service

teachers. The data collected via the questionnaire were analysed descriptively. The mean score of each participant and mean score per NOS tenet were derived.

A total of three categories to provide meaning for the mean scores derived which includes naive conceptions, mixed conceptions, sophisticated conceptions. In the situation when the mean score of a participant falls between 1.00 to 2.50, the participant possesses naive conceptions of NOS. In the situation when the mean score of a participant falls between 2.51 to 3.49, the participant possesses mixed conceptions of NOS. In the situation when the mean score of a participant falls between 3.50 to 5.00, the participant possesses sophisticated conceptions of NOS.

Table 2. Categories determined with indicators and descriptions

Range of Mean Scores	Categories	Descriptions
1.00 to 2.50	Naive Conceptions	Possess mostly naive NOS conceptions
2.51 to 3.49	Mixed Conceptions	Possess some naive and sophisticated NOS conceptions (often equal amounts)
3.50 to 5.00	Sophisticated Conceptions	Possess mostly sophisticated NOS conceptions

A difficulty during the calculation process was whether to include neutral responses, whereby the participants selected “3- uncertain or no comment” as a response to the items in the questionnaire when calculating the overall mean of the participant as well as the mean score per tenet. This is because selecting a neutral response does not necessarily mean that the participant has a naive conception of NOS.

The researchers are of the view that the neutral response from the participant may just indicate that participants do not have knowledge on that area to make a stand or does not want to make a stand. It is unfair to include the neutral response of the participant when calculating the mean score as the mean score calculated will not be an accurate representation of the participants’ NOS conceptions.

### Individual Results of Each Participant

Table 3. Overview of Number of Participants in each category

Range of Mean Scores	Categories	Number of Participants
1.00 to 2.50	Naive Conceptions	5
2.51 to 3.49	Mixed Conceptions	24
3.50 to 5.00	Sophisticated Conceptions	4



Out of the 33 participants, 5 participants fall under the category of having naive NOS conceptions, 24 participants fall under the category of having mixed NOS conceptions while 4 participants fall under the category of having sophisticated NOS conceptions. This shows that the majority of the teachers have mixed NOS conceptions.

### Mean Score Per Tenet

Table 4. Mean Score Per NOS Tenet

NOS Tenets	Mean	Category
Tentativeness	4.22	Sophisticated
Nature of Observations	2.91	Mixed
Scientific Methods	2.19	Naive
Theories and Laws	3.41	Mixed
Use of Imagination	3.10	Mixed
Validation of Scientific Knowledge	2.41	Naive
Subjectivity and Objectivity	2.78	Mixed

Table 5. Overview of NOS Tenets that fall under each category.

Range of Mean Scores	Categories	Quantity of NOS Tenets
1.00 to 2.50	Naive Conceptions	2
2.51 to 3.49	Mixed Conceptions	4
3.50 to 5.00	Sophisticated Conceptions	1

Out of the seven NOS tenets, only the mean score of Tentativeness falls under the category of sophisticated conceptions. This shows that most participants believe that scientific knowledge is subject to change and science in an ongoing endeavour.

Four NOS tenets which include Nature of Observations, Theories and Laws, Use of Imagination as well as Subjectivity and Objectivity falls under the category of mixed conceptions which means that the participants have a mixture of some naive and some sophisticated conceptions of the tenets.

Based on the results above, it could be seen that the participants have naive conceptions for two of the seven NOS tenets which includes Scientific Methods and Validation of Scientific Knowledge.

## Discussion

This study investigates in-service lower secondary science teachers' NOS conceptions in Malaysia. As shown in the findings, most teachers fall under the category of having mixed NOS conceptions. This is similar with the findings of Akerson et al. (2009), Dogan & Abd-El-Khalick (2008), Dumcho Wangdi et al., (2020) and Guerra-Ramos et al. (2010) whereby it was found that naive conceptions and numerous misconceptions were possessed by science teachers. Comparing the results of this study to studies that were conducted locally, such as studies conducted by Eng (2002) and Nyanaseakaran (2004) as cited in Jain & Luaran (2020) have shown that secondary students' conception of NOS is only at satisfactory level. A study by Jain et al. (2013) on pre-service teachers possess partial understanding of NOS and possess several misconceptions of NOS. These findings are similar to the findings of the study. However, it is not surprising that the current results of this study are similar with the results obtained by Jain et al. (2013) which was conducted over a decade ago as limited actions have been taken to educate teachers about NOS.

Studies have shown that NOS conceptions can be improved when NOS issues were explicitly raised during intervention. This is because inquiry sets a suitable context for the development of informed NOS conceptions. Abd-El-Khalick (2012) suggests that it is important for an opportunity to reflect about the inquiry experience as it is the core for an individual to develop a sound NOS conception (explicit-reflective approach). Didactic and implicit teaching is ineffective in the development of sound conceptions of different aspects of NOS (Lederman & Lederman, 2019). A study by Kelly & Duschl (2002) states that NOS is learned, like language, by being part of a culture which cannot be taught directly. Kelly & Duschl (2002) findings support the findings of Abd-El-Khalick (2012) as well as Lederman & Lederman (2019).

As mentioned, the current educational goal of Malaysia is to achieve scientific literacy and the key players that determine the success of this goal are the teachers. It is important for teachers to have sophisticated NOS conceptions as the naive NOS conceptions of teachers may be passed down to their students during science instruction. If these naive conceptions were passed down by the teachers and are not challenged, future generations will also possess naive NOS conceptions.

This study has implications on informing relevant stakeholders about the need to include NOS as a part of teacher training programs and the need to conduct training sessions with in-service science teachers on NOS. This study also identified the tenets that need reinforcements which may help in determining the focus of the development of the training programs with pre-service and in-service science teachers.

## Conclusion

Table 3, Table 4 and Table 5 show the findings of the study. The findings above show that most teachers have mixed NOS conceptions. This shows that immense efforts are needed to enhance teachers' NOS conceptions.

Inaccurate NOS conceptions should be properly addressed. This is to ensure that Malaysia's current educational goal of achieving scientific literacy could be met. As teachers have inaccurate NOS conceptions, these “NOS conceptions” may be passed down to their students which distance the future generations of Malaysia from the nation’s educational goal.

## Recommendations

This study reveals that Malaysian lower-secondary in-service teachers NOS conceptions. On this basis, it is prudent to look at teachers’ practices and teachers’ pedagogical content knowledge in integrating NOS in science instruction.

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## Curriculum Development Process with Personalized Learning Model in Early Reading for Autism Spectrum Disorder Students


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**Abstract:** Reading can be a way to increase students' social interaction and writing, especially for the need to continue to a higher level of education. Students with Autism Spectrum Disorder (ASD) show deficits in reading skills. Recent research shows that there is heterogeneity in this population, which is accompanied by a lack of personalized learning facilities. That way, there is a gap between students, learning, and the support they need. This research aims to produce a curriculum design based on personalized learning with the help of interactive media in beginning reading skills. The curriculum development model used is the Nicolls model. The results of the study show that curriculum development using the Nicholls model can be used for curriculum development in Special Schools (SLB). This is because the model emphasizes contexts and situations where curriculum decisions need to be made. In addition, the results of a limited trial show that this curriculum design is effective for students with ASD. This can be seen from the increase in student learning outcomes in beginning reading skills, especially in introducing words, syllables, and letters. Future research is described in this paper.

**Keywords:** curriculum development, personalized learning, autism spectrum disorder, early reading, sas method

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### Introduction

Reading skills are cognitive abilities combining information interactions and individual knowledge bases to achieve reading goals (Richards & Burns, 2012; Mart, 2012; Bojovic, 2010; Cline, Johnstone, & King, 2006). Meanwhile, with their reading skills, readers can create new knowledge and information that can be shared with others (Zajic, Solari, Grimm, McIntyre, & Mundy, 2020; A.Thompson & SusanSonnenschein, 2016). The

importance of mastering reading skills has the essential skill of listening to someone speak, and they have higher success in writing when they have a strong knowledge base through extensive reading (Richards & Burns, 2012). In addition, reading supports academic skills in continuing to the next level of education (Kaya, 2015). Thus, reading skills become a fundamental skill to be mastered by every student.

Most reading studies involving children with Autism Spectrum Disorder (ASD) have reported specific challenges with reading comprehension as well as the ability to read words as a whole (Zuccarello, et al., 2015; Brown, Oram-Cardy, & Johnson, 2013; Nally, Healy, Holloway, & Lydon, 2017). However, more recent investigations have highlighted that children with ASD exhibit a variety of reading profiles that differ across a range of reading sub-skills, including phonological awareness, decoding, fluency, and comprehension (Johnels, Carlsson, Norbury, Gillberg, & Miniscalco, 2018; Nation, Clarke, Wright, & Williams, 2006; McIntyre, et al., 2017; Singh, et al., 2017). This is because students with ASD have brain development disorders that affect language skills, one of which is in the aspect of reading (Nally, Healy, Holloway, & Lydon, 2017; Paramesti et al., 2021; Munir et al., 2018).

The changing conditions of society, schools, and students support the view of curriculum development as a never-ending activity (Nicholls & Nicholls, 2018). In its implementation, educators of students with ASD in Special Schools (SLB), have been challenged with the hope of improving their students, both in terms of daily and academic skills (Petersen, 2016). However, the diversity of students with ASD continues to increase (Nilsen, 2017). Meanwhile, the teaching system in the classroom provides the same learning resources to different students, so there is concern that there is a neglect of student learning needs (Zhou, Zhang, Zhang, & Xu, 2021; Khoirunnisa et al., 2021). That way, there is a gap between students, learning, and the support they need. This is a challenge for educators to learn according to their abilities (Mariage, Englert, & Plavnick, 2021; Munir et al., 2021). Until recently, teachers struggled to differentiate reading instruction for children with ASD (Accardo & Finnegan, 2017).

Based on the description above, the authors designed a study to develop a personalized learning model-based curriculum using augmented reality to improve ASD student's reading skills. With this in mind, the author tries to offer a new perspective on curriculum implementation, which is implemented through personalized learning models and technology.

## Method

The process of developing a personalized learning-based curriculum assisted by AR media in the early reading skills of ASD students uses the Nicholls curriculum development model (Nicholls & Nicholls, 2018), which consists of five stages, namely: (1) Situational analysis; (2) Selection of objectives; (3) Selection and organization of content; (4) Selection and organization of methods; (5) Evaluation. Nicholls & Nicholls (2018) emphasize a rational curriculum development approach, especially the need for a curriculum that arises from

changing situations. They argue that change must be planned and introduced rationally and validly according to a logical process, which has not been the case in most changes. The existing stages facilitate the alignment of teaching and assessment and the alignment of teaching and curricular goals (Trachtenberg, 2020).

In the situational analysis stage, interviews were conducted with the Principal, distributing questionnaires to class teachers, and reviewing documents. In addition, make observations to identify and analyze student characteristics related to learning outcomes. The results of interviews, questionnaires, and observations were collected by selecting essential points according to research needs. At the selection of objectives stage, the determination of learning objectives was formulated by looking at the syllabus of the 2013 curriculum on Indonesian subjects and based on the results of the ASD students' initial reading ability, who then conducted focus group discussions with ASD experts. At the selection and organization of the content stage, the teaching materials used were adjusted to the student's abilities, and discussions were held with ASD experts as well as Indonesian books for elementary schools in determining them. Then in the selection and organization of methods, the method chosen is the Structural Analytic Synthetic (SAS) reading method with a personalized learning (PL) model. The SAS method can meet the needs of curious children, and educators try to provide teaching materials appropriate to the development and experience of children's language; with the SAS method, teaching materials are given through a structured approach. This method begins with the presentation of words break down into syllables and letters that stand alone and recombined them starting from letters into syllables and words. Meanwhile, the PL model selected to increased student involvement and achievement. It is hoped that motivation and learning focus will increase significantly in personalized learning in line with students' interests. The steps in this PL model are conveying goals and preparing Students, Organizing Student Choices and Votes, Accessing Information, Developing Knowledge, and Providing Feedback. In addition, the media used in the learning process is Augmented Reality (AR), with the development flow using the Linear Sequential Model by Pressman (Pressman, 2015). Finally, at the evaluation stage, it is carried out on all curriculum components to obtain an overview of the quality of a product. Expert judgment was carried out by one curriculum expert and an autistic expert, as well as an analysis of the improvement in learning outcomes for four students using the Early Grade Reading Assessment (EGRA) instrument (Gove & Wetterberg, 2011).

## Results

The results of the situational analysis stage found that students have different abilities in this beginning reading skill. In reading the word, some students still need help. On the other hand, some students still cannot distinguish the pronunciation of the letters m and n, as well as p and b. Students learning styles are different; some like to be complemented by music and pictures and interspersed with drawing or coloring. The development of *Bahasa Indonesia* curriculum, especially in reading skill material, has not been developed optimally according to the needs of students. Materials and evaluations given to students have not been adapted to the abilities of students. The selection of objectives stage gives results as shown in Table 1.

Table 11. Basic Competencies, Indicators, and Learning Objectives




Material Load	Basic Competency	Indicator	Learning Objectives
<i>Bahasa Indonesia</i> – Reading	Describe vocabulary about various types of objects in the surrounding environment through short texts (pictures, writing, and/or song lyrics) and/or environmental exploration.	Shows letters in Indonesian / local language vocabulary	Students are able to show letters in Indonesian / local language vocabulary
	Pronouncing vocabulary about various types of objects in the surrounding environment through short texts (pictures, writing, and/or song lyrics) and/or environmental exploration.	Pronounce vocabulary in Indonesian / local languages	Students are able to pronounce vocabulary in Indonesian / local languages.
		Pronouncing syllables in Indonesian / local language vocabulary	Students are able to pronounce syllables in Indonesian / local language vocabulary.
		Pronouncing letters in Indonesian / local language vocabulary	Students are able to pronounce letters in Indonesian / local language vocabulary.



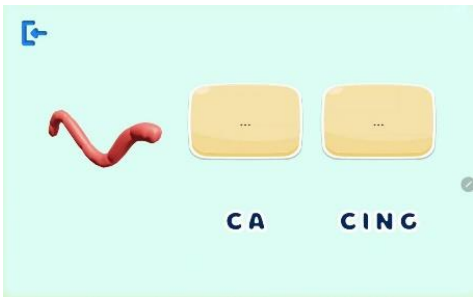
At the selection and organization of content stage, teaching materials are provided according to students' initial reading abilities. Students are grouped into three groups as follows: (1) Group one is for students who are able to pronounce vocabulary with the correct pronunciation according to the sounds of Indonesian vocabulary and sound clear and without assistance; (2) The second group is intended for students who are quite capable of reciting vocabulary with sufficient pronunciation according to the sounds of Indonesian vocabulary and clear voices and with a little assistance; (3) The third group is for students who are less able to pronounce vocabulary with pronunciation that does not match the sounds of Indonesian vocabulary and sounds that are not clear and with a lot of help. Students who belong to group 1, choose words with the form CVCCVC and two to three syllables. Group 2 selected words with the CVCVC form and two syllables. Meanwhile for group 3, the words with the CVCV form and two syllables were chosen. The material content displayed on the AR was validated by an autistic expert.




The selection and organization of methods stage produces an application based on Augmented Reality using a personalized learning model and the SAS reading method. The resulting learning activities are listed in Table 2.



Table 12. AR-assisted Personalized learning activities

Syntax	Learning Activities	Learning Activities on AR Media
Delivering Goals and preparing Students	<p>Teacher:</p> <ol style="list-style-type: none"> <li>1. Prepare students to take part in lessons physically and psychologically by providing motivation</li> <li>2. Convey the learning objectives and outline of the initial reading material</li> <li>3. Convey how to use the media</li> <li>4. Showing the video as a step in apperception</li> </ol>	<p>In AR media, videos are shown as steps in Apperception. The video contains chants in recognition of the alphabet A-Z.</p> 
Organizing Student Choices and Votes	<p>Teacher:</p> <ol style="list-style-type: none"> <li>1. Give students the opportunity to choose initial reading material that they have not mastered</li> <li>2. Provide material suggestions according to the results of the reading skills assessment if students cannot choose material</li> </ol> <p>Student:</p> <ol style="list-style-type: none"> <li>1. Communicating interest and desire in learning to read</li> <li>2. Determine the initial reading material to be studied</li> </ol>	<p>In AR media, students are directed to choose groups according to the results of the preliminary reading assessment.</p>  <p>After that, students can choose the material in the FunRead book that they will study according to their interests. In the book there are 15 words that can be learned by students.</p> 

		
<p>Information Access</p>	<p>Teacher:</p> <ol style="list-style-type: none"> <li>Guiding students to access information about beginning reading material on the media</li> <li>Give students the opportunity to ask for help</li> </ol> <p>Student:</p> <ol style="list-style-type: none"> <li>Access information about initial reading materials on the media</li> <li>Ask for help if there are difficulties in the learning process</li> </ol>	<p>In this syntax, the teacher guides students in scanning markers on books as material to be studied by students. The reading method used is the SAS method so that there is a button to replace changes to the stages of the SAS method on AR media.</p>  <p>If students are able to use AR media, the teacher gives students the freedom to explore the material they will learn and provides space for students to ask questions.</p>
<p>Develop knowledge</p>	<p>Teacher:</p> <ol style="list-style-type: none"> <li>Helping students to do exercises on the media as a form of knowledge development</li> <li>Helping students to validate the knowledge they have acquired</li> </ol> <p>Student:</p> <ol style="list-style-type: none"> <li>Do the exercises that have been provided by the teacher</li> <li>Pay attention to the teacher in validating the knowledge he has acquired</li> </ol>	<p>In this syntax, students are given practice questions in the form of drag and drop. In the first exercise, students are instructed to compose words from syllables.</p>  <p>The second exercise, students are instructed to show the letters according to what is ordered.</p>

		
<p>Giving Feedback</p>	<p>Teacher:</p> <ol style="list-style-type: none"> <li>1. Provide feedback if students can do the exercises correctly</li> <li>2. Give encouragement to try again if students do not get knowledge correctly according to orders</li> </ol> <p>Student:</p> <ol style="list-style-type: none"> <li>1. Get feedback from the teacher on the activities he is doing</li> </ol>	<p>In this syntax, giving feedback is done based on the answers to practice questions.</p>   <p>This feedback is complemented by a sound corresponding to the positive feedback or encouragement to try again.</p>

Finally, at the Evaluation stage, Expert judgment from experts shows that this personalized learning-based curriculum is feasible to be tested with some improvements. These improvements include adding degrees to learning objectives, simplifying instructions on AR applications, and adding material. Limited trials yielded positive results. This can be seen in the increase in student learning outcomes in reading words and syllables from the initial to the final baseline. However, the most insignificant increase was in the material to recognize letters because while at school, students have been taught to recognize letters. However, some students have problems recognizing letters with similar shapes and pronunciations.

## Discussion

In the curriculum development process, it is essential to know the conditions in the field, and this is necessary because it is a guide in improving learning practices in schools (Outer, Handley, & Price, 2013). Interviews with school principals yielded that support from various parties, such as stakeholders and school members, in

implementing the curriculum was the primary key to implementing a program. As a result of research conducted by Cheung & Wong (2012) that, teachers believe a team culture allows colleagues to have the same goals and implementation strategies to work collaboratively, plus working together, they believe, will increase the efficiency of curriculum implementation. The readiness and confidence of teachers need to be increased so that learning can run effectively and increase students' knowledge (Ramli, et al., 2017). Research conducted by Mutiah, Nakhriyah, HR, Hidayat, & Hamid (2020) revealed that outreach to curriculum implementation still needs to be done to align the perceptions of each teacher in implementing the curriculum. In addition, the results of teacher interviews found that schools did not develop learning materials so that the material presented was generalized to each student with different abilities and only focused on the material contained in government books. Meanwhile, the content of learning materials is also the key to this problem because it affects children's curiosity about the material they are studying. Supported by research conducted by Karaduman & Gultekin (2007) that teachers need to develop the material to be delivered because teaching materials determine student academic success from a cognitive aspect.

The objective condition of ASD students' reading ability provides an overview of prospective students who are expected to achieve the learning objectives of reading skills that have been formulated. Each student needs this analysis for mapping material, media, and evaluation. That way, students can get treatment according to their abilities and characteristics (Susan W. Whitea, et al., 2016). Research conducted by Andi & Arafah (2017) revealed that analyzing students' needs based on their abilities could provide important information about what should be taught and how to teach these skills.

The results of this study once again confirm that the AR-assisted personalized learning-based curriculum effectively improves ASD students' initial reading skills. Supported by research conducted by Shemshack & Spector (2020), this personalized learning model is suitable for children with special needs, ensuring that schools accommodate the needs of students with different needs, interests, and goals. The research results of Basham, Hall, Jr., & Stahl (2016) also support this finding that personalized learning provides enormous growth outcomes for students with special needs. In addition, the results of this study align with the findings of Rastegarmoghadam & Ziarati (2017) that the implementation of personalized learning is more effective with the use of technology to facilitate the organization of learning with a large number of students.

## **Conclusion**

This research resulted in a personalized learning-based curriculum design assisted by AR in learning early reading skills for ASD students. Special Elementary School (SDLB) teachers can use this product to learn early reading skills by modeling interactive and communicative learning and taking into account the characteristics and abilities of ASD students. In developing the curriculum, it is necessary to refer to preliminary studies in the field and the principles of curriculum development. The use of instructional media also greatly influences students' interest and motivation to learn. However, still consider the availability of facilities and infrastructure

in schools. In the selection of learning media, the characteristics of students need to be considered so that learning objectives are achieved effectively.

Future research can be carried out in a preliminary study that explores teacher perceptions of student-centered learning. In addition, it allows for opportunities for research on aspects of advanced reading skills. The selection of learning media does not only use Augmented Reality but with other technologies that are by the characteristics of ASD students.

## Recommendations

Although the study results showed an increase in reading ability of ASD students after using an AR-assisted personalized learning-based curriculum, this cannot be separated from the limitations in its implementation. First, the number of interview subjects (teachers) in this study was relatively small. Thus, teachers' views on learning are less varied. This has implications for what needs to be considered in developing this curriculum. In addition, the subjects of this study were relatively small, so they could not be used as generalizations for ASD students' initial reading skills. Second, the material provided needs to be expanded, so students do not feel bored and can explore more material. Third, everyday environmental factors, which are the family, need to be analyzed so students can improve their reading skills by studying independently at home.

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## Financial Stability Challenges Posed By the COVID-19 Pandemic: A Review

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**Abstract:** This paper examines the structure of financial stability and how they relate to pandemic research for the COVID-19 virus. In particular, it analyses significant components of earlier financial stability and Covid-19 analysis, creating a framework to direct subsequent studies in the field. This study utilised the content analysis technique, related visualisation tools, and bibliographic mapping, and the literature on financial stability and Covid-19 was analysed. The worldwide financial crisis, particularly the most recent concern, Covid-19, was considered to have considerably shaped the features of financial stability literature. Two major observable themes from the content analysis are where the research is concentrated. There are the effects of Covid-19 and past financial crises and the impact of Covid-19 on the global financial market. However, a single database potentially limits the literature coverage. In addition, the time frame for the data collection was also short, only 3 years. This study provides a road map for further investigation in the field is offered, together with a summary of the body of knowledge on financial stability and Covid-19.

**Keywords:** Financial Stability, Income Stability, Covid-19, Financial Crisis, Bibliometric Analysis.

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### Introduction

According to The World Bank (2022), Financial stability is the absence of systemic events that prevent the financial system from functioning in crises. Additionally, it has to do with how pressure-resistant economic systems are. Problems in the economy may be corrected by the self-corrective systems which resulted in avoiding the unpositive events from upsetting other financial plans or the wider economy, when the financial system is in the stable position. Banking and financial industries are the backbone of the economy as they provide a lot of financial support, which strengthen the idea of the importance of financial stability. Similarly, as discussed by The Federal Reserve (2018), achieving financial stability was not about debugging or not about

stopping people or businesses from making or losing money, instead, it's focuses on a creation of a system which can withstand and absorb both good and bad economic times. It only contributes to the development of circumstances in which such occurrences do not impair the system's ability to function.

An economic system that meets the borrowing needs of average people and businesses is referred to as being financially stable, allowing them to meet their needs and wants, such as purchasing a home or vehicle, saving for the future, or funding a child's education. In the same way, to expand, build factories, recruit more workers, and pay those workers, businesses must borrow money. All of these things need a functioning financial system, which functions best when the majority of people don't even think about it. Consumers and businesses are aware that they can get financing for expensive projects like building factories, that their funds are safe, or that they can get quick loans to pay bills.

Several essential elements influence the financial system's stability in an economy. The details comprise sensible macroeconomic stabilisation measures, suitable and efficient financial surveillance and regulation, the economic resilience of non-financial enterprises and households, and many more (Caballero et al., 2011; Alexander et al., 2013; Kim et al., 2013; Abildgren, 2016).

Because individuals have little ability to manage compound of the financial products adequately, wise financial policies are vital to keep the financial sector's stability at a good level. In addition, financial regulations's purpose is viewed from a variety of angles. Some want tight financial laws and oversight, while others favor loose control (Skott, 1994 and Gordy & Howells, 2006). In each economy, they use different regulatory policies and framework and defining their policies differently. The regulatory measures that are most commonly argued over among the various regulatory standards are the three Basel II Accord pillars of capital regulation on the basic minimum amount, the extent of a government's supervisory power, and private sector supervision of banks.

The ability of a household's members to weather adverse income or spending shocks or to bounce back swiftly from difficult financial times is known as financial resilience (Mcknight, 2020). An unexpectedly significant expense, a bill for home or auto repairs, the need to replace household items, a rise in loan interest rates, a family member's illness, a relationship's breakdown, destruction of household items due to flooding or fire, or a loss of employment can all cause household financial shocks. Households must have access to enough liquid assets or emergency reserves to handle these shocks, or they must be able to borrow money from banks, extended family, or friends. The implications for financial security will linger more for people who don't have enough cash in hand or an emergency funds to cover an economic shock. This problem is why the financial stability of a household is crucial, not just to the people themselves but also to the economy as a whole.

The world economy has experienced various financial crises that have negatively influenced several nations. Between 2007 and 2009, one of the worst economic crises occurred. The term "global financial crisis" describes the era of tremendous stress experienced by the global financial and banking systems. During the global

economic crisis, a drop in the property market in the United States started an economic collapse that distributed from the USA to other parts of the globe as a result of links in the global financial system. Furthermore, a lot of financial institutions and banks experienced significant losses and needed assistance out from ruling government to operate. Like the main major markets experienced their respective harshest times of recession as of the Economic Depression in 1930, countless individuals were unemployed and could not find any jobs afterwards. In addition, recovery from the situation took considerably longer than it had for previous downturns that were not preceded by an economic crisis. (Bank of Australia, 2020).

A financial crisis is the lack of institutional and market stability within the global financial system. The three characteristics of financial stability can be used to define what the financial crisis's effects are (Zwolankowski, 2011). The first is the financial system's capacity to allocate capital efficiently. Second is a credible risk assessment and a rational appraisal of financial instruments. The ability of financial institutions to deal with shock's effects on their own, lastly. Financial crisis effects must be appropriately managed if financial stability is to be achieved.

Covid-19 was the initial cause of the most current financial crisis. Beginning in 2020, it has led to an economic decline all across the globe. Due to the strict rules, employment losses, and declining living conditions, businesses must close. The Covid-19 epidemic has prompted the introduction of regulatory actions meant to prevent diseases and promoting individual and public health. Government initiatives were focused on limiting individual liberty and stopping unnecessary output. While the country's entire area was under lockdown, respective communities responded in diverse ways, highlighting the necessity for a detailed territorial investigation of the economic ramifications. In actuality, those regional systems focusing on producing non-essential goods may have more to do with the decline in production and weakened ultimate demand that follows. The end of production of those commodities and services whose order cannot be delayed entails a complete reduction in overall output, the degree of which depends on the entire organisation of revenue production and dissemination. Additionally, the inability of those under lockdown to move between regions causes a further decrease in final demand. The financial stability of households, businesses, and the economy has significantly declined due to this issue (Deriu et al., 2022).

The difficulty that specifically came from the COVID-19 pandemic led to this study's discovery that it is essential to look further into this area. Additionally, there aren't many articles out there right now that talk about Covid-19 and financial stability. This study looked at the effects of COVID-19 and financial stability. The current condition of scholarly research on financial stability and the recent pandemic must be considered critically. The findings will make it easier for readers to understand the idea of financial stability and how it currently relates to Covid-19. The findings will also assist the readers in keeping up with current challenges with financial stability and any financial crisis. As a result, it will also aid future research and guide their objectives.

To develop a thorough understanding of earlier investigations, this study covers the key subjects of financial stability and its relationship with Covid-19 research, the field's current situation, and potential ideas for future

studies. Bibliometric analysis is used to ascertain the publication trends on the subject. It combines bibliometric analysis and a thorough literature evaluation to study financial stability and Covid-19. The following research questions (R.Q.s) are considered in this study:

RQ1: What has been the current trend in publishing Covid-19 data and financial stability statistics?

RQ2: What academic fields are most pertinent to financial stability and Covid-19?

RQ3: Who are the most well-known writers in this area?

RQ4: What is the current situation of the Covid-19 partnership and financial stability?

By giving readers an overview of the many assessments performed, this research's primary goal is to examine the current financial stability related to Covid-19. The analysis's investigations span the years since Covid-19 strikes the world and until now (2022). Softwares and system that were used to analyse and make inferences from the data in this study are Harzing's Publish and Perish, and also VOSViewer. The statistics in the figures were also analysed using Microsoft Excel. After defining important keywords for financial stability and Covid-19, the analysis was conducted using the two aforementioned tools.

The following is the order of this paper. The next section provides a brief overview of financial stability in various contexts (households, businesses, and government), followed by a relationship between financial stability to a financial crisis (especially with the Covid-19 situation). Then, it describes the methodology used to locate historical data on earlier publications on financial stability and COVID-19. The data analysis is then reported in the results section. The discussion part is further expanded by presenting the findings of a content analysis technique. The conclusion and discussion of the findings are covered in the last section.

## **Literature Review**

### **Financial stability**

How to establish financial stability is a topic of debate. Either strong institutions, stable markets, a lack of volatility, or something more basic are necessary for financial stability. Or it can be attained and sustained only through free market forces and individual private acts or with the assistance of the government's role in promoting financial stability. There is no firm agreement on attaining and maintaining financial stability (Hasan & Dridi, 2010).

In comprehensive terms, financial stability includes the various components of the financial system, infrastructures, organisations, and markets. Private and public individuals participate in the financial markets and essential pillars of the economic infrastructure, such as the legal system and recognised systems for financial regulation, monitoring, and surveillance. Given the close connections between each of these parts of the financial system, disruptions in any one of them could threaten the entire system's stability, necessitating a systemic viewpoint. At any given time, private institutions and activities, official institutions and actions, or

both simultaneously and iteratively, could lead to stability or instability.

### **The effects of the Covid-19 outbreak on economic financial stability**

The ongoing COVID-19 outbreak has contributed to a rise in global income inequality, largely correcting the trend of the preceding twenty years. This pandemic represents a danger to the decline of world wealth. In contrast to the 2008–2010 global financial crisis, the Covid-19 severe recession and the slow economic recovery in emerging economies and developing nations compared to affluent economies have increased income inequality between countries. Populations' mobility may deteriorate and the country's growing inequality may become established as the outcome of the interruptions to education caused by the Covid-19 pandemic and the overwhelmingly detrimental consequences that it has on low-income families. High inflation and increasing country's budget deficits could restrict a nation's capacity to help underprivileged communities, foster recovery, and foster sustainable growth.

A systematic strategy is required to guide the global economy toward a more equitable development path. This plan must contain steps to lessen income disparity and instability through national changes and with assistance from the international community (Adarov, 2022). To reduce inequality and instability between countries, productivity and enhancing measures are needed in emerging and developing economies. Next are initiatives to increase access to infrastructure, digital services, health care, and education, focusing on disadvantaged population groups. Last but not least, support from the international community is needed to address debt burdens and maintain an open and rules-based global trade and investment environment that fosters a quicker rate of efficiency increase in the economy.

### **Data and Methodology**

The method utilised to choose the data, which began on February 7, 2022, based on the S.C.O.P.U.S. database, is depicted in Figure 1 above. Numerous search results with the keywords; (1) firm resilience, (2) bank resilience, (3) financial resilience, (4) financial crisis, (5) bank sustainability, (6) firms sustainability, (7) income sustainability, (8) financial well-being, (9) financial distress, (10) income stability, (11) systemic risk, (12) Lerner, (13) soundness, (14) market power, (15) insolvency risk, (16) systematic risk, (17) systematic soundness, (18) income stability, (19) Covid-19, (20) Pandemic Covid 19, (21) Coronavirus Disease 2019, were employed to facilitate a more thorough search.

Important publication components, like citation information, are provided via the S.C.O.P.U.S. database. The publications were examined, along with features of financial stability and Covid-19, and a search string was made using the keywords discovered. The search term was developed to cover all the topics covered in the Covid-19 research, including the countries, authors, and factors. Then, a list of 83 articles on financial stability and Covid-19 that were published between 2020 and 2022 was compiled.

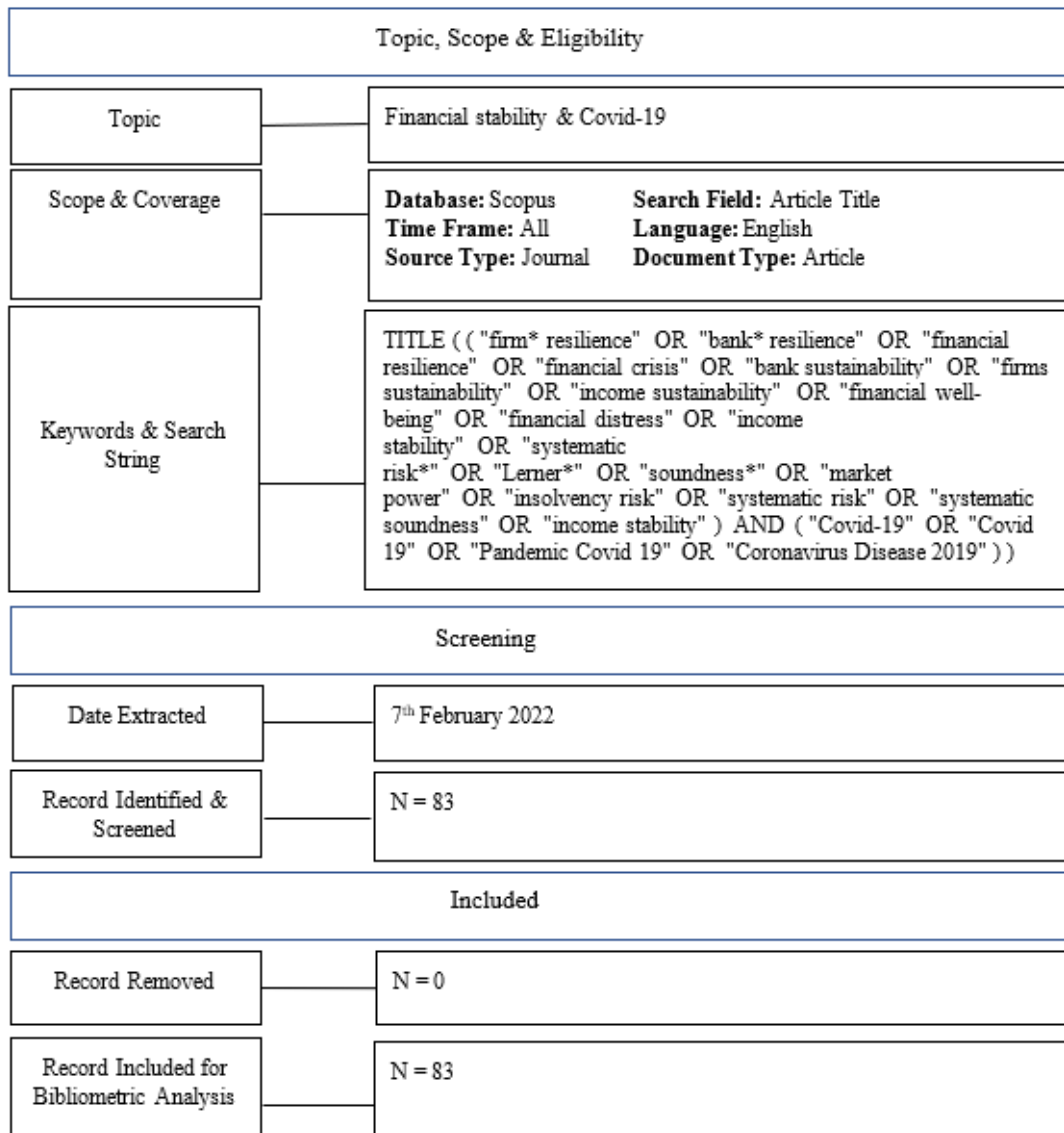


Figure 1. Flow diagram of the search strategy

### Analytical Technique

A scientific discipline's fieldwork activities may provide insight into the discipline's structure (Ronda-Pupo, 2017). The design of financial stability and Covid-19 is ascertained via a bibliometric analysis. When combined with network analysis, it produces a potent combination that shows the structure and critical subjects of a research area. Consequently, this analysis makes it feasible for us to spot existing trends and potential study possibilities (Li, Wu & Wu, 2017). This paper combines a bibliometric investigation with a thorough literature review for these reasons. To undertake a bibliometric analysis of the relationship between financial stability and Covid-19 literature, citation analysis, co-citation analysis, keyword co-occurrence analysis, authors rank analysis, and co-authorship analysis were all employed. These frequently used tools are suitable for answering our research questions. Software like VOSViewer and Harzing's Publish or Perish was employed to assess the outcomes. Utilising Microsoft Excel, the data results were finalised.

**Findings and Discussions**

**Publication by year**

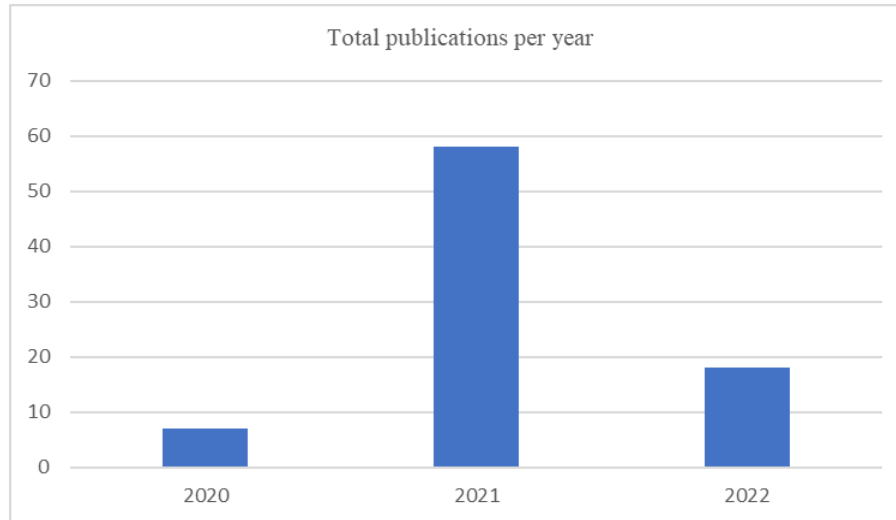


Figure 2.: Total publications by year

Table 1.Total publications by year

Year	TP	NCP	TC	C/P	C/CP	h	g
2020	18	18	210	11.67	11.67	7	14
2021	58	58	229	3.95	3.95	8	13
2022	7	7	3	0.43	0.43	1	1
<b>Total</b>	<b>83</b>	<b>83</b>	<b>442</b>	<b>16.05</b>	<b>16.05</b>		

Notes: TP=total number of publications; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; C/CP=average citations per cited publication; h=h-index; and g=g-index.

Figure 2 and Table 1 illustrate the number of articles on financial stability and Covid-19 between 2020 and early 2022. The significant increase in reports after 2021 could be due to a higher number of cases in 2021 than in 2020 when the epidemic first struck.

**Publishing activity by country**

Table 2.Top 20 Countries contributed to the publications

Country	TP	%
United States	17	20.48%
United Kingdom	12	14.46%
Australia	11	13.25%
China	9	10.84%

Country	TP	%
Poland	7	8.43%
India	6	7.23%
Spain	6	7.23%
Turkey	6	7.23%
France	5	6.02%
Italy	4	4.82%
South Korea	4	4.82%
Tunisia	4	4.82%
United Arab Emirates	4	4.82%
Bangladesh	3	3.61%
Canada	3	3.61%
Malaysia	3	3.61%
Saudi Arabia	3	3.61%
Viet Nam	3	3.61%
Indonesia	2	2.41%
Japan	2	2.41%

Notes: TP=total number of publications

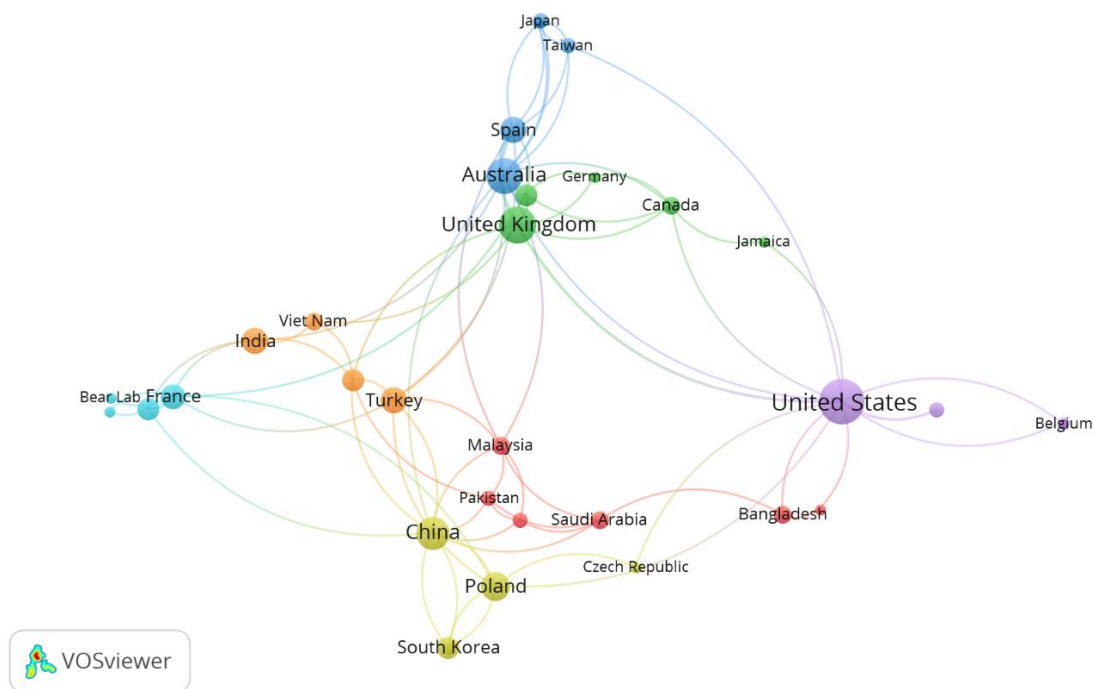


Figure 3. Visualisation map for publication based on co-authorship of countries



As indicated by contributions from numerous countries, researchers have devoted special attention to macroeconomic stability and Covid-19. Table 2 displays the top 20 publishing countries regarding financial stability and Covid-19, with the U.S., U.K., and Australia ranked first, second, and third, respectively. The top publishing countries in Asia are China, India, and South Korea. In addition, we run the data based on the countries with co-authorship. The United States is the largest country having the most co-authored publications with other countries. Figure 3's visuals substantiate this assertion.

### Publishing activity by Journal

Table 3. Top 20 Sources contributed to the publications

Sources	TP	%
Finance Research Letters	4	4.82%
Sustainability Switzerland	4	4.82%
Journal Of Behavioral And Experimental Finance	3	3.61%
Asian Journal Of Psychiatry	2	2.41%
Economic Analysis And Policy	2	2.41%
Economic Research Ekonomska Istrazivanja	2	2.41%
Energy Policy	2	2.41%
European Journal Of Development Research	2	2.41%
Frontiers In Psychiatry	2	2.41%
Journal Medical Libanais	2	2.41%
Journal Of Policy Modeling	2	2.41%
Journal Of Public Budgeting Accounting And Financial Management	2	2.41%
Renewable And Sustainable Energy Reviews	2	2.41%
Research In International Business And Finance	2	2.41%
Academy Of Strategic Management Journal	1	1.20%
Accounting Auditing And Accountability Journal	1	1.20%
Aiub Journal Of Science And Engineering	1	1.20%
Alcohol And Alcoholism	1	1.20%
Applied Economics	1	1.20%
Australian Journal Of Public Administration	1	1.20%

Notes: TP=total number of publications

Table 3 shows the periodicals with the most papers on financial stability and covid-19. Popular publications include the Finance Research Letters and Sustainability Switzerland.

### Publishing activity by author and organisation

According to our data, publications on financial stability and covid-19 were written by 5,815 writers. Table 4 and Table 5, respectively, highlight the top contributing writers and organisations. According to the table, Gajdzik, B. (three) authored the most papers on financial stability and Covid-19, followed by Barrafreem, K.

(two). The most active entities in this field were The Australian National University, which published 3 articles, and the Silesian University of Technology, which also published 3 papers. The top writers and institutions hail from various European, American, and Asian countries. As a result, contributions to financial stability and Covid-19 research have been made worldwide.

Table 4. Most Productive Authors

Author's Name	Affiliation	Country	TP	%
Gajdzik, B.	Silesian University of Technology	Poland	3	3.61%
Barrafrem, K.	Linköpings Universitet	Sweden	2	2.41%
Choi, S.Y.	Gachon University	South Korea	2	2.41%
Itani, R.	American University in the United Arab Emirates	United Arab Emirates	2	2.41%
Jeribi, A.	Université de Monastir	Tunisia	2	2.41%
Shehzad, K.	Southeast University	China	2	2.41%
Tinghög, G.	Linköpings Universitet	Sweden	2	2.41%
Västfjäll, D.	Linköpings Universitet	Sweden	2	2.41%
Yap, O.F.	The Australian National University	Australia	2	2.41%
AROURI, M.	Groupe de Recherche en Management	France	1	1.20%
Abbas, J.	Shanghai Jiao Tong University	China	1	1.20%
Abdul Aziz, A.R.	Universiti Sains Islam Malaysia	Malaysia	1	1.20%
Abdurraheem, I.I.	Universiti Utara Malaysia	Malaysia	1	1.20%
Adenan, M.	Universitas Jember	Indonesia	1	1.20%
Adhikari, P.	Essex Business School	United Kingdom	1	1.20%
Ahrens, T.	United Arab Emirates University	United Arab Emirates	1	1.20%
Akkazieva, B.	WHO Barcelona Office for Health Systems	Spain	1	1.20%
Alam, M.M.	Universiti Utara Malaysia	Malaysia	1	1.20%
Alhenawi, Y.	Ajman University	United Arab Emirates	1	1.20%
Allen, K.A.	Monash University	Australia	1	1.20%

Notes: TP=total number of publications

Table 5. Most influential institutions

Affiliation	Country	TP	%
The Australian National University	Australia	3	3.61%
Silesian University of Technology	Poland	3	3.61%
The George Washington University	United States	2	2.41%
Southeast University	China	2	2.41%
Linköpings Universitet	Sweden	2	2.41%
Decision Research	Australia	2	2.41%
Monash University	Australia	2	2.41%
International Monetary Fund	United States	2	2.41%
Université Saint-Joseph de Beyrouth	Lebanon	2	2.41%
Hôtel-Dieu de France Hospital	France	2	2.41%
American University in the Emirates	United Arab Emirates	2	2.41%
Gachon University	South Korea	2	2.41%
Littauer Center	United Kingdom	1	1.20%
Paris School of Business	France	1	1.20%
Virginia Center for Reproductive Medicine	United States	1	1.20%
IPAG Business School	Australia	1	1.20%
Institute of High Commercial Studies of Sousse	Tunisia	1	1.20%
Chandragupt Institute of Management	India	1	1.20%
Wuchang University of Technology	Columbia	1	1.20%
Apeejay Satya University	India	1	1.20%

Notes: TP=total number of publications

### Citation network analysis

We examined the citation networks of 83 articles to determine which publications have the most significant influence on financial stability and Covid-19. Although there are other methods for measuring a research paper's impact, the most frequent is citation analysis (Ding and Cronin, 2011). We can make intellectual connections using citations and referencing (Appio et al., 2014). The number of sources from other works is used in citation analysis to determine the impact of a publication. VOSViewer was used to do our citation analysis.

Table 6 is a list of the most important research articles. K. Shehzad, L. Xiaoxing, and H. Kazouz (2020) had the most references (78), followed by T. Ahrens and L. Ferry (2020), with 30 citations. Figure 4 depicts the crucial nodes in the citation network that show a study's impact on the body of knowledge on financial stability and Covid-19. As a result, articles with more citations significantly impact the field of financial stability and Covid-19.

Table 6.:Top 15 Highly cited articles

No.	Authors	Title	Year	Cites	Cites per Year
1	K. Shehzad, L. Xiaoxing, H. Kazouz	COVID-19 disasters are perilous than Global Financial Crisis: A rumor or fact?	2020	78	39
2	T. Ahrens, L. Ferry	Financial resilience of English local government in the aftermath of COVID-19	2020	30	15
3	C.-L. Chang, M. McAleer, Y.-A. Wang	Herding behaviour in energy stock markets during the Global Financial Crisis, SARS, and ongoing COVID-19*	2020	26	13
4	K. Barrafre, D. VÃstfjÃll, TinghÃg	Financial well-being, COVID-19, and the financial better-than-average-effect	2020	17	8.5
5	S. Roper, J. Turner	R&D and innovation after COVID-19: What can we expect? A review of prior research and data trends after the great financial crisis	2020	17	8.5
6	M.A. Mamun, A.K.M.I. Bhuiyan, M.D. Manzar	The first COVID-19 infanticide-suicide case: Financial crisis and fear of COVID-19 infection are the causative factors	2020	10	5
7	T. Kapecki	Elements of sustainable development in the context of the environmental and financial crisis and the COVID-19 pandemic	2020	7	3.5
8	B. Upadhaya, C. Wijethilake, P. Adhikari, K. Jayasinghe, T. Arun	COVID-19 policy responses: reflections on governmental financial resilience in South Asia	2020	5	2.5
9	O.F. Yap	A New Normal or Business-as-Usual? Lessons for COVID-19 from Financial Crises in East and Southeast Asia	2020	5	2.5
10	L. Sumer, B. Ozorhon	Investing in gold or REIT index in Turkey: evidence from global financial crisis, 2018 Turkish currency crisis and COVID-19 crisis	2020	4	2
11	A. King, J.K. Andrus, J.P. Figueroa	Financial crisis at PAHO in the time of COVID-19: a call for action	2020	4	2
12	T.S. ÃncÃ¼	Triggering a global financial crisis: COVID-19 as the last straw	2020	3	1.5
13	R.J. Heffron, J. Sheehan	Rethinking international taxation and energy policy post COVID-19 and the financial	2020	2	1

crisis for developing countries						
14	A. Cuellar, T.L. Mark, S.S. Sharfstein, H.A. Huskamp	How to mitigate the mental health care consequences of the COVID-19 financial crisis	2020	1	0.5	
15	Feixiong-Ma, Yingying-Zhou, Xiaoyan-Mo, Yiwei-Xia	The Establishment of a Financial Crisis Early Warning System for Domestic Listed Companies Based on Two Neural Network Models in the Context of COVID-19	2020	1	0.5	



Figure 4. Network visualisation map of the citation by documents  
Minimum number of citations of a document = 1

**PageRank analysis**

According to Ding et al. (2009), PageRank is a supplement to citation analysis, which aids in the discovery of publications referenced by highly cited papers. We created a network map to show the relationships between the referenced papers and the journal writers on the topic of interest. A map of the network display of document citations per country is shown in Figure 5.

A minimal amount of documents required by a nation and sources is set at one. Forty-three countries published research on financial stability and Covid-19, and all matched the criteria. Only five countries, however, are linked and grouped into two clusters. The largest circle on the network map represents China. It reveals that the most cited articles in the study topic's publishing are those written by Chinese authors. By looking at the other significant circles on the network map, we could identify papers written by authors from Tunisia, Poland, South Korea, and Switzerland that are frequently discussed.

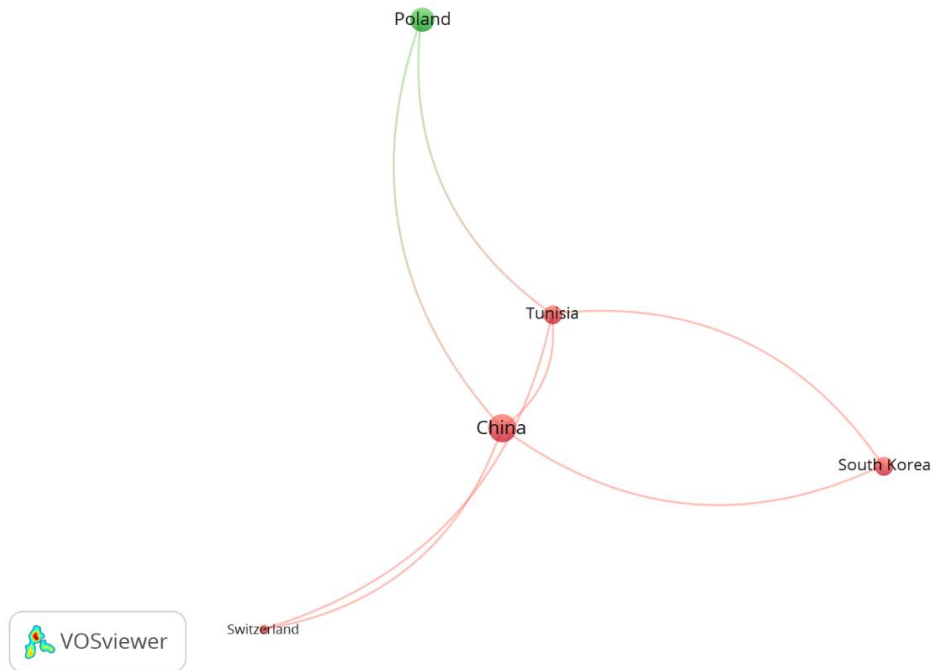


Figure 5. Network visualisation map of the citation countries (PageRank)

Note: Unit of analysis = Countries

**Keyword and co-occurrence analysis**

Using co-occurrence and keyword analysis, one may make sure that an article's keywords are appropriately represented by its author (Comerio and Strozzi, 2019). Whenever two keywords occur within the same paper, it is known as keyword co-occurrence and suggests that the terms are related. Focuses on identifying the most well-known topics between financial stability and Covid-19 experts. We employ keyword and co-occurrence analysis in the VOSViewer to address this.

We use co-occurrence analyses to analyse the most common topics in financial stability and Covid-19. According to Table 7, the most commonly used keyword in the literature on financial stability and Covid-19 appears to be "Covid-19" and "Financial crisis". It demonstrates that the authors would like to show that the economic problems they discussed happened during the Covid-19 phase of time. Covid-19, the financial crisis, and the pandemic are the network's most notable nodes, as shown in Figure 6, indicating their relative importance in financial stability and Covid-19.

Table 7. Top 20 Keywords

Author Keywords	Total Publications (TP)	Percentage (%)
COVID-19	46	55.42%
Financial Crisis	16	19.28%

Pandemic	15	18.07%
Human	13	15.66%
Global Financial Crisis	10	12.05%
Humans	9	10.84%
Coronavirus Disease 2019	8	9.64%
COVID-19 Pandemic	7	8.43%
Pandemics	7	8.43%
Article	6	7.23%
Economics	6	7.23%
Financial Well-being	6	7.23%
Adult	5	6.02%
Coronavirus	5	6.02%
Covid-19	5	6.02%
Female	5	6.02%
Financial Markets	5	6.02%
Investments	5	6.02%
Stock Market	5	6.02%
China	4	4.82%

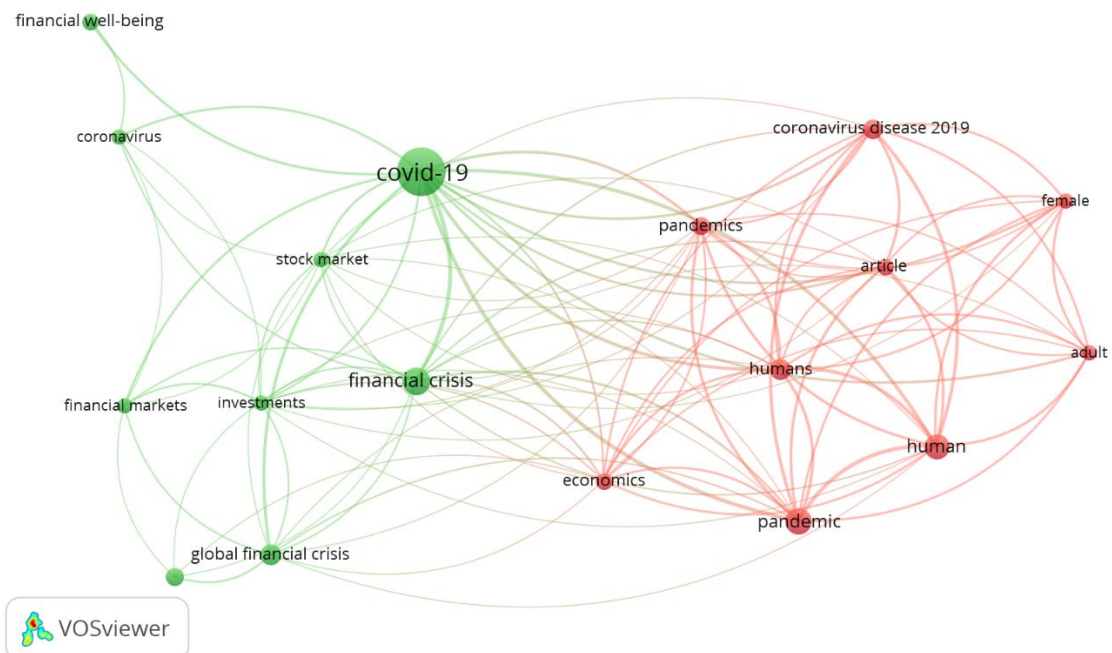


Figure 6. Network visualisation map of the co-occurrence

Note: Unit of analysis = All keywords; Counting method: Full counting; Minimum number of occurrences of a keyword = 5

**Co-authorship analysis**

We review the current level of collaboration and describe the leading writers in this field to find the most prominent authors on financial stability and Covid-19, as well as the current state of cooperation in this subject. The most standard form of intellectual interchange is a scholarly collaboration (Cisneros et al., 2018). Platforms for international cooperation enable developing countries to participate in information creation, frequently pioneered by affluent countries (Palacios-Callender and Roberts, 2018). Any interaction between two opposing viewpoints leads to the formation and maturation of notions. This interaction improves the quality of a multi-author work by minimising errors and incorporating contributions from different fields (Tahamtan et al., 2016).

This section looks at the scope of academic collaboration and identifies the most influential authors in the educational complex formation. Askar S. E., Zaman K., Abdul Aziz A.R., Peng M.Y., Sasmoka & Jabor M.K., Yu D., Nassani A.A., Qazi Abro M.M. and Anser M.K., as illustrated in Figure 7, are prominent authors in a collaborative process. They form a coherent group of authors, concentrating their efforts on authors from their respective countries. Most of the nodes in this network are two-node networks, meaning that most of the study is focused on a few authors. As a result, the co-authorship network can be considered a collection of closed networks with few interactions. The development of a discipline requires collaboration among researchers. As a result, more international cooperation is needed.

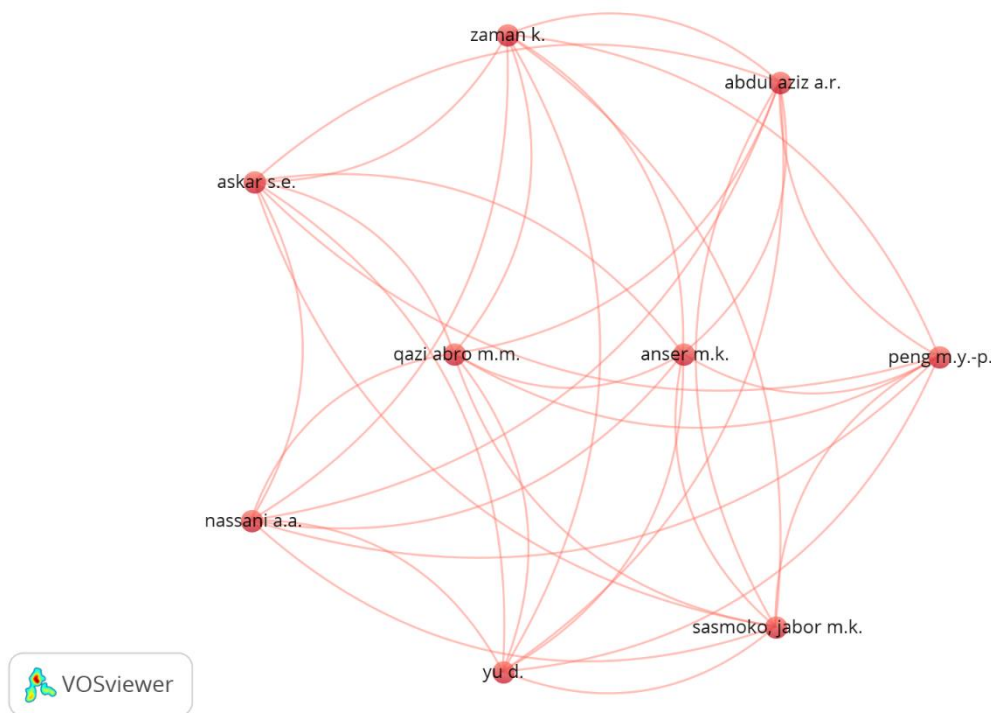


Figure 7. Network visualisation map of the co-authorship

Note: Unit of analysis = Authors; Counting method: Fractional counting; Minimum number of documents of an author = 1; Minimum number of citations of an author = 1



**Co-citation analysis**

The frequency of two articles are mentioned together is known as co-citation, according to Small (1973). According to Rosetto et al., co-citation analysis in bibliometrics might show the intellectual organisation of a field (2018). It is also important to emphasise the objectives, structure, and advancements in a study topic, according to Liu et al. (2015).

We used the VOSViewer tool to generate a network map to visualise the co-citation network among the referenced authors in the study topic's publication. Complete counting was used, and at least ten author citations were necessary. Figure 8 depicts a network map of co-citations based on cited authors. Out of 5,815 authors, 39 fit the criteria, but they are only 37 authors are connected. There are five clusters on the network map. The authors in the same cluster are thought to have cited one another in their writings. Each group usually describes a different point of view on financial stability and the situation in Covid-19.

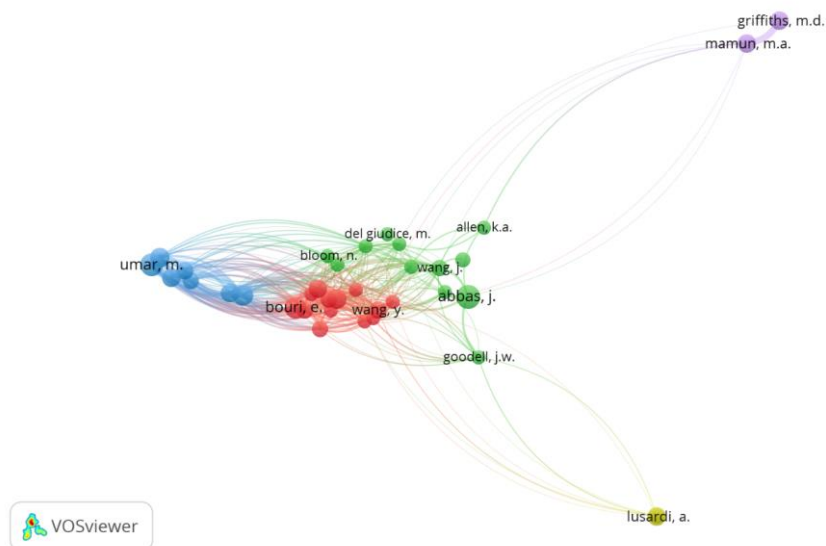


Figure 8. Network visualisation map of the co-citation analysis

Note: Unit of analysis = Cited Authors; Counting method: Full counting; Minimum number of citations of an author = 10

**Literature classification**

Radicchi et al. (2004) state that clustering has been utilized in previous studies to create collections of research articles. According to Xu et al. (2018), data clustering reveals collaborative and connection patterns in a co-citation analysis. We selected the minimal amount of citations and decided on complete counting of a cited reference to 2 by running the co-citation analysis of the cited references using VOSViewer software. Only 25 of the 3,637 mentioned references satisfied the criteria, and only 13 were related. Figure 9 depicts the three clusters by giving each one a different colour.



Figure 9. Network visualization map of the co-citation analysis

Note: Unit of analysis = Cited reference; Counting method: Full counting; Minimum number of co-citations of cited reference = 2

### Content analysis

Analysis of the co-citation network revealed research groupings. For each group, there is a content analysis in this section. The VOSViewer programme was used to execute the co-occurrence term map to perform the content analysis. There were 2,056 terms available by referring to the terms from the topic of this study's title and abstract. However, by limiting the number of occurrences of a term to a minimum of 1,013 final terms were determined as the most relevant to this study.

It contains a total of 13 keywords. According to (Fahimnia et al., 2015; Xu et al., 2018), reviewing the top 10 articles in every cluster to determine a unifying theme is a regular strategy.

#### *Cluster 1: The different effects of Covid-19 and past financial crises*

In several nations, COVID-19 has had a more significant impact on stock market volatility than the past financial crises. The study found that the health crisis brought on by COVID-19 was what initially triggered the financial issue. Furthermore, this cluster concludes that each situation has its unique container market repercussions. Many temporal and spatial sequences in COVID-19 can be compared to the 2008-2009 financial crises, such as supply and demand shocks on container ports and the container shipping company. The COVID-19 dilemma also has the potential to significantly impact small and medium-sized business (S.M.E.) creativity, in addition to having a negative impact on world economy.

#### *Cluster 2: The effects of Covid-19 on the global financial market*

The second cluster concentrated on the financial market's effects of Covid-19 as a result of the global financial

crisis. It implies that, following the global financial crisis (Covid-19), investors will be more vulnerable to asset losses and likely to engage in stock market herding. Furthermore, this cluster has significant consequences for stock market asset allocations, particularly in the United States. Even during the global financial crisis of 2008, silver and the Islamic stock index were safe zones. During extreme market downturns, gold and Bitcoin, as well as during the phase of Covid-19, continue to demonstrate positive behaviour.

## Findings and Conclusions

Many researchers believe that the effects of Covid-19 will be similar to, if not worse, previous global financial crises. It has been argued that the results of the Covid-19 epidemic may have a negative economic impact on businesses and individuals. In this section, we'll go over the details of the top three most cited papers. We believe it is necessary to summarise and study these studies to understand how Covid-19 affected global financial stability. The debate in this field has lasted from 2020 to now (2022), with Covid-19 striking first in early 2020 around the world.

To begin, a study by (Shehzad et al., 2020) looked into the Asymmetric Power G.A.R.C.H. model and discovered that COVID-19 significantly negatively impacts market returns in the United States and Japan. Furthermore, COVID-19 has had a more significant impact on stock market volatility in the United States, Germany, and Italy than prior Global Financial Crises. The investigation confirmed that the health crisis caused by COVID-19 triggered the global financial crisis, yet, the Asian markets continue to offer excellent opportunities for portfolio optimisation. This analysis also supported the pressure impact in such areas. COVID-19, according to the inquiry, has halted the global economic cycle and has the potential to create further hazardous market shocks. As a result, a large percentage of the money should be allocated to preventing future pandemics.

Then we looked at the (Broadstock et al., 2021) study to see if Covid-19 affects financial stability. They look at the role of environmental, social, and governance (E.S.G.) effectiveness throughout the COVID-19 pandemic-induced global financial crisis. It represents a highly negative mood among investors, as evidenced by the massive drop in global equity values during the COVID-19 epidemic. As a result, the particular circumstances for Broadstock's research give an unrivalled chance to ask if investors understand E.S.G. performance as a predictor of future stock performance and risk avoidance. The findings revealed a few outcomes that were relevant to our research. To begin with, E.S.G.'s performance reduces financial risk during a financial crisis and diminishes in 'normal' times, showing its incremental importance during a crisis.

Finally, we looked at a study by Ahrens & Ferry (2020) that was relevant to our situation. According to the report, the government plays a critical role in preventing COVID-19 from negatively impacting a country's financial status. Despite increased service needs, the financial stability of local governments has been a crucial worry over the last decade due to the lack of funding and its impact on local government budgets. More recently, the magnitude and unexpectedness of the COVID-19 crisis have compounded financial stability issues.

Their research examines the financial management measures that an outbreak of this scope that spreads quickly and widely would require. Policymakers must consider how to enhance organisations and economic resilience in preparation for national crises instead of local-level crises, keeping in mind that the central government must borrow from local governments during short-term emergency lack of funding the appropriate amount for each local authority (Travers, 2020).

## Acknowledgements

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## Cyberbullying Among Youths in Malaysia

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**Abstract:** Cyberbullying is a relatively new phenomenon that poses a serious problem, because anyone can become a victim of cyberbullying. Due to the special technical possibilities of social media, it can have long-term effects on the victims, especially on the well-being of young people. The aim of this study is to collect data on related topics such as demographic profiles, social media use, experiences of cyberbullying, attitudes towards cyberbullying and suggestions to curb cyberbullying in Malaysia. An online questionnaire survey was conducted with 50 respondents. The results show that bad things are done to the victims of cyberbullying, causing emotional disturbance and trauma to the victims. Rule utilitarianism and action utilitarianism are used in certain cases to solve the ethical problem of cyberbullying. Although there is no specific law against cyberbullying in Malaysia, there are certain laws such as the Computer Crimes Act 1997, the Communication and Multimedia Act 1998 and the Penal Code to combat cyberbullying. The solution has also been highlighted through awareness campaigns to prevent cyberbullying. For the concerned parties, developing concrete strategies to reduce cyberbullying among youths in Malaysia should be a major concern.

**Keywords:** Cyberbully, social media, Campaign, Computer Crime Act, Wellbeing

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Ciddi (Eds.), *Proceedings of ICRES 2023-- International Conference on Research in Education and Science* (pp. 1096-1112), Cappadocia, Turkiye. ISTES Organization.

## Introduction

The word "bully" was used as early as the 1530s. Bully is used to describe a person who is overly aggressive, the bully towards the victim. Bullying involves the use of physical, verbal or other forms of abuse to gain a sense of superiority and authority over the victim. Verbal and physical attacks as well as gossip and rumours are examples of bullying (Mishna et al., 2020).

It is widely recognised that bullying is the systematic and repeated use of aggression by peers (Burton et al., 2013) and is a purposeful act of aggression in which unequal power relations are exploited to inflict pain or gain material for social advantage (Frey et al., 2009). However, as technology has advanced, new forms of aggressive behaviour have emerged, such as cyberbullying. It is widely recognised that social media serves as a source of social acceptance and reinforcement due to its widespread use by people of all ages.

People can use this platform to communicate ideas, interact socially, build relationships, gain the attention of others and create a social image. Over-engagement in social media has become a "psychological imperative" to help people cope with the pandemic and satisfy their need for human interaction, as social distancing has become the new norm in the current global crisis of the COVID -19 outbreak (S. Singh et al., 2020). The pandemic and the new digital reality collided at the same time, forcing people to deal with both problems simultaneously.

Schools and businesses now use numerous online platforms to conduct business, so more and more people are present online without intending to be. This has led to an increase in cybercrime, including cyberbullying. While cyberbullying has been a common form of online harassment for some time, the pandemic is believed to be responsible for the increase in reported cases of cyberbullying. It has affected people's physical, psychological and emotional well-being (Barlett & Rinker Brendan Roth, n.d.) .

Consequently, many young people are already at risk of cyberbullying and will continue to be exposed to the need to use social media to carry out their daily activities in this pandemic. It is important to protect them from the dangers of cyberbullying. When it comes to protecting personal information, procedures should be put in place to ensure its privacy and security (Thseen, 2021) . Combating cyberbullying requires the use of appropriate technologies and pedagogical approaches. These proposals should also be revised as they apply to all cases of cyberbullying, not just those that occurred during the pandemic. Bullying prevention initiatives are becoming more effective as we know more about the causes of bullying and the specific strategies used by bullies. With the acceleration of technological progress, it will be more difficult than ever to develop effective prevention measures against cyberbullying

## Identification Of Issue

### Cyberbullying in Malaysia

According to (Ahmad Ghazali et al., 2020), there is a strong correlation between cyberbullying and factors such as age, loneliness, self-esteem and empathy, with male youths in Malaysia more likely to be involved in cyberbullying than females. In Penang, Malaysia, the prevalence of cyber victimisation and cyber perpetrators in the last month of cyberbullying experience is 31.6 per cent. However, the prevalence more than doubled when limited to experiences in the last three months (Ahmad Ghazali et al., 2020). These findings show how serious cyberbullying is in Malaysia. Due to the combination of leisure and domestic pressures, the introduction of MCO has inadvertently increased these symptoms (Basir et al., 2020). According to Datuk Dr Amirudin Abdul Wahab, Chief Executive Officer of Cyber Security Malaysia (CSM), society needs to be more sensitive and prepared to deal with the growing problem of cyberbullying, which causes more harm than physical bullying.

According to the Malaysian Institute for Youth Development Research, cyberbullying increased by an incredible 55.6% in 2013 alone. It is believed that 389 cases of cyberbullying occurred among teenagers, with an average of 62.3% of victims having been cyberbullied, while the remaining 37.7% had never been cyberbullied.

In addition, since the introduction of MCO, many teenagers aged 15-25 have spent their study time at home and used the internet for educational purposes. In addition, young people need a break from scrolling through social media platforms such as Tiktok, Instagram and Twitter. However, these youths are vulnerable to cyberbullying as the internet is a borderless space. If left untreated, cyberbullying can have a variety of negative consequences for individuals. Therefore, this study examines the problem of cyberbullying among children, the variables that contribute to it and the measures that can be taken against it.

#### *Types of cyberbullying*

Numerous studies have been conducted to gain a better understanding of the issue, and several of them have divided the broad term "cyberbullying" into specific types.

According (Kaspersky, 2021; Nambiar P, 2020; Securly, 2021). The categories are highlighted below:

- Exclusion: an intentional act of excluding a person.
- Harassment: Persistent pattern of unpleasant or threatening online messages intended to cause harm to another person.
- Outing: Public disclosure of sensitive or intimate information about another person without their consent in order to dishonour or humiliate them.
- Trickery: The gesture of (unknowingly) enticing someone to reveal or publish their personal



information.

- **Cyberstalking:** The use of the internet or other virtual methods to deliberately harass and threaten a victim, which may occasionally be accompanied by physical stalking.
- **Fraping:** When a victim of bullying uses your child's social media accounts to post inappropriate things on their behalf, this is called fraping. When friends share funny posts on each other's pages, it can be harmless, but it can also be very damaging. For example, a bully might use another person's profile to spread racist or misanthropic remarks, damaging their reputation.
- **Camouflage:** A bully who knows the victim personally develops a fictitious internet presence or identity with the sole purpose of bullying another person. He may choose a new persona and images to deceive the victim.
- **Dissing:** Actions of a bully who knows the victim and reveals compromising information about the target in public posts or private discussions to destroy their reputation or damage their relationships with others.
- **Trolling:** The bully attempts to deliberately upset others through inflammatory comments on social media.
- **Flaming:** Directly posting or sending insults and obscenities to the victim to provoke them into an online confrontation.

#### *Hate comments*

Hate speech is any expression intended to insult, demean or incite hatred against a group or class of people because of their race, religion, colour, sexual orientation, gender identity, ethnic origin, disability or national origin. (Ward, 2021) This section describes the case of Thivyaanayagi Rajendran, a 20-year-old woman from Bukit Mertajam. It all started with a Tiktok video in which Thivyaanagi and a foreign colleague acted out a scenario from a Hindi song for entertainment purposes, which was perceived by online users as dating. The video was originally posted by one of her colleagues before it was re-uploaded by a Facebook user under the title "Joke Oruvan" with the Tamil caption "How did this girl fall in love with a Bangla. everyone will undoubtedly bless you". Over 300 comments criticised her for dating a foreigner. (Nambiar P, 2020) Her uncle, K Sathyaseelan, reported the incident to the police for further investigation. To put an end to the nasty comments,

Thivyaanagi's family wrote to the Facebook user asking him to delete the video. However, the user refused and demanded a video apology. On the same day, at around 9:30pm, Thivyaanagi's brother discovered her younger sister hanging in her bedroom. She committed suicide and wrote a note apologising for embarrassing her family. She stated that her actions were triggered by Joker Oruvan's behaviour. The poor young woman had been in a wonderful relationship with her partner for three years and was supposed to get married at the end of the year, but it never happened. Her family wanted justice for her death and called on the government to take the matter more seriously.

### *Sexting (harassment, outing)*

Sexting is a form of cyberbullying that combines outing and trickery to obtain sexually explicit photos or videos of the victim. The perpetrators then disseminate and circulate the sensitive content. (M. M. Singh et al., 2017) This section discusses the case of a 22-year-old woman from Jempol, Negeri Sembilan. It begins with her meeting Mohamad Fazrul Mohd Fuzi, a 26-year-old man from Kuala Pilah, Negeri Sembilan. To demonstrate their love for each other, the two exchange sexual photos of each other. On one occasion, the 22-year-old woman expressed her desire to end their relationship. Mohd Fazrul was furious and refused to accept the reality. He then threatened to spread private pictures and videos of his ex-girlfriend via WhatsApp if she did not get back to him. Raya Muhammad Amirul Noor Hashimi, Deputy Public Prosecutor, took the matter to court and Mohd Fazrul was fined RM3,500 after he pleaded guilty. (A. H. A Manap, 2021) From this incident, we can conclude that sexting can lead to harassment and cyberbullying.

### *Hack*

According to an Ipsos survey on global problems predicted for 2020, 51% of Malaysians said it was likely that their personal online accounts would be hacked in that year. (R. Hirschmann, 2023) The case discussed in this section is that of Keem Ooi, a self-taught baker who impressed her fans on social media with her innovative cakes and pastries. (T. A Yusof, 2020) Faced with her sudden fame, Ooi asked for a 'blue tick' on Instagram to verify her account. One day, she received a direct message (DM) in her inbox that appeared to be from Instagram asking her to click on a link to verify her email address and confirm the verification process. Thinking it was nothing out of the ordinary, Ooi followed the instructions. After noticing an unexpected login to Turkey, the hacker deleted all photos on @keempossible. As a result of this incident, Ooi lost her six-year-old account and was forced to create a new one.

### *Cyberstalking*

Cyberstalking is a particularly serious form of cyberbullying as it can include threats of physical harm to the target. It can involve surveillance, false accusations and threats and is often associated with offline stalking. It is a criminal offence and the perpetrator may face a restraining order, a suspended sentence or even imprisonment. (Securly, 2021) This section is about the modesty of former Miss Universe Malaysia Sabrina Beneett. The former beauty queen's ill-treatment came to light when she suddenly broke her silence on social media, stating that she had been subjected to years of persistent harassment, threats and stalking by the perpetrator.

The 31-year-old psychology and communications student said the perpetrator followed her activities and used many fictitious social media accounts to harass her, even threatening to "destroy" her. She stated that the harasser identified the places he saw her and even identified the friends she was with and the clothes she was wearing, although she made an effort not to post her whereabouts on social media when she was out and about. She said the offender used many fictional personalities to leave filthy obscenities and violent language on her

social media pages, including mocking her modesty. Under Section 509 of the Penal Code, anyone who knowingly insults the shame of a woman by words, sounds, gestures or the display of an object is liable to imprisonment for up to five years or a fine of up to \$5,000, or both. As a result, a 33-year-old unemployed man was convicted by the Magistrate's Court after pleading guilty and paying a RM1,200 fine on the spot at the Jalan Duta Magistrate's Court (Thasha Jayamanogaran, 2021).

### *Impact of cyberbullying*

Abusive behaviour among young people is an ongoing problem that can cause physical and psychological harm to those involved. The impact of cyberbullying on victims is more severe than traditional bullying because cyberbullying can take place around the clock and information can be disseminated more quickly to a larger population through social media. Bullying can have devastating consequences that vary from person to person, as the threshold for different types of bullying, the intensity and frequency depends on the individual.

Eating disorders and sleep disorders are classified as physical effects of cyberbullying. An eating disorder is when a person experiences serious disturbances in eating behaviour, such as skipping meals or binge eating, or when they worry about their body shape and weight. Cyberbullying can increase the risk of bulimia nervosa and anorexia nervosa by increasing the likelihood of dieting and dysfunctional weight control practises to cope with body dissatisfaction and low self-esteem (J. H. Marco, 2018). Cyberbullying can disrupt a person's sleep patterns. Adolescents who were victims of cyberbullying also reported more overall sleep problems, excessive sleep, insomnia, inadequate sleep and parasomnias (Rzewnicki et al., 2020).

In addition, depression and anxiety, low self-esteem, and suicidal thoughts and self-harm are classified as psychological effects of cyberbullying. Victims of cyberbullying may develop depression, anxiety and other stress-related disorders. The added stress of dealing with cyberbullying on a regular basis can rob them of their happiness and satisfaction. According to one study, 93% of cyberbullying victims showed severe effects, with most victims expressing sadness, hopelessness and powerlessness (Nixon, 2014).

Furthermore, cyberbullying often focuses on what already makes victims vulnerable. Victims of bullying may develop a strong dissatisfaction with themselves. This can lead them to begin to doubt their worth. Researchers suggest that cyberbullying can lead to psychological maladjustment and low self-esteem because young people have a strong psychological need to belong and be accepted by their peers.

Targets of cyberbullying may hurt themselves in some way because of their overwhelming feelings. For example, some people hurt themselves by cutting or burning themselves. In fact, studies have consistently found a link between bullying and self-harm. Suicide is also encouraged by cyberbullying. Young people who are regularly bullied by their peers through instant messaging, texting, apps or social media may believe that the only way to relieve the pain is to end their lives.

## Target Community and Context of Study

In addition to the fact-finding, a self-administered online questionnaire via Google Forms was used to collect young people's perceptions of cyberbullying. The link to the questionnaire was shared in WhatsApp groups and on Instagram. This approach enabled the collection of relevant data in a relatively short time and proved practical as the students had access to the young people's age groups. It took about five days to collect all the relevant information.

## Participants

A quantitative survey was chosen to collect data on cyberbullying among adolescents. The 50 respondents were 70% female and 30% male. The target groups for data collection on cyberbullying in Malaysia are youths aged 15 to 24 years. About 64% of them fall into the 22-24 age group. The majority of the respondents (58%) have a Bachelor's degree. Moreover, the majority of the respondents are Malays (96%). According to the findings, 68% of the respondents are active users of social media and their daily internet usage ranges from 9 to 18 hours.

Those who are considered victims of cyberbullying and have experienced bullying others online are also our target group. In addition, to protect the anonymity of the respondents, only some personal variables such as gender and age were collected.

## *Measures*

Sections A and B began with demographic information such as gender, age, highest educational attainment, race and religion. This section also asked about frequency of internet use in hours and whether or not they were active social media users.

Sections C and D collected information about respondents' experiences as a bully, victim and/or bystander. The survey began by asking respondents if they had ever been bullied in their lives, bullied someone or witnessed a bullying situation (dichotomous; yes or no). If the question was answered in the affirmative, the respondent had to answer a series of questions. For example, if the question about cyber victimisation is answered in the affirmative. In this case, the following questions are asked: "frequency of cyberbullying", "perpetrator of cyberbullying", "type of cyberbullying experienced", "cyberbullying platform", "measures against cyberbullying" and "impact of cyberbullying". If cyberbullying is answered yes, the following questions are asked: "Reason for participating in cyberbullying" and "Form of cyberbullying".

Sections E and F captured respondents' perspectives on cyberbullying, bullies and victims. Respondents were given response options on five Likert scales ranging from 0 (strongly disagree) to 5 (strongly agree). Section G began with the question on measures to curb cyberbullying in Malaysia. This section contained multiple choice

answers where more than one answer could be selected. Finally, the question asked for further suggestions, if any.

## Issue Analysis and Critical Thinking

### Most popular platform used for cyberbully

It is common for young people to use online social networking sites (SNS) to socialise. These sites make up a large part of their daily internet use (Campbell, 2012) . Another aspect is that social networks make it easier for cyberbullies to target their victims. The figure above shows the result of the most popular platform for cyberbullying. Instagram (52.4%) has the highest percentage. Twenty-two out of 42 respondents have experienced being bullied on Instagram. Twitter is also the most popular platform among respondents with 45.2%. These platforms are a good place for people to socialise and have fun. However, people still get hurt and most victims do not know who did it or who did it to them (Johnson et al., 2016).

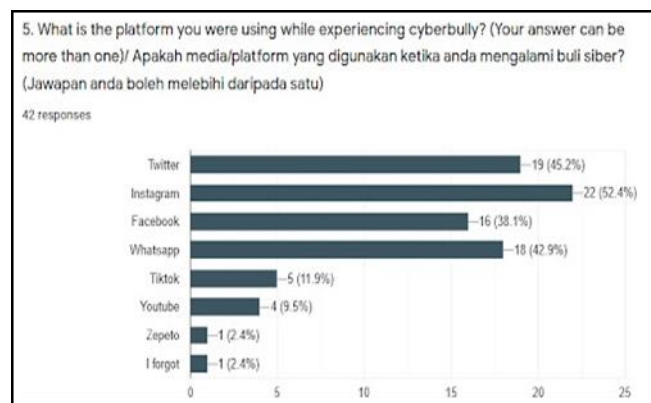


Figure 1. Platform distribution of respondents.

### Gender of respondents

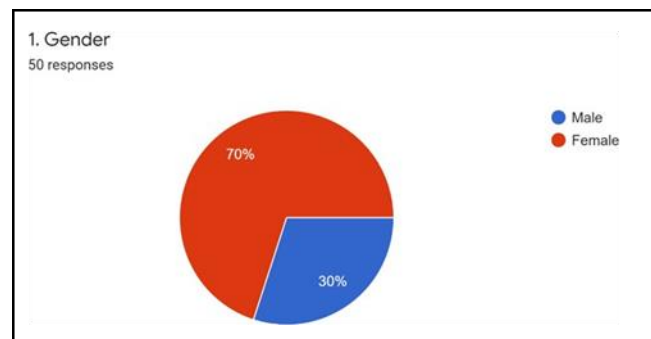


Figure 2. Gender distribution of respondents.

Figure 2 summarises the demographic characteristics of the respondents by gender; the results show that 35 (70%) of the respondents were female and 15 (30%) were male. This indicates that a larger proportion of female

than male youth participated in the study. It also means that there are more female adolescents than male adolescents.

*Cyberbully activities*

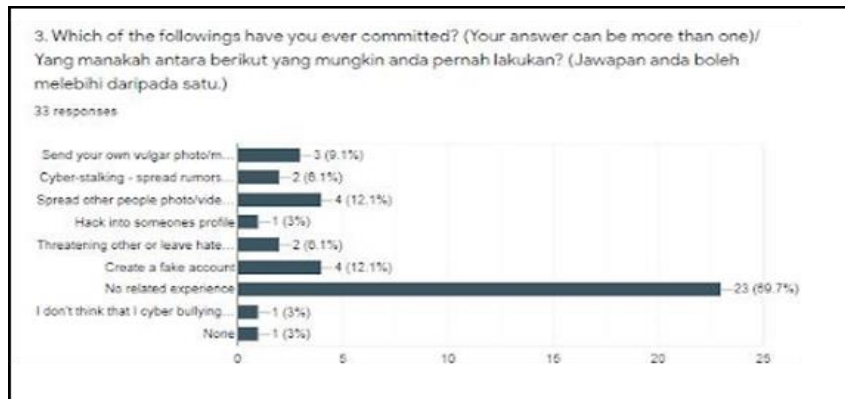


Figure 3. Cyberbully activities distribution of respondents

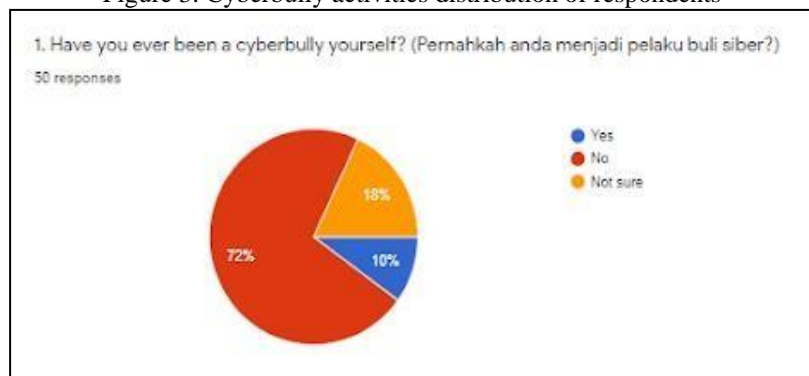


Figure 4. Cyberbully distribution of respondents

Figure 3 shows the survey results on cyberbullying committed by the cyberbullies of 33 respondents. 23 out of 33 respondents have not had any experience in this regard. When asked if they had ever been bullied, 36 of the 50 respondents answered that they had never been bullied (see Figure 4). It could be that 23 of the respondents have never bullied anyone, are victims of cyberbullying or observers; therefore they have no experience in this regard.

*Impacts of cyberbully on individual*

Due to societal pressures and the prevalence of sexually explicit content among women, the consequences of cyberbullying are particularly severe for women (Wachs et al., 2021) . Figure 5 shows the result of the survey on the impact of cyberbullying among 43 respondents who have been bullied once. It can be seen that 81.4 %, i.e. 35 out of 43 respondents, feel insecure and sensitive towards their environment after being bullied. 39.5% of the respondents feel anxious when they receive messages or emails. As (Thseen, 2021) notes, experiences of cyberbullying can cause lower self-esteem, discomfort and sadness, social anxiety, loneliness and depression.

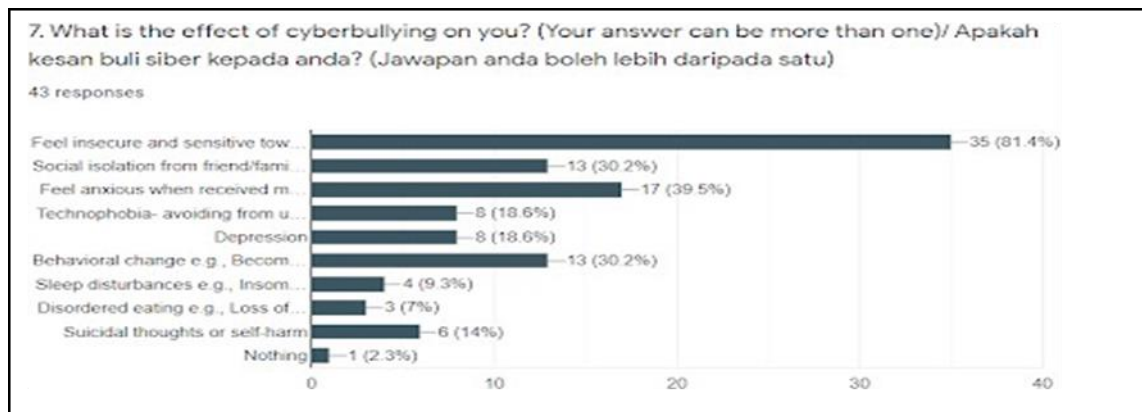


Figure 5. Impacts of cyberbully distribution of respondents

## Islamic Perspectives

In Islam, Allah, the Exalted, has said that Islam does not restrict its people to being good only to each other, but even protects all, irrespective of race, culture and religion, including the creatures of the universe, as mentioned in Surah Al-Mumtahanah, verse 8. People who perform good deeds in their lives are loved by Allah, the Exalted, and are rewarded. The present generation shows that it does not practise the teachings of Prophet Muhammad SAW regarding morality and good deeds. It is obliged to show and practise the good personality of Prophet Muhammad SAW without trying to act with a contrary practise just for the sake of other interests and benefits.

“Allah does not forbid you from dealing justly and kindly with those who did not fight against you in the matter of religion nor drove you out of your land. Surely Allah loves the doers of justice (those who deal with equity).” (Surah al- Mumtahanah, verse 8).

Allah's Messenger (ﷺ) said, "Anybody who believes in Allah and the Last Day should not harm his neighbor, and anybody who believes in Allah and the Last Day should entertain his guest generously and anybody who believes in Allah and the Last Day should talk what is good or keep quiet. (i.e. abstain from all kinds of evil and dirty talk). (Riwayat al- Bukhari: 6018).

In this day and age, trolling and throwing hate comments seems like it has been normalizing in the community as people expect the ones who make mistakes should receive hate comments and deserve to be frustrated. Many people believe that suffering, whether physical or emotional, is a necessary part of regaining one's moral character (Timothy J. Legg, 2020) . In this hadith, Rasulullah SAW stated the correlation between saying good things and someone's faith in Allah SWT. This is because guarding our tongue against talking bad and using it for saying good things is one of the signs of faith.

Thinking before speaking out or commenting on any issues is necessary as it might harm the listeners' mental

and physical. A simple message could hurt one heart as mentioned from a famous quote that the tongue is the sharpest weapon in the world that will kill anybody without bloodshed.

“Today We shall put a seal on their mouths, and their hands will speak to Us and their feet shall bear witness to what they had been doing.” (Surah YaSin, verse 65).

This command is given in regard to the obstinate guilty who will refuse to confess their crimes, lie to witnesses, and also refuse to acknowledge the authenticity of their book of conduct. This command is given to obstinate offenders who will refuse to confess their crimes, lie to witnesses and also refuse to acknowledge the authenticity of their book of conduct.

The words used will be etched in the heart of the listener. Posting a status on social media that angers others is not a good measure to counter hateful situations. Spread awareness and remind each other that all things in this world, the words we use, the messages sent and the posts on social media, will be scrutinised in the akhirah and each person's limbs will be witnesses to the misdeeds and good deeds. Therefore, it is a good thing to maintain consistency by doing good things instead of posting hate comments that lead to strife and destroy the community. Cultivating respect and love for others is a good way to create harmony in the community.

## **Code of Ethics**

Cyberbullying is an ethical problem that can lead to emotional injury for many young people, including suicide (Peled, 2019) . There are three types of theories that can be used in society to solve ethical problems. People who believe in virtues such as utilitarianism, deontology and ethics think this way. However, much attention is given to the utilitarian method of solving ethical problems.

### *Utilitarianism*

Utilitarianism is also characterised by justice and impartiality of actors. The happiness of all people counts equally. When maximising the good, it is the good considered impartially. My good does not count more than someone else's good (Cekić, 2018) . When making a decision, one considers the needs of other people as well as one's own. Rule utilitarianism and action utilitarianism are two types of utilitarianism. Both ways of dealing with bullying are different and work in different ways.

- Action utilitarianism: As a rule, the conclusion is ethically correct because it is based on the decision of the majority, regardless of utilitarian beliefs. So the first strategy in cyberbullying would be to apologise to the victim for what the bully has done. Personal apologies or other media such as letters could achieve this goal. Focusing on the four types of bullies can also help stop cyberbullying. Enrolling vindictive bullies in peer counselling groups can teach them not to take the law into their own hands. Unwitting online bullies can also be enrolled in mentoring and counselling groups to help them. This would help them learn to control themselves



instead of bullying others. To solve these two types of bullying, it is best to act utilitarian.

- Rule utilitarianism: Compared to action utilitarianism, this approach values both benefits to society and fairness. Power-hungry nerds are the most dangerous bullies because they can bully their peers using technology. Their actions are subtle and they do not inform anyone about their actions. Therefore, rule utilitarianism best solves cyberbullying by prosecuting the culprits. Moreover, rule utilitarianism can solve the bullying of mean girls (Shaheen Shariff, 2008) . School staff can deal with the girls because most of these situations involve the same school. School administrators can punish the bullies, helping to end the problem and set an example for future girls who want to follow in their footsteps.

In this way, the decision-making process goes beyond the self-interest of the individual by considering the interests of others. There are two types of utilitarian approaches: rule utilitarianism and action utilitarianism. Rule utilitarianism is the more traditional approach. In terms of how they solve bullying cases, the two techniques differ somewhat.

## **Law on Cyberbullying in Malaysia**

Malaysia doesn't have an explicit cyber law against cyberbullying. According to (MARTIN CARVALHO, 2021) , the MCMC continues to work on anti-cyberbullying legislation. In the absence of a specific law, there are provisions in various laws such as the Computer Crimes Act 1997, the Communication and Multimedia Act 1998 and the Penal Code that can be used to combat cyberbullying.

### **Computer Crimes Act 1997**

- Section 3: Unauthorised access to computer material - Persons may be charged under section 3 of the Computer Crimes Act 1997 if they use a computer to do something with the intention of gaining access to a programme or data that doesn't belong there and they know at the time of using the computer that it doesn't belong there. An offence under this section need not be directed at a particular programme or data, a particular type of programme or data, or a particular computer. It need not be directed at a particular programme or data—  
- fifty thousand ringgit fine or five years imprisonment or both.
- Section 4: Trespass with intent to commit or facilitate the commission of another offence  
- This states that a person who commits an offence as in section 3 with a view to doing something which causes damage or fraud or dishonesty as defined in the Criminal Code [Act 574] is guilty of an offence under this section. It does not matter whether the offence is committed by someone else or by himself. It is immaterial to this section whether the offence to which it relates is committed at the same time as the unauthorised access is secured or at a later time. Under this section, a person who commits an offence is liable to a fine or to imprisonment for a term not exceeding ten years, or to both.
- Section 5: Unauthorised alteration of the contents of a computer - Section 5 of the Act states that a person who does anything which he knows alters the contents of a computer without permission commits an

offence. He or she is guilty of an offence. For this part of the Act, it does not matter whether the act in question relates to a particular programme or data, a programme or data of any kind, or data in a particular computer. For this section, it does not matter whether an unauthorised modification is permanent or temporary. The Penal Code states that anyone guilty of an offence under this section may be fined up to one hundred thousand ringgit or imprisoned for up to seven years. If the offenders cause damage, they can be fined up to one hundred and fifty thousand ringgit or imprisoned for up to ten years.

#### *Communication and Multimedia Act 1998*

- Section 211: Prohibition on provision of offensive content - The Communication and Multimedia Act of 1998 states that no content applications service provider, or anyone else who uses a content applications service, can put up content that is offensive, indecent, obscene, false, menacing, or menacing with the purpose of annoying or harassing another person. Subsection (2) of this section says that if you break subsection (1), you're guilty of an offence and could be fined up to fifty thousand ringgit or imprisoned for a year or both. If the offence isn't ended after you're convicted, you could also be hit with a fine of one thousand ringgit for every day or part of every day that the offence goes on.

- Section 233: Unauthorised use of network facilities or network services, etc. - Under the Communications and Multimedia Act 1998, section 233 provides that a person who, by means of network facilities or network services or application services, knowingly makes, creates or solicits and causes to be made any comment, solicitation, suggestion or other communication of an obscene, indecent, false, threatening or abusive character with intent to transmit the same, with intent, harass, abuse, threaten or victimise another person, or initiates a communication using an application service, whether continuously, repeatedly or otherwise, which communication, with or without disclosure of his identity and with intent to harass, abuse, threaten or victimise a person at any number or electronic address, commits an offence.

In addition, subsection (2) of this section provides that a person who knowingly provides an obscene communication for commercial purposes through a network or application service to a person or who permits a network or application service under his control to be used for an activity described in paragraph (a) of this section commits an offence.

Subsection (3) of this section states that a fine shall be imposed if a person is found guilty of an offence under this section. The fine shall be up to fifty thousand ringgit or one year imprisonment or both. A fine of one thousand ringgit shall be imposed for each day that the offence continues after conviction.

#### *Evidence Act 1950*

Section 114A of the Evidence Act 1950 could also help protect against cyberbullying and the other things mentioned above. Under this, anyone who appears in a publication by his name, picture or pseudonym, or helps to facilitate the publication or republication of the publication, is presumed to have done so, unless it can be proved that he did not do so. This is known as the "presumption of publication" As they have an account with a network provider, they are presumed to have made or shared the publication unless it can be proved otherwise.

Anyone who owns or has control of the computer from which a publication originates is presumed to be responsible for its publication or disclosure. This applies unless the person can prove that he or she was not.

Although there are a number of laws against cyberbullying in Malaysia, perpetrators often go unpunished because there is not enough evidence. It has been very difficult to prosecute the perpetrators. "I did not do it" is one of the justifications given by the perpetrator. This is the most common response from people when a hate or threatening message is linked to their Facebook, Twitter or other internet account. According to the Malaysian Communications and Multimedia Commission, it is almost impossible to take action against someone if they only deny any responsibility. Moreover, no victim of cyberbullying has filed a complaint yet. For fear of being bullied again, victims remain silent. If a victim reports bullying, they face further victimisation or ostracism.

## Solutions and Strategies

The issue of cyberbullying has attracted a lot of attention in order to eradicate this phenomenon. Cyberbullying takes place online, but the consequences are just as severe as physical bullying. This issue should be discussed more to educate parents, young people and children about the dangers of cyberbullying and how to deal with it if they become victims. Campaigns have been launched to educate society and promote its ideals. Awareness campaigns, whether traditional (posters or pennants) or interactive (mobile apps, virtual reality or augmented reality), all have the same goal: to educate the public about the multimedia act (Manshor, 2014), the consequences for victims (Abas Ainna, 2018), the way out in Islam (Ab Manaf & Muhammad, 2022) and the legal right (Ikhsan et al., 2012), especially in eradicating this problem.

Malaysian celebrities have responded by participating in the "End Cyberbullying and False Information Dissemination" campaign, which seeks to combat cyberbullying and the dissemination of false information on social media (Norazlinda Mohammad, 2021) Although this is a joint effort, it is important that everyone takes preventive action, as prevention is always better than cure. Individuals who are victims of cyberbullying can take the following steps to ensure their safety: ignore the perpetrator, take screenshots of evidence, inform a trusted person, report the perpetrator and block them. As a society, we can work together to create a safer online environment that is free from cyberbullying. Avoid anyone who tries to stalk you (Haryani Haron, 2010).

## Conclusion

The use of social media is an important part of any society, especially during the industrial revolution. 4.0. However, immoral behaviour on social media leads to its misuse with the aim of violating cultural norms and laws. The symptoms of cyberbullying, which is an increasingly common trend that needs to be addressed, can have a significant impact on society. One of the contributions of this study is that it reconciles the Western and Islamic perspectives on harmonious interaction on digital platforms. Cyberbullying is a serious problem because anyone can be a victim of cyberbullying. Cyberbullying can have long-term consequences for its victims.

Therefore, we need to think carefully about what we share or say that could hurt others. To prevent cyberbullying and make the internet a safer environment for everyone, parents, schools and children need to work together. The survey shows that most respondents want a healthy online environment that is free from cyberbullying.

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## Can ChatGPT Facilitate the Implementation of Personal Learning Environments in Tertiary Education: Benefits and Risks

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**Abstract:** The integration of ChatGPT in Personal Learning Environments (PLEs) has emerged as a promising approach to personalized learning in tertiary education. ChatGPT is believed to have the potential to transform traditional higher education into a more personalized, quality-driven, and student-centered learning experience that fosters critical thinking, self-regulated learning, and creativity. While recent studies have highlighted the potential benefits of ChatGPT in enhancing personalized learning experiences, there are several risks and challenges that need to be addressed. This paper reviews relevant literature on ChatGPT and PLEs and identifies key risks and challenges associated with their integration, including ethical concerns, data privacy, technical issues, and user acceptance. Meanwhile, the paper also proposes ways and thoughts for the future implementation of ChatGPT in PLEs. The paper concludes that ChatGPT has significant potential to facilitate a new round of educational revolution which pushes educators to reconsider why to teach, how to teach, and what to teach.

**Keywords:** Chatgpt, Chatbot, Personalized Learning, Personal Learning Environment, Higher Education, Benefit And Risk

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## Introduction

Personalized Learning Environments (PLEs) have emerged as a promising approach to improving the quality of higher education. By leveraging the power of technology, PLEs enable students to take control of their learning experiences and tailor them to their individual needs and preferences. One technology that has shown great potential in this regard is ChatGPT. ChatGPT is a state-of-the-art language model developed by OpenAI that has gained significant attention and popularity in recent years. As a large language model, ChatGPT is capable of generating human-like responses to a wide range of natural language input, making it a valuable tool for various applications, including educational ones.

The first principle of ChatGPT is the use of transformer-based language models that rely on self-attention mechanisms to generate coherent and relevant responses. These models, such as GPT-3, are designed to learn from large amounts of data and leverage the power of deep neural networks to generate natural language that mimics human communication. Floridi and Chiriatti (2020) argue that GPT-3 represents a significant breakthrough in the field of AI, allowing for more efficient and effective natural language processing. Zhang and Li (2021) suggest that GPT-3 has the potential to revolutionize industries such as education and customer service. However, Dale (2021) cautions that while GPT-3 is impressive, it is not a substitute for human intelligence and is limited by its training data. Radford et al. (2021) propose that GPT-3 can be enhanced by incorporating visual cues to improve its understanding of the world, while Vaswani et al. (2017) highlight the importance of attention mechanisms in transformer-based models like GPT-3. Moreover, the GPT model is capable of adapting to user preferences and behaviors over time, further enhancing its ability to generate high-quality responses.

Despite the primary purpose of a chatbot being to imitate human conversation, ChatGPT stands out for its versatility in various applications. Notably, it has been reported to have the capability to generate and debug computer programs Tung (2023), compose a wide range of creative works such as music, fairy tales, teleplays, and essays, as well as provide answers to test questions at a level that can surpass that of an average human test-taker Heilweil (2022). It can also generate poetry and song lyrics Reich (2022), emulate a Linux system, simulate an entire chat room, play games like tic-tac-toe, and simulate an ATM Edwards (2022). The training data used for ChatGPT's development includes information on internet phenomena, programming languages, and man pages, such as those of bulletin board systems and the Python programming language Edwards (2022). ChatGPT is an advanced chatbot that is being increasingly used in the education sector to provide personalized learning experiences to students. One of the essential features of educational chatbots is their ability to personalize learning. The integration of AI-powered chatbots with e-learning platforms can also personalize the e-learning process Davies et al. (2020). In this paper, we explore the potential ways, benefits, and risks of applying ChatGPT in the development and implementation of PLEs in higher education.



### **The impact of ChatGPT on human life and education**

ChatGPT was first introduced in June 2018 by OpenAI, a research organization dedicated to advancing artificial intelligence in a safe and beneficial way Radford et al. (2018). ChatGPT is an extension of the GPT (Generative Pre-trained Transformer) family of models, which are designed to generate natural language text in a wide range of tasks, including language translation, question answering, and text summarization. ChatGPT is trained on a massive dataset of text from the internet, allowing it to generate human-like responses to a wide range of natural language inputs.

With its fast development, there are many concerns about the implementation of ChatGPT in all fields of human life, including education. Is ChatGPT an angel or a devil? ChatGPT has the potential to revolutionize education in a way that is similar to how previous technological inventions such as printers, calculators, computers, and information and communication technologies (ICT) have impacted human life and education. The human development index (HDI) considers technological advancements as one of the three key dimensions of human development, along with income and health United Nations Development Program (2020). These technologies have made information and knowledge more accessible, contributing to the spread of education worldwide. The computer, for example, has revolutionized the way education is delivered. It has enabled distance learning and the use of multimedia resources, allowing students to learn at their own pace and in their preferred environment Bates & Poole (2003). Similarly, the telephone has facilitated communication between teachers and students, making it possible for them to discuss academic matters and seek assistance remotely. The printer, on the other hand, has made it easier for students to produce high-quality written work. It has also allowed for the mass production of educational materials such as textbooks, increasing their accessibility and affordability Bates & Sangra (2011).

Like the previous revolutionary inventories, ChatGPT has the potential to significantly impact the value and pedagogy of modern higher education by transforming traditional knowledge-push education to personalized upper-level mind development. According to Benedetto et al. (2019), Chatbots can serve as virtual teaching assistants, supporting personalized learning by providing instant feedback, answering questions, and offering relevant learning resources. This personalization of education has the potential to improve the quality of education by catering to the individual learning needs of each student Davies et al. (2020).

Moreover, ChatGPT can promote critical thinking and self-regulated learning by encouraging students to think deeply about the questions asked by the chatbot and take charge of their learning process Holotescu (2016). Additionally, the use of ChatGPT can enhance creativity and imagination by encouraging students to think outside the box and explore new ideas and perspectives Haristiani & Rifa'I (2020). Furthermore, ChatGPT can promote global competence development by providing students with access to information and perspectives from all around the world Sharef et al. (2021). It can also help students develop emotional intelligence (EQ) by providing them with a safe space to express their feelings and practice empathy Pataranutaporn et al. (2021).

In terms of the impact of ChatGPT on teachers and teaching, the emergence of ChatGPT is expected to bring significant changes to the role of teachers in higher education. Traditional methods of teaching, where teachers were the primary source of knowledge, will no longer be sufficient in the era of personalized learning. With the help of ChatGPT, learners can access personalized learning experiences and content that cater to their unique needs and interests. This shift in pedagogy requires teachers to adopt new roles, such as facilitators, mentors, and coaches, who guide and support learners in their self-directed learning journeys.

Moreover, the traditional system of evaluating teachers based on their knowledge and expertise will need to evolve. Teachers will be evaluated based on their ability to facilitate personalized learning experiences, inspire learners, and promote critical thinking and problem-solving skills. The focus will be on the impact of teaching and learning rather than just the transmission of knowledge. This change in evaluation methods will encourage teachers to adopt more innovative and personalized teaching approaches that better engage and motivate learners.

In summary, ChatGPT has the potential to transform traditional higher education into a more personalized, quality-driven, and student-centered learning experience that fosters critical thinking, self-regulated learning, creativity, imagination, global competence development, and EQ.

### **A brief introduction to PLEs**

Personal Learning Environments (PLEs) is a concept that refers to a system of tools, resources, and social connections that support individual learning goals and strategies. PLEs are becoming increasingly popular in higher education as they allow learners to take control of their own learning experiences and create a personalized and flexible approach to learning Buchem (2014). PLEs can encompass a variety of technologies such as blogs, wikis, social media, and mobile devices, among others Attwel (2007). The effectiveness of PLEs in meeting established learning objectives has been explored in various studies (Fiedler & Våljataga, 2013). PLEs can enhance learners' engagement, motivation, and satisfaction with the learning process, as well as provide opportunities for collaborative and peer-to-peer learning Johnson & Liber (2008).

The use of PLEs can provide opportunities for undergraduate research experiences National Academies of Sciences, Engineering, and Medicine (2017), personalized learning Pane et al. (2017), and the digital transformation of teaching and learning in higher education UNESCO & Tsinghua University (2022). The ontology-driven conceptual model proposed by Nan Cenka et al. (2022) further emphasizes the importance of PLEs as a framework for lifelong learning. However, the implementation of PLEs also presents challenges, such as the need for learner control and the development of the instructional design that supports learner autonomy Våljataga & Laanpere (2010). Despite these challenges, PLEs have the potential to transform traditional teaching and learning practices in higher education Shavelson (2010), as evidenced by their successful implementation in English for Specific Purposes Xu et al. (2020).

### **Potential ways to apply ChatGPT in PLEs development**

ChatGPT can play a significant role in the development and implementation of PLEs in tertiary education. ChatGPT's ability to generate natural language responses can facilitate communication between learners and their PLEs, allowing learners to interact with their PLEs in a more natural and intuitive way. ChatGPT can collect and analyze data on a student's learning patterns, preferences, and performance to create a customized learning experience. Haristianı and Rifa'i (2020) found that ChatGPT can be combined with social media to enhance the Personal Learning Environments of students.

Sharef et al. (2021) also proposed a personalized learning approach based on learning analytics and chatbot technology. ChatGPT is also being used in research to create intelligent and interactive chatbots for personalized learning experiences Yao & Wu (2022); Benedetto et al. (2019). Furthermore, Ashok et al. (2021) conducted a systematic survey of cognitive chatbots in a personalized learning framework and concluded that chatbots can be used to deliver personalized learning to students. Finally, Pataranutaporn et al. (2021) developed AI-generated characters that can support personalized learning and well-being.

ChatGPT can be leveraged in a number of ways to enhance the development and implementation of PLEs in higher education. Some potential ways include:

- 1) **Personalized Tutoring:** ChatGPT can serve as a virtual tutor, providing personalized support to students. It can interact with students, answering their questions and providing feedback on their work in real time.
- 2) **Adaptive Learning:** ChatGPT can adapt to the needs of individual learners, providing customized learning experiences based on their interests, abilities, and learning styles.
- 3) **Content Creation:** ChatGPT can be used to generate content, such as quizzes, assignments, and study materials, that is tailored to individual students' needs.
- 4) **Social Learning:** ChatGPT can facilitate social learning by enabling students to interact with each other and with instructors in real time. It can be used to create discussion forums, chat groups, and other interactive learning environments.

As technology continues to advance, it is likely that personalized ChatGPT programs will become more commonplace in education. This could allow learners to tailor their own ChatGPT experience, building their own database with specific data, language structure, preferred language style, and other preferences. Learners could choose to focus on specific subject areas or language skills, or even develop their own unique ChatGPT persona with a particular tone or style. Additionally, personalized ChatGPT programs could be designed to support learners with specific learning challenges or preferences, such as those with dyslexia or ADHD. The potential for personalized ChatGPT programs is vast and could revolutionize the way learners interact with and learn from AI language models.

### **Benefits of applying ChatGPT in PLEs**

Applying ChatGPT in Personal Learning Environments has several benefits. Firstly, it facilitates personalized learning, which is critical for modern education. Chatbots, powered by AI, can assess a student's level of knowledge and provide tailored learning materials based on the student's unique learning pace, style, and preference. This helps students to grasp concepts quickly and effectively, enhancing their learning outcomes. Secondly, chatbots can provide round-the-clock assistance to students, answering their questions promptly and providing guidance on assignments and projects. This frees up the teacher's time to focus on more important tasks, such as inspiring students and facilitating their self-actualization. Thirdly, chatbots can help to monitor the progress of students and provide relevant feedback, allowing them to identify their strengths and weaknesses and make necessary adjustments to their learning strategy.

The following part listed some of the numerous benefits, including:

- 1) **Improved Engagement:** ChatGPT can help increase student engagement by providing interactive learning experiences and personalized support.
- 2) **Facilitation of self-regulated learning:** ChatGPT can provide personalized and adaptive learning experiences, helping learners to develop self-regulated learning skills.
- 3) **Enhanced learning motivation:** By providing engaging and interactive conversations, ChatGPT can increase learners' motivation and interest in the learning process.
- 4) **Personalization and customization of learning experiences:** ChatGPT can personalize the learning experience by adapting to the learner's needs and preferences, making learning more relevant and effective.
- 5) **Improvement of critical thinking skills:** ChatGPT can stimulate critical thinking skills by providing opportunities for learners to engage in complex problem-solving tasks and discussions.
- 6) **Accessibility:** ChatGPT can help make education more accessible to students with disabilities or other challenges that may make traditional learning environments difficult.
- 7) **Time and cost-effectiveness:** ChatGPT can be used to deliver learning materials and support at a relatively low cost, and learners can access the system at any time and from any location.

### **Risks and challenges of applying ChatGPT in PLEs**

This integration also presents several risks and challenges that must be considered. Some of the critical issues include the need for effective dialogue management, ensuring the reliability and validity of the chatbot's responses, privacy and security concerns, and the need for ongoing maintenance and support. Additionally, the successful integration of ChatGPT in PLEs requires a robust understanding of the pedagogical objectives, student needs, and learning outcomes. The following part describes some risks that need to be considered, including:

- 1) **Privacy Concerns:** ChatGPT relies on access to large amounts of data, which raises concerns about privacy and security.
- 2) **Academic ethical concerns:** Using an AI model to complete assignments or write papers may raise

concerns about academic integrity, plagiarism, and originality.

- 3) Quality of work: While ChatGPT can generate responses quickly, the quality of the work may vary, and it may not meet the same standards as work produced by a human.
- 4) Bias and accuracy: AI models are trained on large datasets, which may have inherent biases that can influence the generated output. This can be a concern in academic work, where accuracy and impartiality are critical.
- 5) Legal issues: The use of AI in education raises potential legal issues around privacy, data protection, and intellectual property rights.
- 6) Technical issues: The reliability and stability of the technology behind ChatGPT may be a concern, as technical issues can lead to lost work, missed deadlines, or other problems.
- 7) Psychological effects: Overreliance on ChatGPT may lead to a lack of confidence in one's own abilities and can also cause anxiety and stress, particularly if the technology is not working as expected or generates unsatisfactory results.

### **Proposed Guiding Principles and Frameworks for integrating ChatGPT in PLEs**

- 1) Provide opportunities for self-directed learning through the use of ChatGPT to allow learners to explore their interests and personalize their learning experiences. Tapalova and Zhiyenbayeva (2022) indicated that AI can be used to enhance learner agency and self-directed learning, and emphasize the importance of sustainable evaluation to continuously improve the learning experience.
- 2) Foster a sense of belonging and community by encouraging learners to engage in collaborative learning activities through ChatGT. Dunleavy & Burke (2019) pointed out that a sense of belonging is a crucial factor that can influence student engagement, satisfaction, and success. They suggested that this can be achieved by creating a supportive and inclusive online learning environment that encourages communication, collaboration, and active participation among students.
- 3) Use ChatGPT to provide timely feedback and support to learners, which can enhance their potential realization and motivation to learn. Weber and Ludwig (2020) found that users perceive chatbots and voice assistants as useful tools for learning and enhancing their skills. In addition, Jeon (2021) found that young learners had positive experiences and perspectives when using AI chatbots in the EFL classroom, as they provided timely feedback and support and increased their engagement and motivation to learn.
- 4) Use a variety of learning interactions in ChatGPT, including discussion forums, quizzes, and simulations, to promote active and meaningful learning experiences. Khan et al. (2017) found that students who engaged in active learning activities, such as discussions and group work, had higher course grades and were more satisfied with the course. Lamon et al. (2020) similarly found that active learning increased student engagement and satisfaction in an online postgraduate course. Rossi et al. (2021) demonstrated that the use of active learning tools, such as simulations and case studies, improved learning outcomes, scientific attitude, and critical thinking skills in higher education students during the COVID-19 pandemic. Overall, the references suggest that active learning can lead to more positive learning experiences and outcomes for students in online courses.

- 5) Implement sustainable evaluation methods in ChatGPT, such as formative assessment and peer assessment, to provide learners with ongoing feedback and promote continuous learning. Nguyen and Walker (2016) discussed the concept of sustainable assessment for lifelong learning, highlighting the importance of incorporating ongoing formative assessment and peer assessment in online learning to promote continuous learning and provide learners with meaningful feedback. Ben-Eliyahu (2021) emphasized the need for sustainable learning in education, which involves integrating social, environmental, and economic considerations into teaching and learning practices to prepare learners for a sustainable future. Caeiro et al. (2020) conducted a critical reflection on sustainability assessment and benchmarking in higher education institutions, emphasizing the importance of incorporating sustainability criteria into assessment practices to promote sustainable development in higher education.

## Conclusion

In conclusion, ChatGPT has the potential to revolutionize tertiary education by facilitating the development and implementation of personalized learning environments (PLEs). By providing students with personalized learning experiences, ChatGPT can enhance critical thinking, self-regulated learning, creativity, imagination, global competence development, EQ, and other important skills that are essential for success in today's world. Additionally, ChatGPT can help educators to shift their focus from being knowledge givers to inspiring, leading, and facilitating learners' self-actualization and personalized learning. This requires a change in the way that teaching is evaluated, moving from how knowledgeable a teacher is to a higher level of value of teaching, influencing teaching, and personalized teaching.

However, there are also potential challenges that need to be addressed when implementing ChatGPT in tertiary education. These include concerns about privacy and data security, the need for effective training and support for educators and learners, and the importance of maintaining a balance between technology and human interaction. Overall, the implementation of ChatGPT in tertiary education has the potential to create a more personalized and effective learning environment that can prepare students for the challenges of the modern world.

ChatGPT has the ability to comprehend and reorganize all human knowledge, and gradually develop consciousness. However, it has not yet reached the level of equivalence to humans. Humans have limited capacity for acceptance and expression, but our social lives are intentional and meaningful. In contrast, artificial intelligence lacks intentionality and meaning on its own. Therefore, our goals and those of AI are different. While ChatGPT has the potential to revolutionize education and communication, it is important to recognize its limitations and understand how it can complement and enhance human capabilities.

As ChatGPT continues to advance and develop a deeper understanding of human knowledge, it becomes increasingly clear that coexistence with this artificial intelligence is inevitable. However, simply banning its

development is not a viable solution, as technology monopolies and the competition for human resources will continue to drive progress. Therefore, efforts should be focused on catching up with AI rather than attempting to control it. It is important to recognize that AI lacks the intentionality that humans possess, making it necessary to break free from traditional human will and seek meaning in new social structures. Ultimately, as humans live and work alongside ChatGPT, it will be important to embrace the opportunities for collaboration and innovation that this new era of coexistence will bring.

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## Oral and Written Historical Sources on the Earthquake and Tsunami Disasters in Nias Island

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**Abstract:** This article describes some historical data or sources that can explain the earthquake and tsunami that occurred in Nias, an island on the west coast of Sumatra in the Indian Ocean. The aim is to uncover sources that contain information that can be used to reconstruct the natural disaster events of the earthquake and tsunami on Nias Island from a historical perspective. As is well known, Nias Island regularly experiences earthquake shocks and sometimes it is also followed by tsunami waves, because the island is located in a disaster-prone area, namely on the Eurasian plate. The writing of this article uses the historical method with a disaster history approach that focuses on historiographical aspects. In over past two centuries, there have been a number of sources which contain the natural disasters of the earthquake and tsunami. These sources can be grouped into two categories, namely oral sources and written sources. Oral sources come from within the Nias community itself while written sources come from outside of the community.

**Keywords:** Earthquake, Historical sources, Indian ocean, Nias island, Tsunami.

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## Introduction

Nias Island, which is located in the Indian Ocean, is one of a series of Indonesian islands that are included in the category of disaster-prone areas, especially earthquakes. It also a tsunami-prone area because large-scale earthquakes are usually followed by high and rising waves of sea water inland. Such conditions can occur because Nias Island and together with the islands on the west coast of Sumatra are located in an active tectonic area where the Eurasian and Indo-Australian plate faults interact. Other islands in the ring such as Semeulue, the Mentawai Islands, Nias is regularly shaken by earthquakes which are sometimes accompanied by tsunamis.

Earthquake and tsunami in the Indonesian archipelago including Nias Island have always been an interesting object of study. Even more if it is related to the terrible earthquakes that hit in 2004 and 2005. Four years after that, on September 30 2009, another earthquake with a magnitude of 7.6 on the Richter scale shook the west coast of Sumatra. This time the earthquake hit Padang and other areas in West Sumatra Province. Then in November 2010 an earthquake was also followed by tsunami waves in the Mentawai Islands and in 2018 an earthquake followed by a tsunami hit Palu on Sulawesi Island. All of this has added to the long history of earthquake and tsunami natural in several coastal areas and islands in the western part of Sumatra

Wherever they are, whether it is in Nias Island and the surrounding islands or abroad, Nias people are very familiar with the term earthquake. Earthquake vocabulary is found in the vocabulary of the Nias regional languages, namely *duru (ndruru)* and *druru (ndruru) danö*. Meanwhile, the word *duru (ndruru) danö* means earthquake (Lase, 2011). The term *ndruru* is widely known in the Nias Archipelago region, including the Batu Islands region in the south, as a natural phenomenon in the form of earth shaking. For at least the last two hundred years, Nias has often been shaken by earthquakes and tsunamis.

Periodically, Nias Island always experiences shocks. This is due to the influence of the geographical location of the territorial area which is in zone 6 with the highest seismic risk in Indonesia (Beetham, 2008). In this regard, Nias Island is also named by the term swaying island with two meanings. First, a floating island. Together with the cluster of islands around it, Nias is in the middle of the Indian Ocean which is floating and "bothered" by the waves. The second meaning is the dancing island. The point is that on this island earthquakes often occur so that the situation is unstable. Residents feel as if they are in a rocking place or as if they are dancing (Hämmerle, 2015; Duha, 2012). As one of the islands in the Indonesian archipelago west of Sumatra, Nias is included in the category of earthquake and tsunami prone areas. Together with the other islands in the chain, starting from Semeulue in the north, the Mentawai Islands and Enggano in the south, since centuries ago Nias has been periodically shaken by earthquakes and sometimes accompanied by tsunamis.

This article aims to reveal a number of data or sources that can reveal the history of the earthquake and tsunami on Nias Island over the last two centuries. These sources are very useful for historians and other scientists who want to write about the history of natural disasters on the island. This paper further intends to reconstruct the history of the earthquake and tsunami that occurred on Nias Island.

## Method

The method used in writing this article is the historical method by utilizing primary and secondary data as a source of writing. These data can be grouped into two parts. The first is data owned by residents who live on Nias Island. Included in this category are data or historical sources in the form of oral traditions, namely folklore which the locals call *hoho*. As well as folk tales, inside sources include oral history interviews. The data included into the second group is data that comes from outside. These data were provided by outsiders who came to Nias Island for various purposes. Some of them are travel reports of explorers and reports of administrators of the Dutch colonial government, as well as journalist coverage in newspapers. These sources were analyzed in such a way as to reveal the events of the earthquake and tsunami on Nias Island over the past several centuries. These sources were obtained through library research and field research. All interpretations of data that have passed source verification or criticism are then presented in the form of historical or historiographical writing

## Results and Discussion

### Oral Historical Sources

#### 1. Oral Tradition

As supporters of Nias culture, the Nias people have an oral tradition of poetry sung by *ere*, a poet who has a respectable position within the traditional Nias social structure. The local people call these oral poems *hoho*. *Hoho* is in the form of spoken verses. In the past, this poem has been recited for centuries by an expert, namely *ere*, which is called *ere hoho*. The origin of *hoho*, among other things, can be associated with the word *Ho*. *Ho* is believed to be the name of one of the ancestors of the Nias people. *Ho* has a long way of life. He wanders in the real world in various areas on Nias Island. Apart from that, *Ho* also ventured into the world of folklore and the imagination of the poets of ancient Nias poetry. So *hoho* is a narrative conveyed by *Ho* to his family and grandchildren. The story told by *Ho* to his grandchildren, then passed on from one generation to the next

Historical memories of the past regarding the earthquake on Nias Island in the early periods can be known through traditional stories contained in the oral tradition called *hoho*. The *hoho* tradition continues to live and develop in the midst of society. When the traditional Nias people were no longer familiar with writing, the stories of the earthquake on the island were revealed through oral traditions which were passed down from one generation to the next. However, similar to the other stories, the story contained in this *hoho* is still heavily mixed with myths. Apart from earthquakes, *hoho* also contains stories about the origins of the Nias people's ancestors (Hammerle, 2022), customs, leadership, and others

In the *hoho* story, there are several variants regarding the factors that caused the earthquake on Nias Island. But everything is always centered on a figure named Latura Danö. In another version the figure's name is Bauwabadanö Hia. According to the mythology, the origin of the Nias people in their *hoho* comes from the sky (heaven). So that in this traditional view natural disasters are associated with supernatural forces. Some people conclude that natural disasters are God's plan.

Latura Danö is the grandson of a pair of deities who live in heaven, the male named Tuhamoraangi Tuhamoraanaa, and female name Burutiraoangi Burutiraoanaa. This couple has a son named Sirao who is the heir to the throne as well as the ruler of a kingdom located in heaven called *Teteholi Ana'a*, who later became the biological father of Latura Danö. Besides Latura Danö, Sirao still has eight more children. In the next story it is told that Latura Danö and his 8 brothers were descended (*ladada*) from heaven which is located in the upper world as the abode of the gods. They were brought down to earth. The location where they were dropped off was right at Tanö Niha, which is what the Nias people call the name of Nias Island

Unlike his 8 siblings, Latura Danö has different body size from ordinary human. His size is too big and fat. As a result, when Latura Danö was lowered to the ground and touched the ground, the ground immediately collapsed and gave a hole because it couldn't support its body weight. The body finally penetrated into the inner layers of the earth. When he was in the bowels of the earth he never came out again. Nias people believe that Latura Danö has transformed into a large snake lives there. In *hoho* it is stated that Latura Danö is *da'ö zanaya tanö Sisagörö*, *da'ö zanaya tanö sébolo*. It means he is the breadwinner of the vast earth (Zebua, 2010).

There is a time when Latura Danö who has transformed into a snake is writhing in the ground. This situation is usually triggered by the behavior of some people who inhabit Nias Island, which have deviated from the actual rules, causing bloodshed. In the past, there were often conflicts and wars between residents from different villages (*banua*) in Nias. The same goes for criminal acts. If the conflict spills blood to wet the surface of the ground and seeps in, Latura Danö doesn't like it. The snake was disturbed and then wriggled its body. The impact of the force when the snake wriggled was so great that it shook the earth of Nias just like an earthquake. The people of Nias believe that the earthquake in Nias was caused by the power of a large snake as the embodiment of Latura Danö who was writhing in the earth. People then think of it as an earthquake

When did the earthquake shaking end? The answer is when the big snake incarnated by Latura Danö stopped writhing after hearing prayers and requests from the people. Residents who are worried about the earthquake call out *biha tuha, biha tuha* which means enough grandfather or stop grandfather as a sign of their repentance for not committing criminal acts anymore.

## 2. Interviews

The second group of oral sources that can be used as historical sources regarding the natural disaster of earthquakes and tsunamis in Nias Island is in the form of oral history interviews. Many branches of social

sciences and humanities use interviews as data or sources in research on societal research objects, including historical studies.

Unlike the first type of oral source, which is oral tradition where the sources are already available within a community in the form of folktales called "hoho" in Nias Island, the second type of oral source requires a process of conducting interviews. The reason is that these sources are not readily available. To obtain them, effort is needed from the interviewer or researcher to directly meet with informants, namely the Nias community members who have experienced the earthquake and tsunami disaster, in order to conduct interviews with them.

Any resident of Nias Island who has experienced the earthquake and tsunami disaster can be considered as an informant and can be interviewed to obtain information that can serve as a source or data for constructing the historical narrative of the natural disaster that occurred on the island. The devastating earthquake and tsunami that occurred around 20 years ago, specifically in 2004 and 2005, can be inquired from the Nias residents who experienced the event. The majority of them are still alive as the event happened relatively recently, just 20 years ago from now.

To obtain information about the 2004 and 2005 earthquakes and tsunamis, the informants who can be interviewed are scattered throughout the entire Nias Island. This is because both earthquake and tsunami were of a large-scale events, with magnitudes of 9.3 and 8.7 respectively. Practically, every location across Nias Island, from north to south, and from west to east, experienced the same shaking.

In addition to the Nias community residing on Nias Island, oral sources in the form of interviews can also be conducted with the Nias people living in other areas outside of Nias Island. These individuals are the residents who migrated and moved away from Nias Island after the earthquakes and tsunamis that occurred in 2004 and 2005. It is known that the impact of the earthquakes on the social and economic life of the Nias community was extraordinary. After the earthquakes, they sought better livelihoods in various island regions of Indonesia, particularly Sumatra Island and Java Island.

The informants who can be interviewed and whose results can be used as oral historical sources can be grouped into two categories. Firstly, the majority group consists of individuals who directly experienced the devastating earthquakes and tsunamis at that time. Secondly, apart from experiencing the shock of the earthquake and the tsunami, some individuals from this group also actively participated as volunteers in assisting the communities affected by the earthquake and tsunami. This group includes members of Non-Governmental Organizations (NGOs), including international donor agencies, who came to Nias Island to aid in the post-disaster recovery efforts after the earthquake and tsunami. As it is known, the earthquake that occurred on December 26, 2004, with a magnitude above 9, devastated Aceh and the west coast regions of northern Sumatra, including Nias Island. After the earthquake, numerous foreign NGOs arrived on Nias Island to provide social assistance through the Rehabilitation and Reconstruction Program. These NGOs recruited local survivors from Nias Island, particularly young individuals, to assist in implementing the programs they were running.

Amidst the ongoing handling of the earthquake and tsunami victims, another significant earthquake and tsunami occurred, just slightly below the magnitude of the December 26, 2004 earthquake, measuring 8.7 on the Richter scale. As a result, the suffering of the Nias Island residents continued to escalate. The first earthquake had not been fully addressed when, within a span of only three months, the second earthquake struck. This situation led to the prolonged presence of NGOs in Nias and an increased recruitment of volunteers to aid in the disaster response efforts on the island.

## Written Historical Sources

Without disregarding oral sources, both in the form of oral tradition and oral history interviews, historical narratives are predominantly built upon written sources. One frequently asked question regarding history is when it began. The answer is that history began with the discovery of writing. This is also what distinguishes the field of history from archaeology, as both disciplines uncover past events. Archaeology focuses on the study of human history in ancient times before the existence of writing.

There is a proverb that strongly emphasizes the relationship between history and writing, which states, "No document, no history" or "No written, no history." It means that without written records, there is no history. This highlights the crucial role and significance of written sources in constructing historical narratives as sources or data.

Furthermore, written sources, especially primary or contemporaneous sources, are generally considered more reliable in terms of their authenticity compared to oral sources, including oral traditions as discussed earlier. According to Sartono Kartodirdjo (1985), these written sources are referred to as documentary materials. There are five types of written materials commonly used by historical researchers in writing about the past: 1) Autobiographies; 2) Personal letters; 3) Newspaper; 4) Government documents; and 5) Novels and fictional stories.

### 1. Records of Dutch Colonial Officials

The second category of historical sources that can reconstruct the history of the earthquake on Nias Island is in the form of notes or writings. In contrast to oral sources, which are only passed down from mouth to mouth using language as the only means of communication, namely the Nias regional language, this is not the case with historical sources in the form of writing. Writing sources are made and recorded using various languages from various nations or countries. This really depends on the background of the author. If the writer is a European, such as the Netherlands and Germany, the writing will be written in Dutch or German and if the writing is made by Indonesians outside of Nias, then the writing adapts to using the Indonesian language. There are also writers who use English writing as an international language.

The first historical source of the earthquake and tsunami was in the form of records made by officials of the Dutch colonial government who had served or politically controlled and ruled Nias Island from the 19th century to the first half of the 20th century. Its position in historical sources is included in the category of government documents. This means that these sources are written by the governing authorities, regardless of their position and rank. Written historical sources in the form of government documents can be written or published by both high-ranking officials and ordinary employees, without exception. Some types of written sources included and contained in government documents are government decisions, news and official reports about official events, annual reports in all areas of government, along with statistical data, government statements and statements regarding several issues, as well as lists of personnel in the central and regional government (Kartodirdjo, 1985). The earliest writing was by James du Puy (1780-1847). Du Puy was the first official of the Dutch colonial government to be assigned as a resident of Sumatra's Westkust in the West Coast region of Sumatra whose power includes a series of islands in the Indian Ocean located west of Sumatra including Nias Island. He was the highest leader of the Dutch East Indies government on the west coast of Sumatra, which at that time was centered in the city of Padang after the interregnum or the transition of British rule to the Dutch in 1819 (Asnan, 2003 and 2006). The writing by Du Puy contains information about an earthquake and tsunami that occurred in 1797, several years before he took office.

The next written record for the earthquake event is occurred in 1861. The report was made by Th. C. Rappard. He was a *controleur of Benneland Bestuur* (BB), the domestic government of the Dutch colonial government who served on Nias Island until 1905. In his article entitled *Het eiland Nias and zine bowoners* (Nias Island and its inhabitants) Rappard described the earthquake occurred in 1861 (Rappard, 1909).

Not only Rappard, the record about the earthquake that occurred in 1861 was also written by E.E.G. Willem Schröder. Similar to the position held by Rappard, Schröder was also an official of the Dutch colonial government at that time with the position of *controleur* in charge of public relations or public relations (*contoleur voor de aanrakingen*) on Nias Island from 1904-1906. In 1906 he was appointed full *controleur* until his term ended in 1908 (Hammerle, 2013). Apart from serving as a government official, Schröder has a talent for writing. While serving in Nias, he succeeded in writing a thick book in 1907. The 866-page book is entitled *Nias: Ethnographische, Geographische, en Historische, Aantekeningen en Studiën*, published in Leiden, the Netherlands in 1917.

The book contained the condition of Nias Island and various events that had occurred there, including the earthquake natural disaster. First, Schroder records earthquake events that occurred in the early 20th century. Unlike the two previous earthquakes that occurred in the 19th century, Schröder experienced this earthquake directly when he was still serving as an official of the Dutch colonial government on Nias Island. (Hämmerle, 2013).

In addition to the events he experienced directly while on duty, in his book Schroder also wrote about a devastating earthquake that occurred during his 46 years sent and assigned to Nias, namely the earthquake on



February 16, 1861. According to Schoder's records, the earthquake occurred in 1961 followed by the rising sea water to land which became known as a tsunami. Apart from the west of Nias Island, the earthquake and tsunami that occurred on January 16, 1861 also hit the southern part of Nias Island (Schröder, 1917).

## 2. Explorer Notes

Historical sources in the form of notes or writings were both made by explorers. In the context of written historical sources, this type of source is referred to as personal letters, diaries, and memoirs. Specifically, the accounts of journeys written by explorers are called memoirs. These accounts usually do not contain personal or private issues but rather focus on more general matters such as the condition of a country, city, or region. Personally the explorers are people who have an adventurous spirit, like to travel to various places and then they write and make reports about the events they experience. Among these explorers there were those who visited Nias Island and some who did not have time to reach the island. During the 19th century, it was recorded that 2 European explorers wrote and left notes about the natural disasters of earthquakes and tsunamis on the island. The first writing was made in the mid-19th century in 1843 to be precise. The first explorer to write about the earthquake in Nias was named Franz Wilhelm Junghuhn. He was a German botanist and geographer (geologist) who later moved to become a Dutch citizen. Junghuhn gained the trust of the Dutch East Indies government based in Batavia and was recruited as a health worker on Java Island, precisely in Batavia and Semarang. From 1840 to 1842 he was assigned to Padang. His job is to carry out investigations into the Land of Batak in northern Sumatra. After that he returned to Batavia.

Junghuhn never came or visit Nias Island during his time in Padang. Even though since 1825, starting from the time after being abandoned by the British EIC, politically the status of Nias Island came under the influence of the Dutch colonial government which was centered in Padang. Nevertheless, Junghuhn wrote about the earthquake and tsunami occurred on Nias Island in 1943. The information made by Juhhuhn was contained in an article written by Nieuwenhuisen and Rosenberg (1863) entitled *Verslag omtrent het Eiland Nias en Deszelfs Bewoners* which was published in the treatise *Verhandelingen van het Koninklijk Bataviaasch Genootschap van Kunsten en Wetenschappen* (VBGKW). According to Junghuhn's story, Nias Island experienced an earthquake between 5 and 6 January 1843, the continuous shaking lasted for 9 minutes

The next article was written at the end of the 19th century by an explorer who visited Nias Island. The explorer's name was Elio Modigliani who comes from Italy. At that time Modigliani traveled from Europe to the Dutch East Indies and then sailed to Nias Island. Elio Modigliani arrived in Nias and lived there for 6 months from April to September 1896. During this time, he traveled around and explored several parts of Nias Island, starting from areas located on the coast to entering areas located inland or upland. Almost half of the southern part of Nias Island was visited by Modigliani.

During his journey on Nias Island, he equipped himself with writing a kind of diary. These notes, among other things, contain stories of the journey he experienced while on Nias Island. These notes were then collected and

recorded after he returned to Italy. The result is quite thick about 724 pages. The book, which is more appropriate as an ethnographic work, succeeded in describing the life of the people of Nias at the end of the 19th century as well as knowing the way of thinking and mentality of the people of Nias at that time (Puccioni, 2013). Earthquakes and overflows of water also bode ill for Nias people. It appears not only in the real world but sometimes both are present in dreams during sleep. If the people of Nias dream of shaking the earth accompanied by a flood, then it is a bad sign that they need to take another policy, not as planned.

The problem of dream interpretation was revealed by Elio Modigliani in the 19th century when he visited Nias in a report on his trip to Nias in 1886. These dreams influenced the way of thinking and acting of the Nias people. Good or bad implementation of dreams related to earthquake shocks and overflow of water on land can be seen in the choice of location for building a residential house as well as the model and architecture of the house. (Modigliani, 1890)

### **3. Experts Writing**

Entering the 21st century, more articles have been written about the natural disaster of the earthquake and tsunami on Nias Island. This time it was carried out by scientists, an experts on earthquake and tsunami natural disasters. Scientists who write about earthquakes have reappeared after the devastating earthquake and tsunami that hit Nias Island in 2004 and 2005. However, in this article only a few scientists are described.

Two of the scientists who wrote about the historical events of the earthquake and tsunami on Nias Island were Rastogi and Jaiswal. They wrote and compiled a catalog of earthquake events in the Indian Ocean including Nias Island. Referring to the catalog of 90 tsunami events occurred in the Indian Ocean region over the past 2 millennia from 326 BC to 2005, as compiled by Rastogi and Jaiswal (2006) and Rastogi (2007), records of earthquake events and the tsunami occurred on Nias Island has been recorded since the 18th century.

The earliest earthquake and tsunami recorded in the catalog occurred at the end of the 18th century, exactly, on February 10 and 11, 1797 with a magnitude of 8.2 on the Richter scale. This note seems to have taken its source from a report by a Dutch colonial government official, James Du Puy, as described in the previous section. Then when entering the period of the 19th century, the earthquake and tsunami occurred again. Even in that century it was recorded as the most common occurrence. During the 19th century, Nias Island was shaken by earthquakes more than 5 times. Some of them were also followed by rising tsunami waves to the mainland.

The next article is written by Brian G. Mc. Adoo et al which tell stories about earthquakes and tsunamis in the 20th century. Entering the beginning of the 20th century, or 46 years after the previous large-scale earthquake in 1861, Nias again experienced earthquake and tsunami shocks. This time it happened on January 7, 1907. Except for the inscription made by Schröder above. there is no record of the extent of damage and loss of life at that time even though the earthquake is also thought to have been followed by a tsunami. As a comparison, at the same time an earthquake also occurred and was experienced by the people who live in Simeulue, an island

located north of Nias. Some time after the earthquake, Simeulue Island was also hit by a tsunami with rising Indian Ocean sea water to the mainland. It is estimated that more than 50 percent of the infrastructure in Simeulue was badly damaged, including many victims. The tsunami was so terrible at that time that the victims were found on coconut trees as high as 10 meters and even in the hills which were quite far from the coast (Mc Adoo, 2006).

#### 4. Journalist Works

The next category of historical sources in the form of written notes informing about the earthquake and tsunami on Nias Island is in the form of journalistic works. These works were written by journalists and then published in various media, both print and online. The first journalistic work was published in 1861 in a Dutch-language newspaper, namely *De Javasche Courant*.

The following journalist's work was published in *Kompas*, a nationally-run Indonesian newspaper, December 27, 2018 edition. According to the records of *Kompas* journalists, History noted again after 57 years, precisely in 1961, an earthquake occurred again on Nias. This time in the southern part of Nias with a power of 8.9 Mw (*Kompas*, 27 December 2018). Forty years after that, no information was found regarding the same incident on Nias Island. It was only at the beginning of the 21st century that the earthquake cycle returned there. The west coast of Sumatra was rocked by a tectonic earthquake on December 26, 2004, or 43 years after the last earthquake in 1961.

Written sources and even video recordings are now available on the contemporary earthquake and tsunami events. As an example of the earthquake and tsunami on Nias Island in 2004 and 2005. There are lots of written reports that have been done by journalists and published in various newspapers. Only a day after the earthquake, several newspapers, especially those published in Medan, the capital of North Sumatra Province. make a report on the occurrence of the earthquake and tsunami in Nias. Some of the coverage was published in the *Analisa* newspaper

Nias Island experienced two catastrophic earthquakes in two consecutive years from 2004 to 2005, respectively on December 26, 2004 and December 2005. The first earthquake was a tectonic earthquake, followed by rising sea levels to the land (tsunami). The earthquake lasted for 3 minutes caused many buildings were damaged.

This earthquake rocked the Province of Nanggroe Aceh Darussalam (NAD) and several areas in North Sumatra Province, such as Nias Island, Sibolga, Central Tapanuli and Pantai Cermin. The earthquake shocks triggered a tsunami and flash floods in the Nias Regency area. As a result, many infrastructure and access to land routes were damaged, which made it difficult for victims to evacuate.

The day after the earthquake, several newspapers were mainly published in Medan, the capital of North Sumatra Province make a report on the occurrence of the earthquake and tsunami in Nias. The high tide has hit several

sub-districts in Nias Regency, namely Sirombu, Mandrehe, Tuhemberua, Lahewa, Afulu as well as several sub-districts in South Nias. Public facilities in Sirombu, like the market and seaport, were inundated with water up to 2-3 meters. A number of small islands off the coast of Sirombu such as Hinako, Bawa, Herooma, Bogi, Asu, Imana and Amatala are threatened with sinking (Analisa, 27 December 2004). Journalists from the Waspada Daily published in Medan also reported that the worst conditions were in two sub-districts located in West Nias that is Sirombu District and Mandrehe District. The day after the incident left 42 people dead and 75 people missing, where the most victims were in the two sub-districts, most of whom were children (Waspada, 27 December 2004)

The earthquake and tsunami disasters experienced by the Nias people had an impact on their psychological condition. As reported by the Waspada Daily, Nias people who survived from the disaster experienced depression caused by a feeling of disappointment at the central government which seemed to place Nias second in giving attention as a form of disaster management. The magnitude of the impact of the tsunami in the area of Nanggroe Aceh Darussalam compared to several areas affected by the tsunami in North Sumatra has made public and even government attention focused on the area of Nanggroe Aceh Darussalam

The Governor of North Sumatra immediately responded to the tsunami disaster that hit the Nias area, who assigned the Head of the SAR (Search and Rescue) Task Force to inspect the location and bring in aid. The response in the form of an assignment was issued in the early hours after the tsunami occurred. The site inspection itself was divided into 2 teams, namely sub-team A which surveyed the Batu Islands area in South Nias and sub-team B observed Sirombu District and Mandrehe District. Meanwhile, the assistance was in the form of 1 10,000 KVA generator, food ingredients such as indomie, rice, cloth, sarongs, medicines, and SAR equipment. Meanwhile, after 4 weeks, the Regent of Nias and Nias Selatan together with the *Satkorlak* (executive coordinating unit) carried out rehabilitation and reconstruction as well as cleaning up the city

The condition of Nias has returned to normal after being hit by the earthquake and tsunami. This can be seen from the condition of the government which has been running well, government offices are operating as usual, and the bodies of the victims have been buried. All victims have been evacuated and aid has been sent from Sibolga. What the government did was to collect data which was then followed up with the rehabilitation and reconstruction of the Nias area.

Nias has been able to enter the rehabilitation stage because Nias' condition can be said to be stable. This was stated by the Governor of North Sumatra after inspecting the location. The management of the national disaster has not yet reached the rehabilitation stage, but the Governor of North Sumatra has suggested that Nias should enter the rehabilitation stage, where apart from being in a stable condition, the level of damage itself is not too severe when compared to Aceh.

Nias was given its own authority over Nias regional complaints over the earthquake and tsunami disaster by President Susilo Bambang Yudhoyono during his visit to Nias Island. The Regent of Nias on behalf of the community thanked the President and Minister for responding to complaints from the Nias region. This response

gives hope to Nias to catch up with other districts in North Sumatra. Furthermore, the Regent of Nias also thanked the news media for reporting on the condition of Nias, making it easier for aid providers to find out about Nias.

## Conclusion

The history of the earthquake and tsunami natural disasters that have occurred on Nias Island over the past three centuries from the end of the 18th century to the beginning of the 21st century can be traced from available sources or data. Broadly speaking, these sources can be grouped into 2 categories, oral sources and written sources. Oral sources are in the form of folklore of Nias people which is called hoho in the local language. Hoho actually existed long before the 18th century. Its existence coincides with the emergence of traditional Nias people's perceptions of the factors that cause earthquake shocks that often occur on the island they live on. Hoho also existed before the introduction of written sources. Like most studies on folklore in ethnic communities, the stories in hoho are mixed with mythical stories. The myth of the cause of the earthquake on Nias Island is somewhat similar to stories in other areas such as in Sumatra. The occurrence of the earthquake was caused by shaking due to the stretching of a large snake that was in the bowels of the earth. In addition, the source is in the form of interviews. In general, Nias people, both living on Nias Island and overseas who directly experienced the devastating earthquakes on 26 December 2004 and 28 March 2005, could be interviewed to obtain information related to these events.

Then the sources of the second category are in the form of writings made since the 19th century. Compared to oral sources in the form of oral traditions, these written data are of course more scientific so that the degree of truth can be accounted for. This written source can also be divided into 4 sections including reports of Dutch colonial officials, explorer notes, scientific works, and journalistic works. Unlike the case with oral sources, both in the form of oral traditions in the hoho and interviews, in general, they originate from within (internal) the Nias community itself. On the other hand, written sources are generally produced by people who are not Nias people but people who have had contact with the island or Nias people both Indonesians and foreigners.

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## Factors Affecting Customers' Acceptance of Rigid Plastic Packaging Design based on Material Value Conservation Paradigm

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**Abstract:** Increasing plastic consumption each year has led to growing concern over its waste. There are several ways that has been done in order to reduce plastic waste over the years and one of them is recycling. In Indonesia, plastic recycling rate is low despite the country's high plastic waste production. In order to increase plastic recycling rate, value of rigid plastic packaging post consumption must be maintained as high as possible. Based on material value conservation paradigm, the use of color, glue, ink, and other treatment toward rigid plastic packaging will affect its value. Plastic packaging design based on material value conservation paradigm is used to maximize value of post consumption plastic packaging. However, through observation, most of beverages with rigid plastic packaging in the market do not meet material value conservation criteria. In this paper, customers' acceptance model of beverages with rigid plastic packaging that fulfil material value conservation criteria is developed to encourage the implementation of rigid plastic packaging according to material value conservation paradigm.

**Keywords:** Customers' acceptance, Material value conservation, Plastic, Packaging, Value

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### Introduction

Plastic is referred to as a versatile material because its application is very wide, from plastic packaging to building materials (Shen et al., 2020). Plastic wide range of application is due to its properties such as lightweight, cheap, strong, easy to shape, and resistant to chemicals (Andrady & Neal, 2009). The high level of plastic use causes the demand for plastic production to continue to increase every year. In 2021, global production increased by 4% to around 390 million tons (PlasticsEurope, 2022). From that number, plastic packaging industry contributes around 36% of plastic production (Geyer et al. 2017). Increase in production and use of plastic is accompanied by increasing amount of waste generated (Kunwar et al., 2015)

because after plastic packaging materials fulfill their purpose, most of them are discarded and become post-consumption waste (Ragaert et al., 2015). This post-consumption waste, then goes to recycling plants, incineration sites, and final disposal sites (Geyer et al. 2017).

Function of packaging is to preserve, protect, trade, market and distribute food/drink in a cost-effective manner for the satisfaction of industry and customer and also to minimize negative impacts on the environment (Marsh & Bugusu, 2007). Packaging materials can be either rigid or flexible. Rigid packaging includes bottles, jars, cans and cans, while flexible packaging includes plastic film, paper, foil, cloth and sacks (Ncube et al., 2021). The most widely used type of plastic for packaging is PET (PlasticsEurope, 2022). Recycling rates for PET bottle in Indonesia is 75% (Kharisma, 2023). Treatments toward plastic packaging such as giving color pigments, using adhesives, using printing inks, and other production process treatments can cause value reduction of the remaining plastic material in the recycling process (Gabriel, 2016). Low value of post-consumption plastic packaging makes it unattractive for recycling because of its low selling price of the material (Gabriel et al., 2018).

### **Material Value Conservation**

The purpose of implementation of material value conservation paradigm is to minimize material value reduction and maximize its residual value so as to increase the life cycle. Post-consumption plastic packaging is divided into four categories based on material value conservation or its residual value, with category one having the highest residual value and category four having no residual value so it is discarded and becomes waste. Post-consumption plastic packaging that belongs to category one or has the highest residual value is the one that does not contain color pigments, no printing ink on the packaging, and uses plastic or paper labels that are easily removed. Post-consumption plastic packaging that belongs to category two or has moderate residual is the one that uses bright or transparent pigment color, especially blue or green pigments, and printing ink on the packaging. Post-consumption plastic packaging that belongs to category three or has a low residual value is the one that uses a lot of color pigments and printing ink on the packaging. If the packaging is used for materials that are toxic and dangerous then the post-consumption plastic packaging is included in category four or has no residual value (Gabriel, 2016).




Observations were made in order to find out the various designs of plastic soft drink packaging that are being sold in the market in Indonesia today and what treatment is given to the plastic packaging in the production process which will then affect the residual value of the plastic packaging. Table 1 shows a summary of the results of observations on the design of plastic soft drink packaging currently being sold in the Indonesia's market.

Based on the results of the observations discussed earlier, it can be seen that beverages sold in the market, their packaging does not reach their maximum residual value due to various treatment toward the packaging. One product has been found to have high residual value because it met all material value conservation criteria. This



study is conducted in order to answer the following question: what will affect customer acceptance if design packaging that have moderate residual value is changed to the one that meet material value conservation criteria. Then, a comprehensive customers' acceptance model for rigid plastic packaging designs that meet material value conservation criteria is made to answer the question.

Table 1. Indonesia's market observations result on the design of beverages plastic packaging

Pictures	Treatments toward plastic packaging	Categories based on its residual value
	No treatment	High residual value or category 1 Meets material value conservation
	Product label glued to plastic bottle, glue left residue in packaging	Moderate residual value or category 2 Does not fully meet material value conservation
	The use of blue pigment on bottle, product label glued to plastic bottle, glue left residue in packaging	Moderate residual value or category 2 Does not meet material value conservation

**Method**

**Developing Conceptual Model and Hypothesis**

The conceptual model is shown in Figure 1. Few studies have reported that environmental concern influences intention towards buying green products (Paul et al., 2017, Prakash & Pathak, 2017, Prakash et al., 2019, Yadav & Pathak, 2016). Further, knowledge about environment also reported in a few studies to influence green purchase behavior in customer (Kanchanapibul et al., 2014, Yadav & Pathak, 2016). Hence, the hypotheses are: H1: Environmental concern influences customers' acceptance for beverages rigid plastic packaging designs that meet material value conservation criteria.

H2: Knowledge influences customers' acceptance for beverages rigid plastic packaging designs that meet material value conservation criteria.

Theory of Planned Behavior is a theory which states that the relationship between attitudes, subjective norms, and perceptions that will influence an individual's behavioral intention to perform an action (Ajzen, 1991).

H3: Subjective norm influences customers’ acceptance for beverages rigid plastic packaging designs that meet material value conservation criteria.

H4: Perceived behavioral concern influences customers’ acceptance for beverages rigid plastic packaging designs that meet material value conservation criteria.

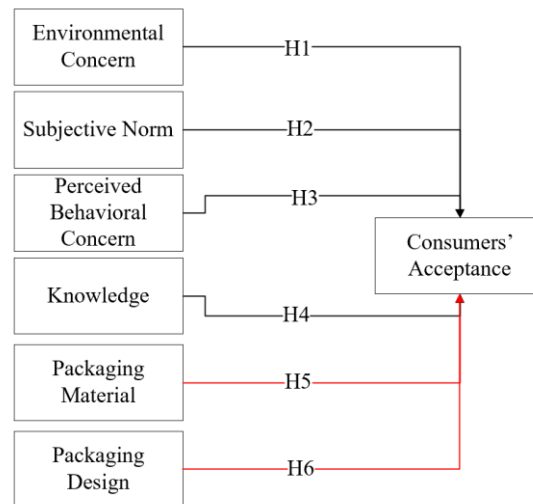


Figure 1. Conceptual Model

From the previous literature study about material value conservation and observation, it is known that the new packaging design is the one without any treatment given toward it. This new packaging design use less material because product label or description is not using any label or glue, instead it is embossed on the packaging. Previous study about product packaging material and product packaging attributes influences customers’ intention to buy green product has been conducted (Dinh et al., 2022, Waheed et al., 2018).

H5: Packaging material influences customers’ acceptance for beverages rigid plastic packaging designs that meet material value conservation criteria.

H6: Packaging design influences customers’ acceptance for beverages rigid plastic packaging designs that meet material value conservation criteria.

The latent variables in the proposed conceptual model require manifest variables to measure these latent variables that is shown in Figure 2. The number of manifest variables for each latent variable depends on the number of questions.

**Designing Questionnaire**

Data was collected through a questionnaire. The sample size follows the N:q rule described by Jackson (2003). Minimum sample size in terms of the ratio of the number of cases (N) to the number of model parameters that require statistical estimation (q). The recommended ratio of sample size and parameters is 20:1. For example, if the parameter requires approximation, q = 10, then the minimum sample size is 20q, or N = 200. A less ideal

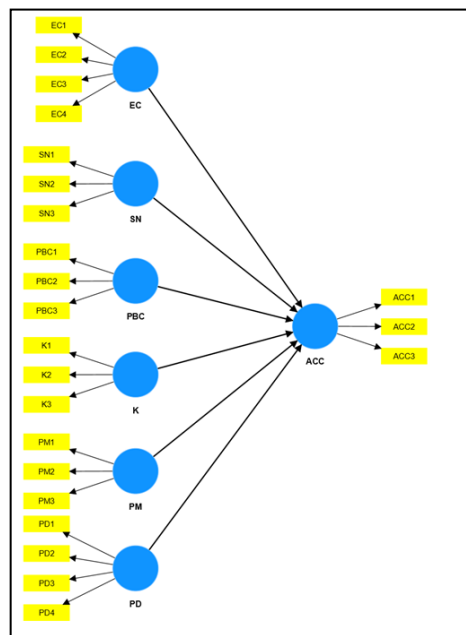


Figure 2. Manifest Variable in Conceptual Model

size would be the ratio  $N:q = 10:1$ , which for the example just for  $q = 10$ , the minimum sample size will be  $10q$ , or  $N = 100$ . As the ratio  $N:q$  decreases from  $10:1$  (for example,  $N = 50$  for  $q = 10$ , the ratio is  $5:1$ ), so does the confidence in the results. The risk for technical problems in the analysis is also greater. Based on Table 5 there are 23 parameters, so the minimum sample required is 460.

The questionnaire begins with explanation about material value conservation to educate respondent about the topic, filling in the respondent's age, gender, salary, and education. Next, it is followed by a list of questions. The list of questions is answered using a Likert scale. The Likert scale consists of 5 levels starting from strongly disagree indicated by number 1, disagree with number 2, neutral with number 3, agree with number 4 and finally strongly agree indicated with number 5.

### Collecting Questionnaire Results

Questionnaires were distributed in person and online via Google Form to people who live in Jakarta, Indonesia. Data from the questionnaire results were then collected and only complete data is to be processed. Data that passes the selection results can then be processed with the smartPLS 4.0 software.

Validity and reliability test are carried out to evaluate whether the model built is appropriate. A variable is said to have good validity against latent variables if standardized factor loading  $\geq 0.5$ . If all indicators' standardized factor loading  $\geq 0.5$  then the indicator can be said to be a good measurement for the variable in question. Reliability is a measurement of consistency. A good variable has a Construct of Reliability (CR) value of  $\geq 0.7$  and a Variance Extracted value of  $\geq 0.5$  (Kline, 2016).

## Results

### Evaluation of Measurement Model

Table 2 shows the results of the convergent validity test with loading factor. All values are declared valid because they are above 0.708 (Hair et al., 2008).

Table 2. Validity Test using Loading Factor

	ACC	EC	K	PBC	PD	PM	SN
ACC1	0.876						
ACC2	0.833						
ACC3	0.875						
EC1		0.834					
EC2		0.779					
EC3		0.824					
EC4		0.816					
K1			0.872				
K2			0.807				
K3			0.863				
PBC1				0.880			
PBC2				0.819			
PBC3				0.853			
PD1					0.856		
PD2					0.790		
PD3					0.844		
PD4					0.846		
PM1						0.881	
PM2						0.821	
PM3						0.862	
SN1							0.865
SN2							0.829
SN3							0.868

Table 3 shows the results of the convergent validity test with Average Variance Extracted (AVE). All values are declared valid because they are above 0.5 (Hair et al., 2008).

Table 3. Validity Test using Average Variance Extracted (AVE)

Average variance extracted
----------------------------

	(AVE)
ACC	0.742
EC	0.662
K	0.719

Table 3. Validity Test using Average Variance Extracted (AVE) (cont.)

	Average variance extracted (AVE)
PBC	0.724
PD	0.696
PM	0.731
SN	0.730

Table 4 shows the results of the discriminant validity test with Fornell Larcker. All values are declared valid because the AVE root value is greater than the correlation value between variables.

Table 4. Validity Test using Fornell Larcker

	ACC	EC	K	PBC	PD	PM	SN
ACC	0.869						
EC	0.869	0.898					
K	0.860	0.865	0.877				
PBC	0.867	0.896	0.871	0.851			
PD	0.859	0.888	0.865	0.891	0.855		
PM	0.883	0.855	0.847	0.863	0.837	0.858	
SN	0.853	0.858	0.857	0.864	0.854	0.858	0.854

Table 5 shows the results of the discriminant validity test with Cross Loading. All values are declared valid because the value is greater than 0.7 and the value is greater than the correlation with other variables.

Table 5. Validity Test using Cross Loading

	ACC	EC	K	PBC	PD	PM	SN
ACC1	0.876	0.772	0.767	0.755	0.752	0.762	0.765
ACC2	0.833	0.709	0.689	0.711	0.719	0.731	0.699
ACC3	0.875	0.764	0.763	0.773	0.749	0.788	0.74
EC1	0.742	0.834	0.728	0.731	0.715	0.716	0.716
EC2	0.695	0.779	0.706	0.737	0.729	0.684	0.672
EC3	0.703	0.824	0.679	0.713	0.729	0.683	0.677

EC4	0.687	0.816	0.702	0.734	0.72	0.701	0.728
K1	0.73	0.73	0.872	0.731	0.719	0.739	0.749
K2	0.702	0.715	0.807	0.735	0.705	0.703	0.686
K3	0.752	0.754	0.863	0.749	0.774	0.712	0.743
PBC1	0.741	0.773	0.739	0.880	0.772	0.744	0.736
PBC2	0.708	0.749	0.748	0.819	0.75	0.73	0.73
PBC3	0.763	0.764	0.738	0.853	0.753	0.73	0.74
PD1	0.729	0.745	0.747	0.762	0.856	0.708	0.711
PD2	0.711	0.708	0.694	0.729	0.79	0.698	0.717

Table 5. Validity Test using Cross Loading (cont.)

	ACC	EC	K	PBC	PD	PM	SN
PD3	0.724	0.751	0.736	0.741	0.844	0.7	0.725
PD4	0.704	0.76	0.708	0.741	0.846	0.686	0.697
PM1	0.784	0.746	0.747	0.757	0.72	0.881	0.764
PM2	0.718	0.722	0.691	0.721	0.684	0.821	0.688
PM3	0.761	0.727	0.734	0.735	0.742	0.862	0.747
SN1	0.725	0.72	0.735	0.735	0.704	0.766	0.865
SN2	0.697	0.728	0.713	0.721	0.736	0.694	0.829
SN3	0.763	0.752	0.749	0.758	0.75	0.739	0.868

Table 6 shows the results of the reliability test with CR (Composite Reliability) and Cronbach's Alpha. All values are declared valid because the value is greater than 0.7.

Table 6. Validity Test using CR (Composite Reliability) and Cronbach's Alpha

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
ACC	0.826	0.828	0.896
EC	0.830	0.831	0.887
K	0.803	0.805	0.884
PBC	0.809	0.811	0.887
PD	0.854	0.855	0.902
PM	0.815	0.818	0.891
SN	0.815	0.817	0.890

### Evaluation of Structural Model

Structural model evaluation is carried out using path coefficient, and P values, which is shown in Tables 7.

Table 7. Path Coefficient and P values

	ACC	P values
EC	0.159	0.000
SN	0.101	0.169
PBC	0.095	0.180
K	0.149	0.000
PM	0.341	0.000
PD	0.133	0.002

Environmental concern ( $p < 0.01$ ) has a significant influence on customer acceptance toward beverages plastic packaging designs that meet material value conservation criteria, that supported the hypothesis H1. Knowledge concern ( $p < 0.01$ ) also has a significant influence on customer acceptance toward beverages plastic packaging designs that meet material value conservation criteria, that supported the hypothesis H4. Further, packaging material and packaging design attributes also has a significant influence on customer acceptance toward beverages plastic packaging designs that meet material value conservation criteria, that supported the hypothesis H5 and H6.

Table 8 shows the results of the model fit measure. The Standardized Root Mean Square Residual (SRMR) value below 0.08 indicates the model is fit. The better the model is if the NFI (Normed Fit Index) value is close to 1.

Table 8. Fit Measures

	Saturated model	Estimated model
SRMR	0.049	0.049
d_ULS	0.652	0.652
d_G	0.633	0.633
Chi-square	1780.35	1780.35
NFI	0.829	0.829
R-square	0.848	0.848

## Discussion

Figure 3 shows results of variable that is accepted in hypothesis testing and how each of those variable relation to customers' acceptance. The result suggested that packaging material variable significantly influences customer acceptance toward beverages plastic packaging designs that meet material value conservation criteria the most which means showing information about less material that is used in material value conservation design will affect customers' purchase beverages purchase behavior. Customers' acceptance toward beverages

plastic packaging designs that meet material value conservation criteria can also be predicted by environmental concern, knowledge, and packaging design attributes.

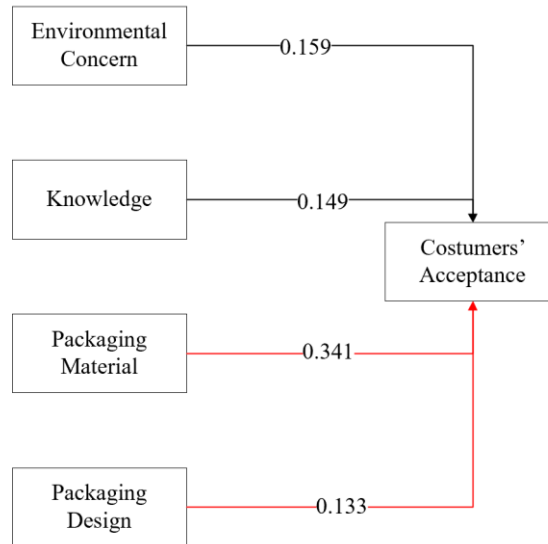


Figure 3. Relation between variable and customers' acceptance

## Conclusion

This study aims to develop a comprehensive customers' acceptance model for rigid plastic packaging designs that meet material value conservation criteria. From the developed model, it can be concluded that environmental concerns, knowledge, packaging material, packaging design influence consumer acceptance of beverages packaging designs that meet the criteria for material value conservation. The information obtained from this research can be useful for encouraging the implementation of conservation of material values for beverages rigid plastic packaging designs by plastic packaging manufacturers at the request of plastic packaging buyers (in this case beverages manufacturers) (Gabriel & Anindityo, 2018). Finally, material value conservation implementation is expected to increase bottle to bottle recycling in Indonesia.

## Recommendations

Further studies need to be done to see the influence of other stakeholders (for example government, packaging manufacturer, packaging buyer, and others) (Gabriel & Anindityo, 2018) on costumers' acceptance. It is important because with customers alone, the implementation of material value conservation cannot be done.

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## Analysis of Symmetric Timetable Frameworks Based on Unfixed 4-Blocks

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**Abstract:** Fixed frameworks called modules are often used in order to easily avoid conflicts among curriculum courses when scheduling timetables at many universities. This paper proposes a novel approach for the timetable frameworks by introducing symmetric timetable modules based on unfixed 4-blocks, which will be refined as fixed 3-blocks and potential 1-block. We show that the unfixed 4-blocks are superior to the traditional fixed 3-blocks without any loss from the viewpoint of consumers. Our operational strategies based the concept of unfixed 4-blocks provide many advantages including both flexibility and controllability at the same time when timetables are scheduled. Although the method theoretically can reduce the upper bound of space utilization to 75% in the worst case from the viewpoint of suppliers, we argue that it is not a critical issue in practice, because the practical space utilization is desired to be typically lower than 75% in order to get the reasonable space idleness, and furthermore, the upper bound can be increased much larger when multiple school years use multiple spaces.

**Keywords:** Frameworks, Modules, Potential Block, Symmetricity, Flexibility, Controllability

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### Introduction

Timetabling is defined as the problem of allocating resources to objects located in space and time in a manner as close as possible to desired objectives under given constraints (Wren, 1996). Even though this has been a classic and important problem for a long time, it has been continuously studied in the areas of computer theory, industrial engineering, and management science to find the next best solution.

At schools, hospitals, and various industries, they are making a lot of efforts to regularly create timetables for their given needs. Most timetabling problems have NP-hard time complexity even in simple cases (Even, Itai, & Shamir, 1976; Kubiak & Kubiak, 2021; Rosa et al., 2021), that is, any deterministic algorithm with polynomial time complexity has not been discovered and the infeasibility has not been proven. This means that the optimal solution cannot be found in realistic time with the current techniques when the problem size becomes larger than a certain. This causes innumerable alternative approaches for finding the optimal solutions of timetabling problems continuously for a long time in the fields of computer theory, industrial engineering, and management. We consider the timetabling problem in universities, which has been studied by many researchers (Chen et al.

2021; Babaei, Karimpour, & Hadidi, 2015) since it has become more difficult due to various cases such as students and facilities increasing over the past 30 years. While some of these researches have been applied into developing automatically scheduling software, most researches (Babaei, Karimpour, & Hadidi, 2015; Bashab, et al., 2023; Rappos, Thiémar, RobertJean, & Hêche, 2022; Sylejmani, Gashi, Ymeri, & Ymeri, 2022; Colajanni, Colajanni, Daniele, & Daniele, 2021; Bashab et al., 2020; Ruslaan, Zakaria, & Zakaria, 2019; Lindahl, Sørensen, & Stidsen, 2018; Oluwole, Oghenefego, & Obi, 2018; Lindahl, Mason, Stidsen, & Sørensen, 2017; Islam, Perves, Shahriar, & Hasan, 2016; Nothegger, Mayer, Chwatal, & Raidl, 2012; Burke, Marecek, Parkes, & Rudova, 2012; Yang, & Jat, 2011; Lü, & Hao, 2010; Burke, Marecek, Parkes, & Rudova, 2010; Pongcharoen, Promtet, Yenradee, & Hicks, 2008; Lewis, 2008; Burke, MacCarthy, Petrovic, & Qu, 2006; Thompson, 2005) have focused on only academic and theoretical achievements for solving NP-hard problems heuristically by generalizing and formalizing the unlimited constraints of resources such as space, classes, and courses. However, unfortunately, there are still a lot of real unsolved problems and difficulties in creating university timetables. This paper does not belong to a fundamental heuristic algorithm of the difficult NP-hard problem of theoretically generalized time tabling, but presents a practical issue how to pre-define frameworks before timetabling, which have the purposes to avoid the conflicts of course registering and efficiently utilize the resources.

In fact, many universities have created a framework called timetable module and still create semi-automatic timetables by human hands. This paper notes that the degree of difficulty that can be satisfy consumer demands varies greatly when creating timetables, and the composition of the timetable module is the most basic and practically important concept. In a broad sense, these timetable modules can be regarded as part of the constraints in the timetable problem, however, unlike other constraints, we cannot find any research that deals with this issue separately or importantly since it looks difficult to represent the frameworks called modules like other generalized constraints.

In usual, Korean universities first build timetable modules, and timetables are still created semi-automatically by human hands. Sometimes this method can be more practical because major courses are opened by first considering a single major rather than a whole generalized scheduling problem for a few of double majoring students. Furthermore, there is a limit to automation by expressing various requirements that vary variably depending on the department every semester as constraints.

Typically, a course requires 3 hours per week, and some courses requires 2 or 4 hours per week. From now on, a unit for an hour per week in timetables will be called a block. The commonly-used traditional timetable modules consist of 3 fixed blocks as illustrated in Figure 1, which will be denoted by 1Module-3Blocks. This paper proposes symmetric timetable modules of 4 unfixed blocks, which will be denoted by 1Module-4Blocks. In 1Module-4Blocks models, 3 blocks to be used are postponed and 1 unused block is utilized for other purposes such as lunch time.

We also present their operational strategies and comparative analysis showing that our models can be applied

without any loss or better from the demand point of view. From the supplier's point of view, assuming that the upper limit of the acceptable space utilization rate is reasonably reduced, various advantages such as flexibility, controllability, predictability, and balance ability can be obtained together.

## Designing Symmetric Timetable Modules Based on 4-Blocks

### Fixed 1Module-3Blocks Models

In Korean university curriculum, one course usually consists of 2 to 4 hours called blocks per week, but most of the courses are 3 hours. In addition, the timetable module is often composed of one 1-sized block plus one 2-sized block, and some universities include two 1.5-sized blocks or two 1-sized blocks.

For example, Figure 1 shows the timetable modules actually used in Korean universities, in which English alphabets with the same background color are the module names of definite courses. The common point of these modules is that the blocks used for courses are fixed, i.e., not destroyable in principle. In S and W universities, one module is composed of one 1-sized block plus one 2-sized block for the courses based on 3 hours per week. In N university, they also provide other modules such as two 1.5-size blocks, and two 1-sized blocks for the courses consisting of 2 hours per week in Tuesday and Thursday. The first two modules are for ordinary private universities, and classes are held until the actual 8th period, and the third module is for relatively large national universities, and modules are designated until the 10th period.

In the third module of Figure 1, lunch time (a b c d) is specified separately. Unfortunately, however, most of the university schedules do not specify lunch time separately, as in the first two modules of Figure 1. When students sign up for classes, they empty either 4<sup>th</sup> or 5<sup>th</sup> period lesson for their lunch time. Each department also places the courses on the timetable considering not only students' but also professors' lunch time. In other words, in the college timetable, it is not inevitable to listen or lecture the 4<sup>th</sup> to 5<sup>th</sup> period lessons consecutively, so if there are 2 courses that have been consecutively arranged in 4<sup>th</sup> to 5<sup>th</sup> period lessons, it can be considered mutually exclusive when signing up for courses, i.e., it is practically no different from those organized in the same time zone.

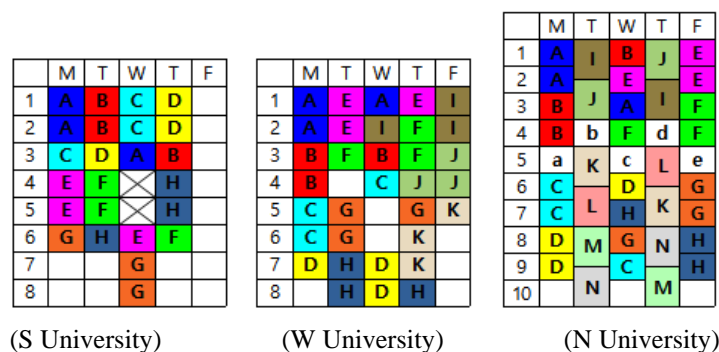


Figure 1. Examples of Timetable Modules

**Unfixed Symmetric 1Module-4Blocks Models**

This paper first presents 6 kinds of symmetrical 1Module-4Blocks models, in which one module is composed of 4 unfixed blocks, as shown in Figure 2. It is assumed that a day consists of 8 lessons from Monday to Friday, which are generally accepted in the most ordinary universities. 1Module-4Blocks in the tables are symmetrically composed of Monday and Wednesday, Tuesday and Thursday, and Friday morning and Friday afternoon, respectively. Rarely, if you have a Saturday class, you can make Friday and Saturday symmetrical, or Friday afternoon can be excluded sometimes.

In Figure 2, three basic modules of Horizon, Cross, and Shuffle methods are presented, in which modules are symmetrically arranged, respectively. In the horizon method, a module is composed of two 2-sized blocks both of which are placed in the same period horizontally, while the cross method places two 2-sized blocks in different period crossing each other. In the shuffle method, a module is composed of one 2-sized blocks and two 1-sized blocks, and two modules are placed by being shuffled.

Three other models produced by applying the three basic modules. S+H Combo and S+C Combo modules arrange other models in the morning and afternoon by simple merging of the shuffle method with the horizontal and cross methods, respectively. S+H+C Hybrid module is merging the slightly-modified modules of the shuffle, horizontal, and cross methods. These three applied modules also have the property of symmetry which can provide many advantages.

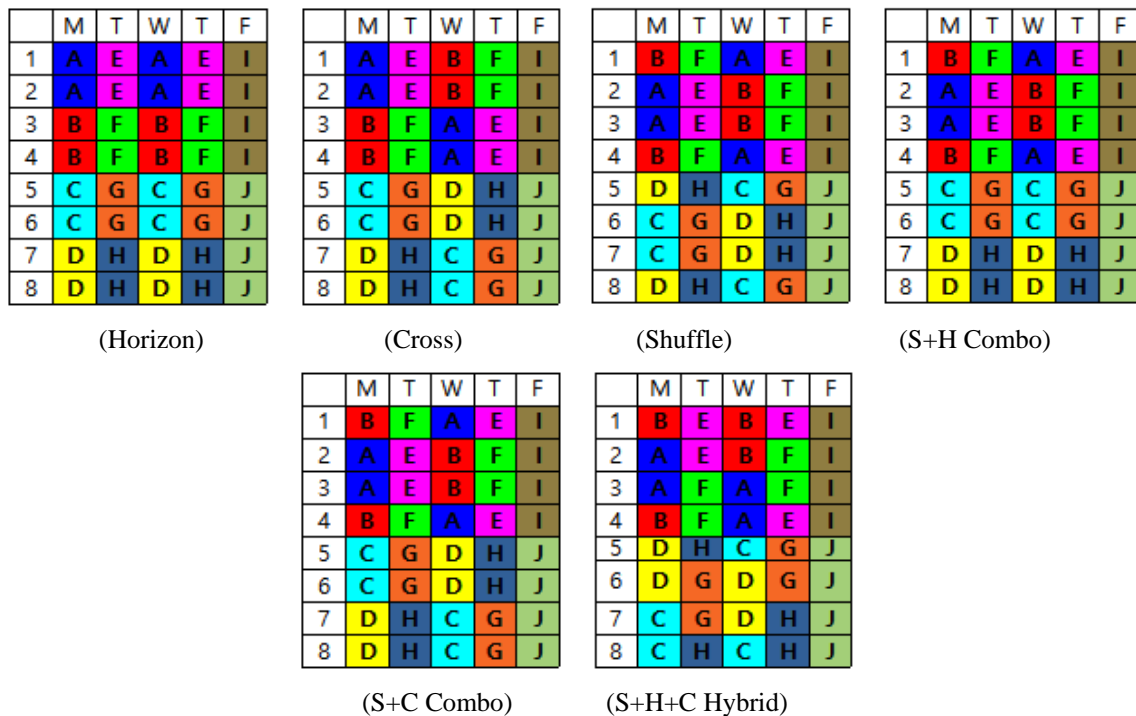


Figure 2. Symmetric Timetable Modules Based on Unfixed 4-Blocks

### Comparison of Fixed 3-Blocks and Unfixed 4-Blocks

Simply considering for courses consisting of 3 hours per week, it looks like that the number of courses that can be arranged in 1Module-4Blocks decreases compared to 1Module-3Blocks, i.e., the number of modules that can be placed flat is 10 and 13 per week, respectively. However, when we consider the almost essential condition of lunch time, the number of modules available at the same time that students can apply for classes or assign major courses in the department varies as shown in Table 1. It is because the practically possible arrangement of courses is restricted by the conflicts of two courses using the 4<sup>th</sup> and 5<sup>th</sup> period blocks if we have to empty one of the 4<sup>th</sup> and 5<sup>th</sup> period lessons for comfortable lunch time.

Table 1. Comparison for Courses Consisting of 3 Hours per Week

Module Types	Flat Arrangement [Supplier's Viewpoint]	Possible Arrangement [Consumer's Viewpoint] = Flat Arrangement – (Conflicts – Duplication)	
		Minimum	Maximum
1Module-3Blocks	$8\text{period} \times 5\text{days} \div 3\text{block} \approx 13\text{courses}$	$13 - (5 - 0) = 8$	$13 - (5 - 5 \div 2) = 10$
1Module-4Blocks	$8 \times 5 \div 4 = 10$	$10 - (0) = 10$	$10 - (0) = 10$

[Proof of Table 1]

Assuming that one course consists of 3-hour blocks per week and one of the 4<sup>th</sup> or 5<sup>th</sup> period block should be reserved for lunch time, it is possible to arrange lunch time by adjusting without any conflicts between two courses in 1Module-4Blocks. It is because we can empty 1 block in the 4 unfixed blocks in each module. However, in a 1Module-3Blocks, two courses each containing the 4<sup>th</sup> and 5<sup>th</sup> period blocks are mutually exclusive and cannot be used simultaneously; this case is defined as a conflict between the pair of two courses. For example, the pair of blocks (C E) (D F) (B H) in S university module and (B C) (J G) (J K) in W university module of Figure 1 are conflicting each other.

The number of conflicts per week in 1Module-3Blocks can occur 5 times from Monday to Friday. However, it is possible to reduce the modules that cannot be used at the same time by arranging a course to appear two times in the conflicts of the 4<sup>th</sup> or 5<sup>th</sup> period block; this case is defined as the duplication of conflicts. For example, the course J in W university module of Figure 1 causes the conflict two times in the module pair (B C) (J G) (J K). It means that the two conflicts (J G) (J K) can be resolved if the blocks of course J is used as lunch time, while only on conflict is resolved if the blocks of course B or C is used as lunch time.

Assuming 1Module-3Blocks models consist of 1+2 blocks, it is obvious that the conflicts can occur 5 times per week. The duplication per week can occur at most 2 times, which can be calculated as  $(5 \text{ days} / 2 = 2.5)$ . On the other hand, we can avoid any conflict in 1Module-4Blocks models. Therefore, the minimum and maximum numbers of courses available at the same time is calculated as shown in Table 1.

(Q.E.D.)

As shown in Table 1, the number of courses available simultaneously is always 10 in 1Module-4Blocks, but 1Module-3Blocks models are the same as 10 for the maximum and decreases to 8 for the minimum, which is an unexpected result. More importantly, it is difficult to place course blocks symmetrically in 1Module-3Blocks and we cannot avoid ad-hoc arrangement. Therefore, it is difficult to reserve lunch time without conflicts in the case of S university module of Figure 1, and in the case of N university module of Figure 1, many people flock to the lunch time of 1 hour. Furthermore, it is difficult and wastes more blocks to accommodate some courses consisting of 4- or 2-hour blocks per week even though most courses consist of 3-hour blocks per week; a course of 4 blocks waste 2 blocks because it requires 2 modules, and a course of 2 waste 1 block.

The 1Module-4Blocks model has flexibility and controllability to reserve comfortable lunch time, and easily accommodate some courses consisting of 4 or 2 blocks without wasting blocks as much as 1Module-3Blocks, except for increasing the upper bound of space utilization and the number of applicable courses from the supplier's viewpoint. How to get far more advantages as well as flexibility and controllability with the symmetric 1Module-4Blocks will be explained in detail in the next chapter.

When comparing 1Module-4Blocks to 1Module-3Blocks from the supplier's point of view, the only disadvantage is that the upper bound of space utilization is reduced to 75%, while 1Module-3Blocks has 100% upper bound. However, it is not desirable to 100% fully utilize space, but 100% full utilization is meaningless from the consumer's point of view because there is a conflict between two courses each containing the 4<sup>th</sup> and 5<sup>th</sup> period blocks due to lunch time as explained in the proof of Table 1.

## **Operating Unfixed 4-Blocks with Potential Blocks**

The timetable modules in Figure 1 in the previous chapter consist of definite blocks and unusable blocks. This chapter discusses the advantages and operations that can be obtained by adapting 4 unfixed blocks of a module in Figure 2, to 3 fixed blocks plus 1 potential block that refers to a block that has priority for a specific module but can also be used as another purpose such as lunch time and consultation time or other modules.

Assuming that one course consists of 3 hours per week, Figure 3 illustrates how to operate timetable modules of Figure 2 with 3 fixed blocks and 1 potential block, where potential blocks are expressed in white base, while fixed blocks are in other colored bases. When we have to unavoidably destroy some fixed blocks, the recommendations are expressed in parentheses <>. The primary recommendation is to accommodate 3 consecutive blocks, which are sometimes needed for part-time instructor or experimental courses. Note that our adapted 1Module-4Blocks model does not waste one more module for accommodating 3 consecutive blocks because the module with one destroyed block can use another potential block. On the other hand, the traditional 1Module-3Blocks model makes another module unable to be used, which are troublesome issues in actual operating of modules.



To summarize the important characteristics of the adapted 1Module-4Blocks, if a potential block is used for another purpose, the flexibility of the option of the module to which the potential block belongs is lost, but the module is still available. Also, even if a fixed block is used as another module of a recommendation  $\langle \rangle$ , it is not completely destroyed so that the module to which the confirmation block belongs cannot be used.

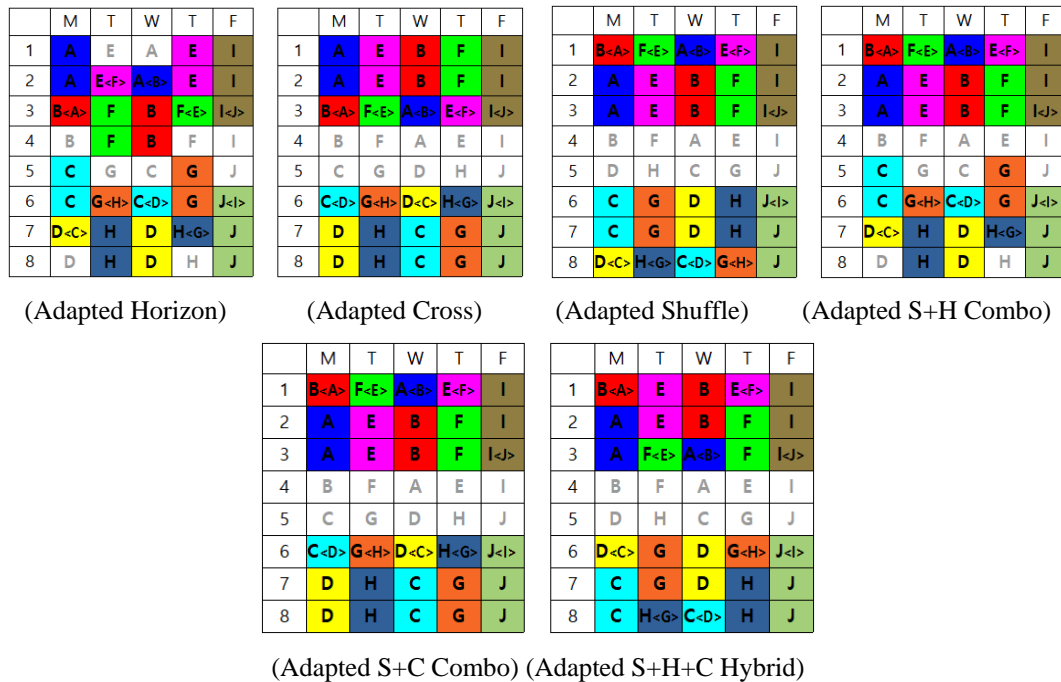


Figure 3. Adapted Symmetric Timetable Modules Based on Unfixed 4-Blocks

### Receptivity Comparison of Adapted 1Module-4Blocks Models

Table 2 lists the basic requirements when preparing the college timetable and compares how much the proposed models can accommodate them without destroying the module. It is based on Monday to Thursday except for the same Friday in all models. The more soluble it is, the darker it is expressed in gray.

Without decreasing the number of courses available simultaneously, the 1Module-4Blocks models have more receptivity for users' requirement than the 1Module-3Blocks models. Potential lunch time is the most essential requirement because there is no separate lunch time that makes two modules be conflicted in 1Module-3Blocks models. Modules consisting of 2+2 blocks are also an important receptivity of the model when one course with experimental practice consists of 4 blocks per week in science and engineering, which makes another module unusable in 1Module-3Blocks models. Similarly, there is a nice receptivity for 3 consecutive blocks without destroying other modules. Naturally, the same time zone whether a course can be placed in only side between morning and afternoon, and preferred start time between the 1<sup>st</sup> and 2<sup>nd</sup> period in the early morning, are mainly considered for the convenience of consumers. Note that the last two receptivity of the same time zone and preferred start time can accommodate the different life patterns of instructors especially, furthermore, which are more advantageous to more of lunch time.

Table 2. Comparison of Receptivity for Consumer's Requirements (Monday ~ Thursday)

Kinds of Modules		Number of Potential Lunch Time	Number of 2+2 Blocks	Number of Consecutive 3 Blocks	The Same Time Zone	Preferred Start Time	
						1 Period	2 Period
(Figure 1)	S University	(Fixed) 1	Moming 1 Afternoon 4	Afternoon 3	×	○	×
	W University	(Fixed) 2	Moming 1 Afternoon 2	Afternoon 1	○	○	×
	N University	(Fixed) 4	Afternoon 1	Moming 1 Afternoon 1	×	○	×
Adapted Horizon		4 <sup>th</sup> Period 2 5 <sup>th</sup> Period 2	Moming 4 Afternoon 4 (Both 6)	Afternoon 4	○	×	×
Adapted Cross		4 <sup>th</sup> 5 <sup>th</sup> Period 4	Moming 4 Afternoon 4 (Both 4)	Moming 4 Afternoon 4	×	○	○
Adapted Shuffle		4 <sup>th</sup> 5 <sup>th</sup> Period 4	0	Moming 4 Afternoon 4	×	○	○
Adapted S+H Combo		4 <sup>th</sup> Period 2 4 <sup>th</sup> 5 <sup>th</sup> Period 2	Moming 4	Moming 4 Afternoon 4	Afternoon ○	○	○
Adapted S+C Combo		4 <sup>th</sup> 5 <sup>th</sup> Period 4	Afternoon 4	Moming 4 Afternoon 4	×	○	○
Adapted S+H+C Hybrid		4 <sup>th</sup> 5 <sup>th</sup> Period 4	Moming 2 Afternoon 2	Moming 4 Afternoon 4	○	○	×

### Strategies for Dynamic Allocation and Operation of 4-Unfixed Modules

As explained previously, it is originally an NP-hard problem to satisfy various requirements while minimizing module destruction when empty modules are assigned to courses in the proposed timetable models. This paper presents a heuristic algorithm using a greedy method (Horowitz, Sahni, & Rajasekaran, 2008), which cannot guarantee the optimized solution for requirements such as lunch time and other consumer's preference, but is expected to provide reasonable solutions and easy to perform by human hands or implement in software.

Our greedy method has a strategy to deal with subjects that are difficult to allocate modules at the first time, and to assign fixed blocks before potential blocks. The basis of this strategy is not only to avoid module destruction,

but also to maintain the options of other modules as much as possible.

In universities, one course is usually 2, 3, and 4 hours per week, and the course lectures are provided with 2, 2+1 (or 3), and 2+2 consecutive blocks, respectively. Our greedy method to place the courses by allocating empty blocks is based on human intuition. First of all, 2 consecutive fixed blocks are allocated to any type of courses, and then other blocks are added in the less order of possibility to destroy modules. If there are no empty blocks available to add, the assignment of the course is postponed to the next processing step.

Procedurally speaking as illustrated in Table 3, for a course which needs anyone of 2, 3, and 4 hours per week, first we assign one 2-sized fixed block to all courses, and next, the module allocation is finished by searching for 1-sized blocks that can be added in the order of steps ①~⑧: 1<sup>st</sup> post-processing ①~④ and 2<sup>nd</sup> post-processing ⑤~⑦. The last exception handling ⑧ is for the courses that cannot be post-processed in ①~⑧.

The difference of the 1<sup>st</sup> and 2<sup>nd</sup> post-processing is whether or not destroy another module. The homo- or hetero-block of Table 3 describes whether or not it is in the same module with the already allocated 2-sized fixed blocks for arranging a course, i.e., homo-blocks to each other are represented with the same alphabet. The blocks in the 3<sup>rd</sup> ~ 6<sup>th</sup> period of a day can be allocated, i.e., empty, only if at least one potential block is empty for lunch time.

Table 3.The Order and Methods for Adding Blocks to Already Allocated 2-Sized Fixed Blocks

Steps		Cases of Blocks	Addition to Fixed the 2-Sized Blocks (Homo-/Hetero- and Fixed/Potential Blocks)
1 <sup>st</sup> Post-Processing	①	2+2	1 Homo-Fixed + 1 Homo-Potential
	②	3	1 Hetero-Fixed with Mark <>
	③	2+1	1 Homo-Fixed (If Not, 1 Homo-Potential)
	④	2	(Not Added)
2 <sup>nd</sup> Post-Processing	⑤	2+2	1 Hetero-Fixed + 1 Homo-Potential of <i>Newly Added</i>
	⑥	3	1 Hetero-Potential (Because 1 Hetero-Fixed was Used in ②)
	⑦	2+1	1 Homo-Potential (If Not, 1 Hetero-Fixed)

Exception- Handling	⑧	2+2	Process Manually in Ad-hoc.
		3	
		2+1	
		2	

In the 1<sup>st</sup> post-processing of Table 3, empty blocks are added to already allocated 2-sized fixed blocks of each course in the order of courses consisting of (2+2)-, 3-, 2+1-blocks, which is the less order of possibility to destroy modules. The courses, which cannot be finished in the 1<sup>st</sup> post-processing because of the unavailability of suitable blocks, are processed in the 2<sup>nd</sup> post-processing.

Even though it is expected that almost all of courses can be can be allocated if the ratio of all courses to all modules is reasonable, i.e., the ratio should be less than 1.0 and the smaller is the better, there can be some unfinished courses until the 2nd post-processing. Obviously, the number of courses remaining after the 1<sup>st</sup> and the 2<sup>nd</sup> post-processing will be proportional to the complexity and number of courses to be placed in a timetable. The last unfinished are exceptionally handles manually in ad-hoc by minimizing the destruction of other modules as possible.

Finally, our heuristic algorithm using the greedy method is summarized as follows.

<p><b>[Input]</b> All courses in a semester and a timetable model of Figure 3.</p> <p><b>[Output]</b> A timetable placing the all courses.</p> <p><b>Step 1:</b> Assign a 2-sized fixed block to the all courses.</p> <p><b>Step 2:</b> Try to add more blocks to the all courses without destroying any module as ①~④ in Table 3.</p> <p><b>Step 3:</b> Try to add more blocks to the courses unfinished in Step 2 by destroying one module as ⑤~⑦ in Table 3.</p> <p><b>Step 4:</b> The courses unfinished even in Step 3 are processed manually in ad-hoc.</p>
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Taking advantage of the stronger symmetry of cross, shuffle, and S+C combo models among the symmetrical 1Module-4Block models of Figure 2, we can operate the modules more flexibly and dynamically according to consumer's requirements. For example, if there are many students and instructors avoiding the 1<sup>st</sup> or 8<sup>th</sup> period, we can convert the potential blocks in the 4<sup>th</sup> period to the 1<sup>st</sup> period or the 5<sup>th</sup> period to the 8<sup>th</sup> period, respectively, as shown in Figure 4. Even though it was omitted, the fixed blocks that can be used as another module can be described with the mark <> similarly in Figure 3.

In particular, the complete symmetry of shuffle models can be used to dynamically swap potential blocks or minimize collisions when instructors' preference for the start of the 1<sup>st</sup> or 2<sup>nd</sup> period is one-sided; first allocate the blocks of courses by excluding the preference, and then post-process whether the preference can be satisfied by replacement of potential blocks. This another strategy can be used when every requirement cannot be

satisfied but only partial satisfaction is possible.

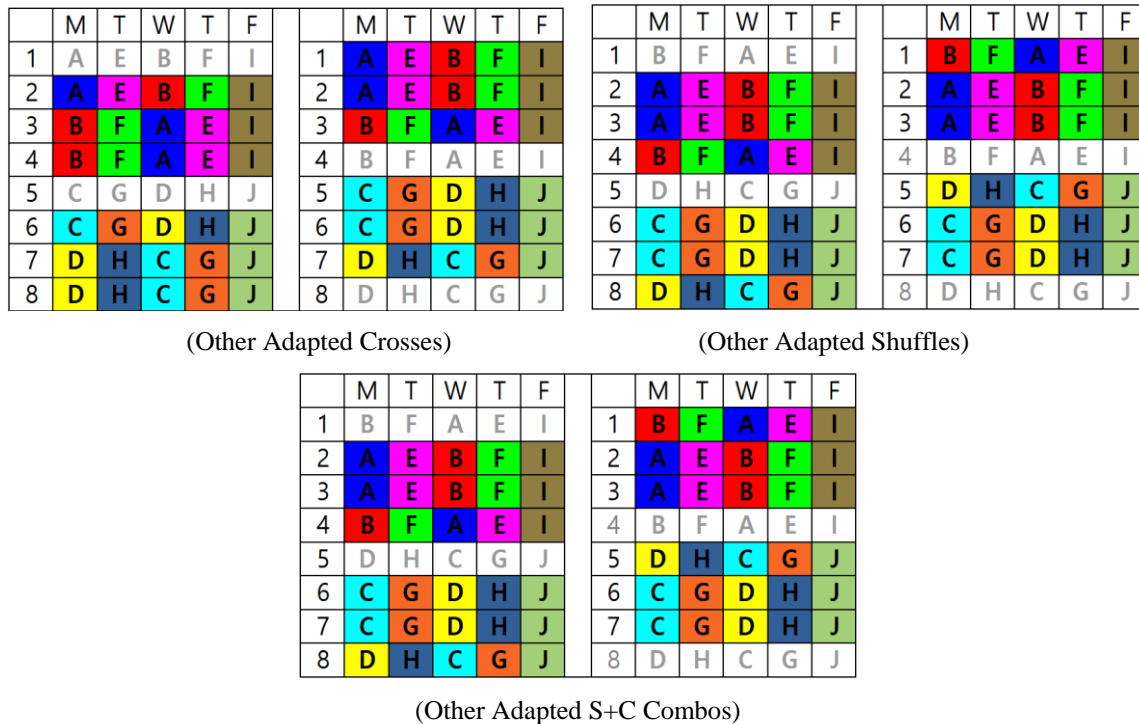


Figure 4. Other Adapted Symmetric Timetable Modules for Considering Preferred Start Time

For example, if a department is focused on the preference for the start of the 2<sup>nd</sup> period, it is difficult to satisfy all. In this case, first we build up the timetable for all courses with Step 1-4 of our heuristic algorithm after designating the potential blocks as the 4<sup>th</sup> and 5<sup>th</sup> period, and next, the preference for the start of the 1<sup>st</sup> or 2<sup>nd</sup> period is swapped in order to change the start from the 1<sup>st</sup> period to the 2<sup>nd</sup> period.

**Summary of Advantages in Symmetric 1Module-4Blocks Models with Potential Blocks**

Table 4 summarizes the advantages of the adaptive symmetric 1Module-4Block models presented compared to the traditional 1Module-3Blocks models. Concretely, we enumerate the possible functions that can be obtained by operating the 1Module-4Block models with adapted potential blocks.

Table 4. Advantages and possible functions of adaptive symmetric 1Module-4Block models

Advantages	Possible Functions
Flexibility	<ul style="list-style-type: none"> <li>- Securing Lunch Time</li> <li>- Considering the Preference of the Start between the 1<sup>st</sup> and 2<sup>nd</sup> Period</li> <li>- Choosing between (2+1)-Blocks and 3-Blocks for the Course of 3-Hours</li> <li>- Accommodating the Course of 4-hours</li> <li>- Suitable for the Course of 2-Hours</li> </ul>

Controllability	-Dynamic Operation of Potential Blocks -Inducing a Fixed Lunch Time -Excluding the Isolated 1 <sup>st</sup> Block or the Isolated 8 <sup>th</sup> Block (Allocating Two Consecutive Blocks) -Controlling the Preference of the Start between the 1 <sup>st</sup> and 2 <sup>nd</sup> Period
Predictability	-Predicting the Same Movability Based on Symmetry
Balance Ability	-The Same Allocation for 3 or 4 Blocks Before and After Lunch Time

## Conclusion and Further Researches

This paper has proposed the new frameworks of symmetric 1Module-4Blocks timetable modules, and compared them with the traditional 1Module-3Blocks modules from both consumer and supplier viewpoints. The new modules have no loss or better outcome from the consumer's viewpoint and only a theoretical disadvantage from the supplier's viewpoint, which is not critical in practice. Theoretically, the upper bound of space utilization can decrease to 75% in the worst case every school year uses its own one space. In spite of this theoretical disadvantage, we argue that it is not a critical issue because the 100% fully utilization is undesirable to get the not crowded and comfortable space, and furthermore, the upper bound can be increased much larger than 75%, or nearly 100% when multiple school years use multiple spaces.

By presenting effective models and operational strategies by adapting potentially determined blocks to the proposed symmetric 1Module-4Blocks models, we demonstrated how many advantages can be obtained without loss from the consumer's viewpoint. The first advantage is the flexibility for securing lunch time, considering the preference of beginning time, and accommodating various courses of 2-blocks, (2+1)-blocks, 3-blocks, (2+2)-blocks, and 4-blocks. The second advantage is the controllability of operating potential blocks dynamically such as a fixed lunched time, exclusion of isolated 1-blocks, and so on. We can also get other advantages such as the predictability of students' movement and the balance ability of space allocation.

The adapted symmetric 1Module-4Blocks timetable modules proposed in this paper are expected to be applied directly or modified in consideration of the actual environment when constructing university timetables. The next research to be considered is how to more expand or generalize the proposed module research as one of the main solutions to the original timetabling problem of universities.

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## A Hybrid Recommendation System for Tourism in the Sultanate of Oman

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**Abstract:** In the era of technology, information or data is an important factor to do any kind of task. Recommendation system has been introduced in the tourism sector where the system can be used to provide the user with personalized recommendation of the places to visit. Sultanate of Oman has got various tourists attractions and it is one of the safest tourist destinations in the world. The purpose of this paper is to design and develop a recommendation system for tourism sector in Oman which will recommend to the users based on their searched destinations using hybrid recommendation system that is combination of- content-based and collaborative filtering algorithm. To train and then to provide meaningful recommendations, dataset has been developed by implementing web scrapping method from one of the popular websites ‘tripadvisor’ which consists of the description of all the tourism places in Oman namely destination names, type of the destination, average rating of the places, the number of people rated the place and image of the destination. The recommendation system is integrated with a web application that acts as a web interface. The system has been developed using python programming language while the web application was developed using Django framework along with HTML and CSS. To evaluate the efficiency and performance of the developed system, it was compared with three other algorithms namely Radius Neighbors classifier, Linear Regressor and Logistic Regressor. The same dataset was provided to all the three algorithms where 70% of the data is used as training data and the rest of the 30% of the data is used for testing. MSE (Mean Square Error) and RMSE (Root Mean Square Error) are calculated for all of the mentioned algorithms, and it was found the developed system performed better than most of the algorithms with less error.

**Keywords:** Recommendation system, Content-based filtering, Collaborative filtering approach, Mean Square Error, Root Mean Square Error

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### Introduction

Internet is a source of information which is growing rapidly with its increase in popularity. Everyday new information is being introduced to the internet. This makes internet a pool of information that consists of useful

as well as not so useful information. This state of ‘information overload’ has been a problem for users as it is hard for them to obtain information which are important. Therefore, in this era of “information overload” (Li et al, 2019) there is a need of a system which will filter the relevant information from the big pool of information. Thus, the recommendation system has been introduced in mid-1990 to help users select the useful information or product from a number of available options (Sharma & Singh, 2016).

Recommendation system is defined as a filtering system which is used to filter out the unimportant information and recommend the users only the information which are relevant to their search. Two of the very popular filtering approaches are known as content-based filtering and collaborative filtering. (Alrasheed, H. et al, 2020) This system has been used in many sectors such as entertainment, e-commerce, retail etc. Recommendation system has been introduced in the travel sector where the system can be used to provide the user with personalized recommendation of the places to visit. (Sebastia, L. et al, 2009)

The aim of this research is to design and develop a recommendation system. Recommendation system requires the involvement of machine learning models. Machine learning is a branch of Artificial Intelligence that studies the dataset provided to the system and then provide accurate output or recommendation to the users based.

One of the main objectives to achieve the aim of this research is, to develop appropriate machine learning algorithms and train them with the dataset to get required output to the user.

## **Literature review**

Obeid et al (2019), proposed a “ontology-based recommender system in higher education” for those students who are interested in higher studies after high school graduation. According to the research done by the authors, 75% of the students are uncertain about their career choice and they join universities without a proper plan of their career path. Therefore, the proposed system aims to help students decide a major based on their skills and interests and not by their grades. The system uses semantic web methods and machine learning technologies to provide recommendations to the students. The system uses ontology to model three domains knowledge- higher education institute, employment and students. By learning from graduate student’s information, collected via survey, using machine learning techniques suggestions will be made to the students. The classification, filtering and clustering of information is done with the help of machine learning techniques.

The authors plan to use algorithm techniques such as; k-mode, self-mapping and hierarchal cluster algorithm to process the data. The survey for this system is intended to be presented to the French and Lebanese students through their university portal.

The approach used in this system solves some of the problems such as data sparsity and cold start. But the system relies heavily on the survey result from the graduate students.

To make a recommendation system efficient and to improve the satisfaction level for the users, the researchers

Hassannia et al, (2019), developed a web application named “Intelligent Tourism Recommendation Agency using an innovative technology - Multi Agent System (MAS) to collect, process and then provide recommendation to the users. The aim of the research, “Web based Recommendation System for Smart Tourism: Multiagent Technology”, was to develop a smart recommendation system in tourism sector that would be an advancement towards the smart tourism goals.

The system consists of five agents who are responsible for doing different kinds of task including real-time data communication and filtering information. The advantage of using this kind of technology is to make agents expert in specific task which in turn will improve the quality of the system. The five agents are Tourist Supply Chain Agent (TSCA), TPA (Tour Package Agent), Recommendation Agent (RA), User Agent (UA), and Broker Agent (BA).

At first when a new user visits the system a set of questionnaires are asked to obtain demographic information about the user. Then from the tour evaluation data is sent to the system and the using these two sets of data and the information from the TSCA suitable recommendation is provided to the customers.

The web application was implemented using Java Agent Development Framework (JADE). The user interface was developed with the help of HTML and AJAX platform. The broker agent used contract net protocol to assign task among the agents. To develop the ontology model Web Ontology Language was used with the help of Protégé tool. The system was tested with real time information. 70 tour packages were made using demo information, considering the variety of possibilities with different hotel types, airlines, cities, prices etc. to make it more challenging for the system. Each customer used the system and then it was evaluated based on two factors- precision, which is the ratio of selected relevant packages to number of retrieved packages, and recall, which is the ratio of selected relevant packages to total relevant packages. Based on the recall factor, the acceptable recommendation for the proposed system was approximately 20%, whereas based on the precision factor the acceptable recommendation is approximately 30%.

Jia, Gao & Shi (2016) developed “An Agent Framework of Tourism Recommendation System” to provide better recommendation to the users. The framework uses three filtering approaches - content-based recommendation, collaborative filtering and Constraint-based filtering approach. These three approaches were developed in three different agents which are- Content-based Agent, Collaborative Filtering-based Agent and Constraint-based Agent.

The aim of each agent is to provide recommendation according to the user’s preferences. Then these recommendations will be sent to another agent known as recommendation agent. A part of the recommendation sent by each agent will be collected and send to the tourist agent. Initially this agent collects 1/3 of the recommendation made by each agent. However, according to the user feedback this weight changes. Tourist agent provides the user interface and collects the feedbacks from the users. Other than this, the framework has another agent known as the Collector Agent. This agent contains web crawlers that travels through different

websites and stores information. The crawlers can also identify tourism related webpages and extract the textual information after downloading the webpages.

The content-based agent uses machine learning algorithms to learn the user profiles. Each item has some specific features and attribute assigned to it. In most of the content-based system the string-matching operation is done on the user profile and the item extracted from the web. If a document has the similar keyword as of the user profile, then that document is taken as a relevant document. However, the drawback of this method is the natural language ambiguity. Due to the use of synonyms a relevant document could be missed.

The aim of collaborative-filtering agent is to find the users with similar interests. They are known as the user's neighbors and they are considered as having same preferences. At first the tourist information is analyzed and modelled. Tourist information includes their tour history. Then according to the visiting history and using the collaborative filtering method the neighbors are found. According to the similarities the neighboring tourist list will be calculated. Finally, the top similarities will be recommended to the user. This can be done only if the user has previous tour records. However, if the user is new or has no previous records then according to their basic information such as- gender, profession etc. the similarities will be found. Other than that, the data will have to be pre-processed every time before generating the neighbors. This process includes- data cleaning, data integration, data conversion and data reduction. This is done to remove any user with void or null information.

To find the similarity in this system the author proposed to use Cosine method –

$$\text{Sim}(T_i, T_j) = \frac{RT_i \cdot RT_j}{(|RT_i| * |RT_j|)}$$

Here,  $T_i$  is tourist one and  $T_j$  is tourist second.  $R$  represents the ratings retrieved from each tourist.

Selmi, Brahma and Gammoudi (2017), developed a new approach called PACT (Predicting Agent using Collective Trust). The aim of this approach is to find the trusted agent so that agents can collaborate with each other and share information. In order to find the reliable agent, the system carries two phase – modeling phase and decision-making phase. Fuzzy Formal Concept Analysis (FFCA) is used to model the trusted networks among the agents. On the other hand, Theory of Belief Function is used to help agents decide the most trusted agent.

In this paper the authors considered 5 agents which are-  $a_1, a_2, a_3, a_4, a_5$  and developed a trust relation network with each other. In the modeling phase the agents are organized as groups along with their trust relationships. Fuzzy Formal Context is used to do this. Next, using Fuzzy Formal Concept the concepts are obtained.

In the decision-making phase the authors developed a new algorithm known as  $\text{Pred\_Agent}$  which is used to recommend a list of agents that can be trusted for the agent who wants to collaborate and share information. The algorithm allows the agent for example-  $a_1$  to create a trust relation between all the other available agents. From the extracted concepts that share a trust relationship with the agent. The highest degree of association for each agent is found and then according to the trust level the suitable and most trusted agent is chosen.

To test the credibility of the approach the authors have used the Adovogato dataset that consists of

approximately 6541 users and 51127 relationships. To evaluate the algorithm the authors found the precision, recall and FScore of the system. The following formulas are used in evaluation:

$$\text{Precision} = (|X \cap Y|) / (|Y|)$$

$$\text{Recall} = (|X \cap Y|) / (|X|)$$

$$\text{FScore} = (2 * \text{Precision} * \text{Recall}) / (\text{Precision} + \text{Recall})$$

Here, X represents the list of agents which an agent trust and Y represents the list of agents that the developed algorithms suggests to trust. The authors decided that the threshold value should be 0.5, that is if an agent scores more than or equal to 0.5 then the agent will be trusted otherwise it will be rejected.

The proposed algorithm was compared with two other trust evaluation strategies which are known as, Min-Max and Multi-Max.

At the end of the evaluation, it was found that the new approach, PACT, have an accuracy of 73% compare to other approaches. Also, runtime for the prediction is found for all the three approaches and compared.

### Proposed Recommendation System

To develop the recommendation system, the system was divided into four components where each component is responsible to perform a specific task as shown in figure 1.

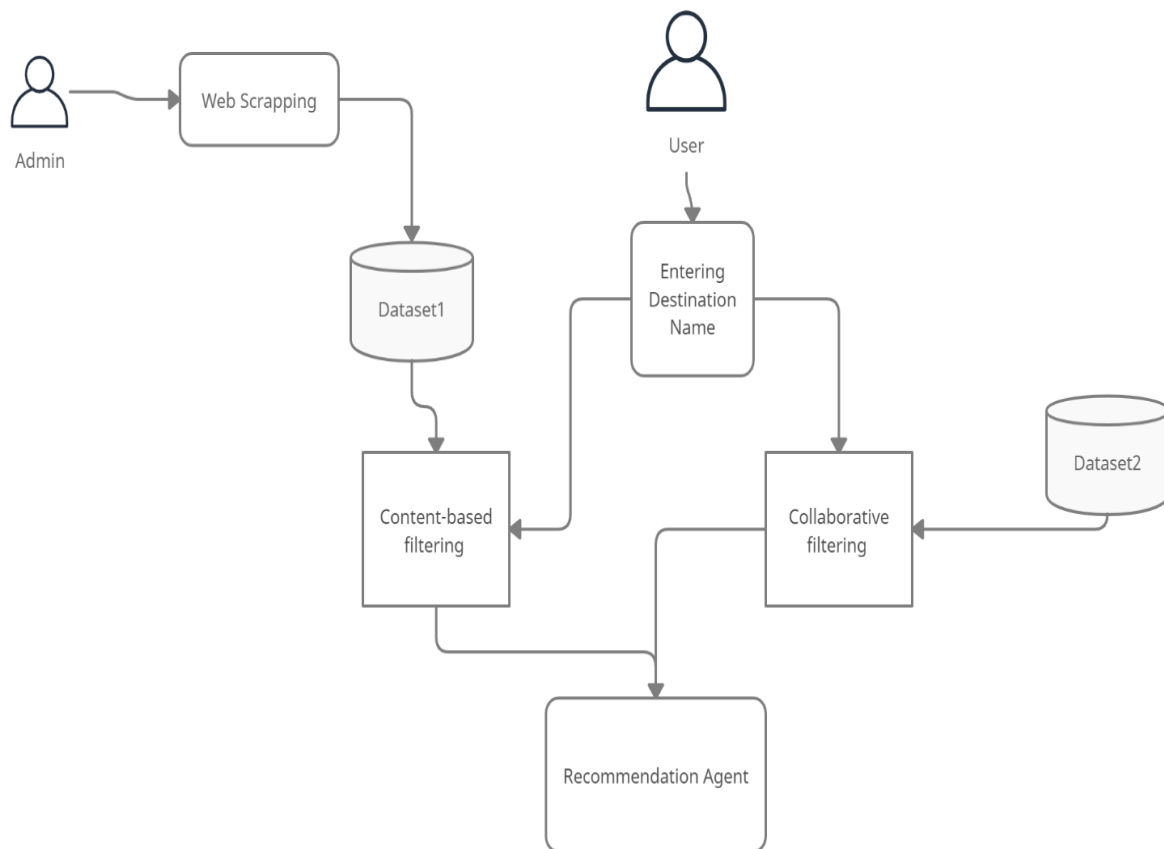


Figure 1. Recommendation system components

The components used are:

- *Dataset:* One of the most important items in the recommendation system is having a dataset. To develop the recommendation system two datasets have been developed. One of dataset has been developed by implementing web scrapping method. One of the popular websites ‘Tripadvisor’ has been chosen to scrape data. Tripadvisor is a popular tourism website which contains descriptions of all the tourist places in a country or city. It helps tourists understand and gather information about their trip. The website allows user to give their ratings and review about different places or hotels. Tripadvisor also contains information about different tourist destination in Oman along with their ratings on the website given by different users. This particular website has been chosen as it consists of the description of all the tourism places in Oman. This dataset has been named as “oman\_tourism.csv”. This dataset consists of- destination names, type of the destination (i.e., the destination is a beach or historical place or mountain etc.), average rating of the places, the number of people rated the place and image of the destination.

The second dataset, “oamn\_tourism\_review.csv”, was created manually. This dataset consists of the information of user ratings for the destinations. The ratings given by the users were recorded and was entered in this dataset.

- *Content-based Filtering Algorithm:* The working principle of the algorithm is to find the similarity between the features of the items in the dataset and based on the similarity recommend the items which are similar to the searched item. Based on this principle the system is developed where ‘items’ are considered as the destinations. The similarity of the destinations is found based by analyzing the type of the place.

At first to cleanse the dataset, “oman\_tourism.csv”, Tokenization has been done on it break into small token. Then using the algorithm TF-IDF (Term Frequency Inverse Document Frequency) to find the important and relevant words. Next to find the similarity between two places the vectors obtained from the TF-IDF algorithms are used. Based on the similarity the places are arranged in descending order, i.e., the places with highest similarity as of the searched places are at the top. (Kumar & Sharma , 2016)

- *Collaborative Filtering Algorithm:* This algorithm works with user ratings. In the developed system item-based collaborative approach has been used, which suggests that two items in a dataset are said to be similar if a user has given same ratings to both items.

To implement this approach the nearest neighboring method has been used. This method takes the dataset, ‘oman\_tourism\_review.csv’ in the form of matrix as an input. The brute force algorithms is used to find the distance between the user searched place and all other places in the dataset. Once all the distance is calculated, based on it the places are recommended. If the distance is less, then the similarity is high.

- *Recommendation Agent:* Once both the algorithms- collaborative and content-based, has created lists of recommended places, both the lists are sent to the recommendation agent. This component is responsible to combine these to list and display the final recommendation to the user.

## System Implementation

The developed recommendation system works with a web application which acts as the front-end of the system while the recommendation system is in the backend of the system as shown in figure 2. The users can access the

recommendation system only with the help “Travello” web application. The user enters the destination name in the search box placed on the webpage. The web application then sends the destination name to the recommendation system. The recommendation system searches the user entered destination name. If the destination is found then the system performs two tasks. First the system collects all the details of the searched destination and displays them on the webpage. Next, the system finds all the destinations which are similar to the user entered destination using the two filtering algorithms- collaborative and content-based filtering algorithm, and displays them on the web page.

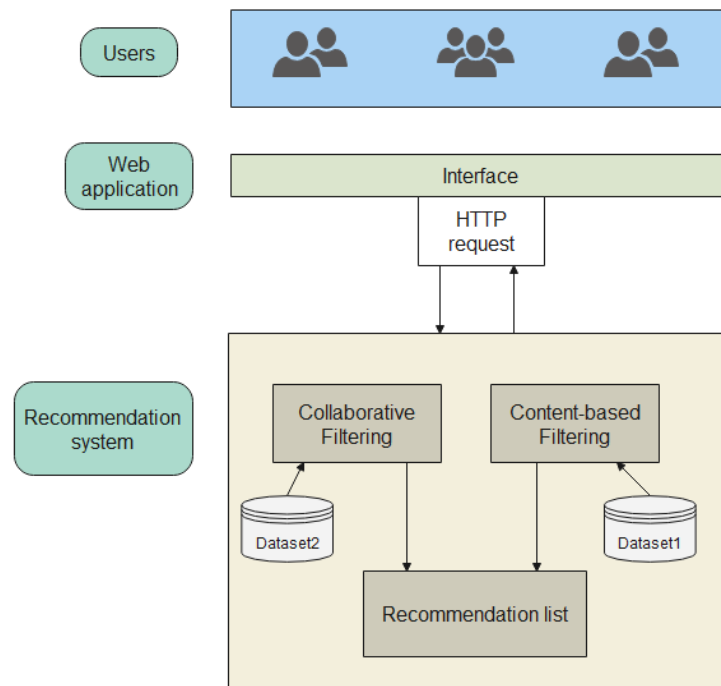


Figure 2. System Components

To develop the web application, Django framework was used along with HTML and CSS. While HTML and CSS helped in designing the web application, the integration of the application with the recommendation agent was done with the help of Django. The recommendation agent, collaborative filtering and content-based filtering algorithms are developed using python programming language.

The user enters the destination name in the search box placed on the webpage. The web application then sends the destination name to the recommendation system. The recommendation system searches the user entered destination name. If the destination is found then the system performs two tasks. First the system collects all the details of the searched destination and displays them on the webpage. Secondly the system finds all the destinations which are similar to the user entered destination using the two filtering algorithms and displays them on the web page. The figure 3 shows the destinations generated by the system for the place “Sultan Qaboos Grand Mosque” in Oman.

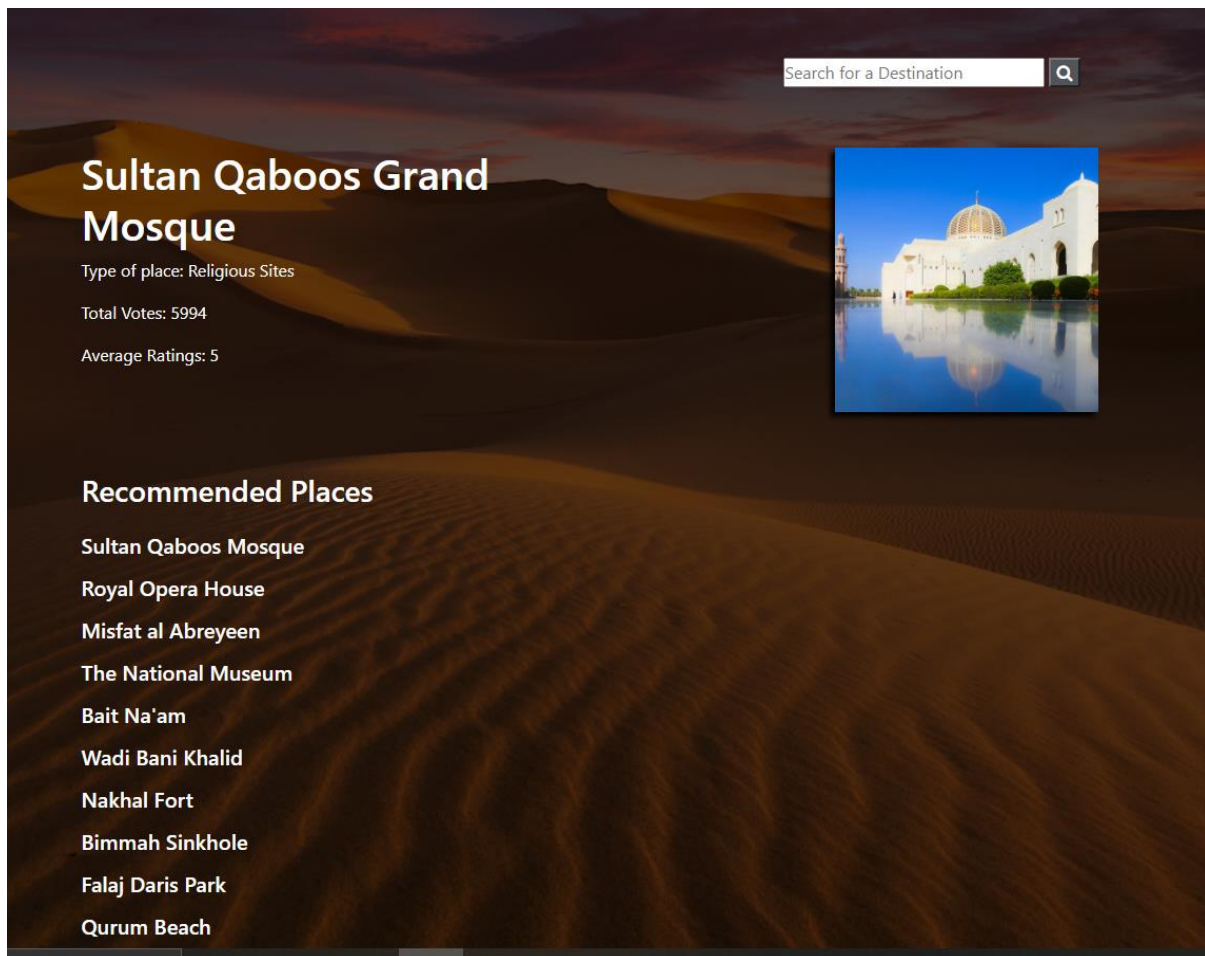


Figure 3. Web application interface

## Performance Analysis and Result

To evaluate the efficiency and performance of the system, the developed system is compared with three other algorithms - Radius Neighbors classifier, Linear Regressor and Logistic Regressor. The same dataset was provided to all the three algorithms where 70% of the data is used as training data and the rest of the 30% of the data is used for testing. MSE (Mean Square Error) and RMSE (Root Mean Square Error) are calculated to compare with the developed system. To calculate the RMSE the following equation has been used.

*Equation 5: RMSE*

$$RMSE = \sqrt{\frac{\sum_{i=1}^N (Predicted_i - Actual_i)^2}{N}}$$

Where N is the total number of data, predicted is the predicted output and actual is the best fit line. After finding the MSE and RMSE are plotted in a graph.



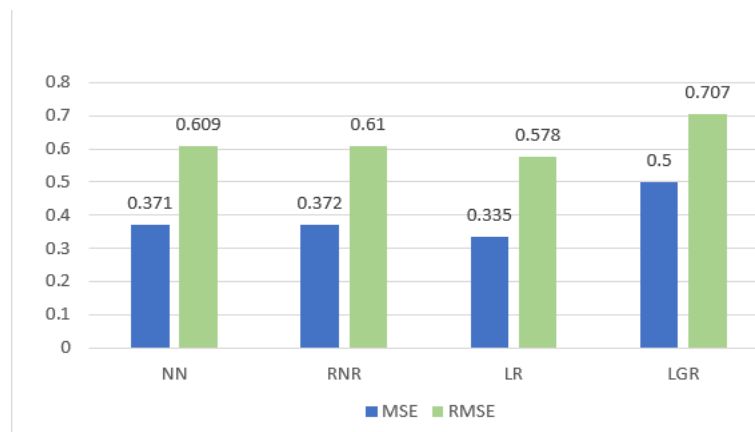


Figure 4. Prediction rating comparison

The first algorithm that was used to make a comparison is the Radius Neighbor Regressor (RNR) along with Linear Regression (LR) and Logistic Regression (LGR). While comparing the system’s MSE and RMSE with the other algorithms it was found that the error is less than two of the models which are Logistic Regression and Radius Neighbor Regressor. But the model linear regression performed slightly better than the proposed model. However, the dataset used in this experiment is small and therefore, to make a better comparison a larger dataset is required.

## Conclusion

In this work, tourism recommendation system for Oman is developed using content-based and collaborative filtering algorithm. Datasets have been derived using web scraping from “Tripadvisor” website which acts as an input to train the algorithms as well as to provide recommendation to the users. A web application has been developed with the help of Django web framework to receive user inputs. The developed recommendation is integrated with the web application which takes in the user input, destination name, from the web application and performs filtering, generating a list of recommended places and then displays it on the web application. The developed system is tested using several test cases to test several aspects of the system such as efficiency, performance etc. To evaluate the efficiency of the system two evaluation metrics were used- Mean Square Error (MSE) and Root Mean Square Error (RMSE). It is found that the MSE of the system is 0.371. Since the error is small, it can be said that the accuracy is high which provides a positive view of the developed recommendation system.

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## The Validity and Reliability of Parental Involvement Questionnaires Among Vocational College Students in Malaysia

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**Abstract:** The needs of education among the community itself was a challenged. This study focused on the validation of Parental Involvement Questionnaires (PIQ) for student versions to measure parental involvement among vocational college students. Two aspects of validation are the reliability and validity of PIQ through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). There are six domains of parental involvement: parenting, communicating, volunteering, learning at home, decision making, and collaborating with the community. There are 430 samples are selected among the final year students in vocational colleges. Data were analysed using *Statistical Packages for Social Sciences (SPSS)* and through *Structural Equation Modelling, Amos* version 22.0. The finding revealed that the measurement model adequately fit with the data collected within a vocational college students' context, which is RMSEA=0.054, CFI=0.927, TLI=0.916 dan Chisq/df= 2.229. The reliability of the instruments ( $\alpha=0.933$ ) and factor loading  $>0.50$  was attained from each item measured. EFA and CFA is a critical process to validate the PIQ for students' versions to make sure it was useful to measure all the domains involved in parental involvement among the vocational college students. Through the reliability and validity resulted from EFA and CFA, we will probably confirm that PIQ for students' version is valid to be used for empirical study.

**Keywords:** Exploratory Factor Analysis, Confirmatory Factor Analysis, Parental Involvement Questionnaires, Parental Involvement, Vocational Colleges Students

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## Introduction

Parents play an important role both at home and at school to educate their children. There are six domains of parental involvement that covers the components of parenting, communication, volunteering, home learning, decision making, and community collaboration (Epstein, 1992). Numerous studies show that parents tend to give more attention to young age children compared to college-aged teenagers. Among the earliest studies conducted for students in the early stages of schooling is the research by Adamski et al. (2013); Cunha et al. (2015); Dumont et al. (2012); Gonida & Cortina (2014); McNeal, (2012); Park & Holloway, (2013); Phillipson & Phillipson, (2012); and Valdez et al. (2013). There are only a few studies conducted at the secondary school level and the college or university level (Chen & Ho, 2012; Rivers et al., 2012; and Wang & Sheikh-Khalil, 2014). According to McNeal (2014), the implementation of the new curriculum is quite challenging, grown-up children need to be independent, and families who are more focused on young age children because parents give less attention to this group of students. It is because children at the secondary school level have reached maturity compared to children in preschool. At this stage, parental attention and involvement in children's education seem to be declining despite realizing that they need to provide support to children. McNeal (2012) also states that the curriculum and syllabus are getting challenging, children in secondary school need to be independent, and parents are more focused on younger children. Parental involvement has a vast scope, and it covers all aspects, from young children to adults. Parental guidance and participation in children's education are not limited in the house only, but it must be practiced in school. This involvement occurs indirectly and naturally born from the sense of awareness of the parents themselves to support their children to achieve high achievement (Abd Razak, Zuwati, & Umi Kalsum, 2013; Abd. Razak & Noraini, 2011; Dikkers, 2013; and Epstein, 1992, 2008).

Nowadays, in vocational colleges, parents who are involved in the education of children becomes a sensitive issue to implementation as it is seen as a factor that contributes to children's academic achievement. Although the implementation of transformation for technical and vocational education has been mobilized for a long time, the success of students is still disappointing. On the contrary, parents afford to support their children by attending programs organized by the college. Parents can also help their children complete assignments given by teachers by contributing ideas and during semester breaks (Hoover-Dempsey et al., 2001). More than that, some parents are concerned about providing a unique learning place for children to review lessons at home, monitor assignments, and also guide while the children are at home. Parental involvement in this study only considers the perspective of students on the extent to which their parents are involved in aspects of parenting, communication, home learning, volunteering, and community collaboration. Therefore, this study is conducted to identify the validity and reliability of the Parental Involvement Questionnaires (PIQ) to measure parental involvement among students in vocational colleges. The instruments used in this study consists of six domains which are parenting, communication, volunteering, home learning, decision making, and community collaboration.

### **Justification in Selecting the Six Domain of Parent Involvement**

Many previous researchers have been conducted their research by using this instrument to study the relationship between the factors of student academic achievement, demographics, teacher competence, parental involvement, and others. Therefore, before obtaining the expected result of findings, a researcher must determine and measure parental involvement. Parental involvement has been defined and measured inconsistently across studies depending on the needs and limitations of individual studies. No specific findings related to the measured dimensions and specifications will be assessed or have been achieved. The PIQ instrument is intended to build a complex that encompasses many parental behaviour and attitudes. For this reason, it is crucial to study the relationship between family and demographic factors as well as various specific components in terms of parental involvement. For example, a single mother may have a low level of attendance in school activities due to work schedules and other childcare responsibilities but consistently assisting her child with homework at night. Similarly, poorly educated parents may feel comfortable attending to school activities but cannot help their children with homework. Risk factors such as maternal depression can result in less parental involvement that will cross all domains due to its negative impact on interpersonal relationships, worldviews, and activity levels. Therefore, one of the goals of this study is to determine how these different factors will be associated with varying types of parental involvement.

This PIQ instrument was developed with multi-dimension by studying the strengths and weaknesses of some current models (Eccles & Harold, 1996; Epstein, 1995; and Grolnick & Slowiaczek, 1994). Grolnick and Slowiaczek (1994) organize the three dimensions of parental school involvement: (a) behaviour (participation in school activities and helping with homework); (b) cognitive intellectual (exposing children to intellectually stimulating activities); and (c) personal (stay informed about the child's schooling). However, one concern in this model is that the dimensions built are broad, incorporating different types of specific engagement into each dimension. For example, the behavioural domain combines parental activities in the school environment with the activities in the home. Such a broad category may only involve the involvement of parents with associations with student achievement factors.

Meanwhile, Eccles & Harold (1996) outline five dimensions of parental involvement in Michigan Children and Beyond Studies: (a) monitoring (how parents respond to teacher requests to help their children with schoolwork such as checking homework or listening to them read); (b) voluntary level (parental level) participation in school activities including Parents-Teachers Organization (PTO); (c) parental involvement in children's daily activities related to homework); (d) contact the school about the progress of their children, and (e) contact the school to find out how to provide additional assistance. Dimensional monitoring and involvement of directly related behaviours to help children with homework, and possibly, become better conceptualized as a structure. The last two dimensions involve both parties contacting the school. Besides, these two dimensions are measured by only one item. Therefore, the reliability of these dimensions cannot be determined.

From the perspective of Epstein (1995), he outlines six dimensions of parent-school partnerships that focus on

the role of schools in fostering these relationships. The six dimensions are: (a) parenting (helping families provide home-based support for learning); (b) communicate (design effective communication in school about programs and progress); (c) volunteering (recruiting and organizing parents to support school goals and child development); (d) home learning (providing information for families to help students at home with homework); (e) making decisions (including parents in school decisions, developing parent leaders and representatives); and (f) working with the community (integrating community resources and services to strengthen school programs, family practices, and student development). These dimensions are well defined and provide useful guidelines for formulating the dimensions of parental behaviour. However, they tend to measure teacher and school behaviour rather than parental involvement.

All these three models exhibit differences in the scope, number, and dimensional reliability assessed. They are creating dimensions for parental involvement specifically to the scope of behaviour, a variety of parental behaviours, and models consisting of items sufficient to measure the construction accurately, which will increase the possibility that useful findings will be obtained in future research. The dimensions constructed by Grolnick and Slowiaczek (1994) are extensive, encompassing many different behaviours in one particular factor, while the dimensions in the Eccles model (Eccles & Harold, 1996) more to limited scope, creating dimensions that are different from almost the same behaviour. Between the three models, Epstein (1995) model has made new dimensions that are not only defined by behavioural factors alone. Grolnick and Slowiaczek (1994) measure some limited dimensions in parental involvement. Researchers Eccles and Harold (1996) used a single item assessment for a particular dimension. In this reference model using this PIQ instruments, six specific dimensions of parental involvement aspects will be measured using an evaluation of various items for each dimension.

A valid conceptualization of parental involvement must explain the difference between parental and teacher involvement. Distinguishing between the parent involvement can help to explain some of the conflicting research findings related to parental involvement positively and negatively. For example, Epstein (1996) found that teachers who initiate more relationships with children are less well in school. Meanwhile, parents will start more relationships if they want their children to be more successful. Eccles and Harold (1996) and Grolnick and Slowiaczek (1994) only focus on the parental involvement initiated by parents, whereas Epstein focuses on parental involvement undertaken by the school. In this study, the focus will be on the relationships undertaken by parents to isolate risk factors for parental behaviour.

Following the condition and society in Malaysia, parental involvement was found to contribute to the progress in student education. Although this PIQ instrument is an adaptation of the parental involvement instrument introduced by Salina & Epstein (1993) due to the environmental factors that are different from the culture of society, especially in Europe, then PIQ is still relevant to be used by researchers in Malaysia. Simultaneously, there are still few instruments that precisely measure parental involvement, which includes a comprehensive six dimensions and not focuses solely on parental behaviour alone. The validity and reliability of this instrument will be measured through the Exploratory and Confirmatory Validity Tests, followed by further analysis through

measurement models carried out as reinforcement.

### Parental Involvement Questionnaires (PIQ)

Findings from the research of (Fan & Williams, 2010; Fan, 2001; Gonida & Cortina, 2014) show that active parental involvement positively affects student academic achievement. This is the opposite when it is found that the lack of parental involvement in school activities and programs impacted student achievement (Weston & Lareau, 1991). Therefore, student excellence cannot be achieved if the participation of student parents in college programs and activities is not enhanced (Henderson & Mapp, 2002). However, Lareau's (2000) statement differs when it is found that time constraints contribute to why parents are less sensitive to the role they should play in children's education. In reality, they let the children learn without proper monitoring. Parental involvement, whether at home or in school, relates to children's academic achievement (Epstein & Dauber, 1991; Wang & Sheikh-Khalil, 2014; Yahaya & Obih, 2010; and Yeoh & Woo, 2010). Thus, parents who are involved in helping children at home have a positive impact on student achievement (Bower & Griffin, 2011; Desimone, 1999; Fan & Chen, 2001; Hoover-Dempsey et al., 2001).

Therefore, to identify the extent to which parental involvement has implications for students' academic achievement, the PIQ instrument has been used to test the six domains mentioned, which are the aspects of parenting, communication, volunteering, home learning involvement, decision making, and community collaboration.

Table 1. Number of Items in The Parent Engagement Domain

No	Domain	Item	No of Item
1.	Parenting	1,2,3,4,5	5
2.	Communication	6,7,8,9,10,11,12	7
3.	Volunteering	13,14,15,16,17	5
4.	Involvement in learning at home	18,19,20,21,22,23,24,25,26,27	10
5.	Decision making	28,29,30,31	4
6.	Collaboration with the community	32,33,34,35	4
7.	Total Item		35

The PIQ instrument was adapted from the Epstein Parent Involvement Inventory, 1992b. This instrument uses a Likert scale ranging from scale 1=Strongly Disagree to scale 5=Strongly Agree. It measures the extent of parental involvement, according to the student's perspective. Although in previous studies, this instrument was used for middle-grade students in the United States, it is still applicable for vocational students in Malaysia (Carpenter, 2012; and Feldon et al., 2011). This is because the range of age of the students involved is between 16 to 18 years old that is the same as middle-grade students in the United States and vocational college students in Malaysia. This instrument contains six domains: parenting, communication, volunteering, home learning

involvement, decision making, and community collaboration. A total of 35 items of the questionnaire were used to measure parental participation, as stated in (Table 1) above.

The back-translation process is carried out in which the original language, English and translated into the Malay language. This method is used to ensure that a phrase or item is translated correctly from one language to another (Brislin, 1970). This statement is supported by researchers Amer, Zuraidah, Norazan & Adzrool (2011), which stated that the process of back to translation is divided into three stages. For the first stage, the original instrument will be translated into the target language. In the second stage, the second individual, who is also an expert in two languages, translates back from the target language into the language of the original instrument without knowing the items contained in the original instrument. Then, the translation of the second expert version is compared to the first version that would be done by the third expert. Versions that have been translated by the first expert will be used when the original instrument has similarities or acceptable to the third expert. This procedure is performed by the researcher to ensure that the process of translation gives the same meaning between the source language and the target language. The reliability of the scale in this instrument studied by previous researchers is at values  $\alpha=0.77$  and  $0.929$  (Epstein & Dauber, 1991; and Lewis, 2001). For this study, the researchers found that the value of  $\alpha=0.933$  indicates good reliability (Pallant, 2002).

Previous studies have also shown that parental involvement is related to children's success in school (Grolnick & Slowiaceck, 1994; Henderson & Mapp, 2000; Fan & Chen, 2001; Cojocariu & Mareş, 2014; Hill & Tyson, 2009; Jeynes, 2015; Matejevic, Jovanovic, & Jovanovic, 2014; and Porumbu & Necşoi, 2013). The findings of previous studies also shown the importance of parental involvement in helping student achievement, which has been a concern for a long time (Epstein, 2001; Kreider et al., 2007; Jeynes, 2015; and Von Otter, 2014). Parents who are always involved in their children's education will encourage student success, especially academic achievement. Therefore, the communication factor is significant in the relationship between parents, students, and teachers.

This aligns with the findings of Kosaretskii & Chernyshova (2013) found that electronic communication via email, websites, and social sites has encouraged parental involvement (Isernhagen & Bulkin, 2011). As a result, parents have more open opportunities to communicate with teachers and also motivate students to work harder in their studies. It allows parents, teachers, and students to share information more quickly and accurately. Apart from the importance of communication, parents also need to support their children's learning at home.

This view is also supported by findings from Kosaretskii & Chernyshova (2013), who also advised parents to provide private and suitable learning space for children to study at home. In this way, children are allowed to increase their potential through encouragement and support while at home. According to Chen & Ho (2012), "filial piety," which is an emotional and material encouragement such as love, meeting needs, respecting and trying to fulfil the desires of children, encourages them to be more successful in their studies. The above findings are further reinforced by (Cunha et al., 2015; Fan & Williams, 2010; and Gonida & Cortina, 2014) asserted that parents who help children to complete homework at home would encourage student excellence in



academics. These studies show the importance of parents in assisting students, especially in their academic achievement. Therefore, the goal of this study consists of two aspects, that are; (a) Exploration Factor Analysis and (b) Confirmatory Factor Analysis through PIQ instrument among vocational college students.

## **Methodology**

### **Research Sample**

The research involved the participation of 430 students aged between 16 to 17 years. They have been selected from 13 pilot vocational colleges throughout Peninsular Malaysia. The sampling technique used in this study is stratified random sampling. It is used to identify the respondents chosen for each vocational college involved. The data collection process is self-administered by the researcher. During the data collection process, research participants are required to answer the PIQ instrument set according to the time fixed by the researcher. To ensure the smooth data collection process, the researcher has asked for permission to conduct this study at the designated college from the Ministry of Education Malaysia. Since this study involves students from vocational colleges, approval on location is also obtained from the Technical and Vocational Education Division (BPTV). The analysis of data was done by using two software, which is SPSS and Amos 2.0. This software is used to analyse data for exploratory validity using SPSS, while Amos 2.0 for confirmatory validity and construct a measurement model through a structured equation model (SEM) model approach.

### **Research Instrument**

This instrument consists of 35 items adapted from Salina & Epstein (1992b) to measure the six domains of parental involvement (Table 1). A scale of 5 Likert points from 1 (Strongly Disagree) to a scale of 5 (Strongly Agree) is used to agree with each item measured. The researcher summed up all the scores for the items to get the overall value. Next, a reliability test is conducted for validity. The results of the analysis found that the reliability value for each item is acceptable. The values obtained are  $\alpha=0.763$  to  $0.863$ , which indicates the consistency of each aspect in the domain of parental involvement. Therefore, all 29 items in this instrument can be used for further analysis as they have a good consistency value exceeding 0.70 for each domain measured.

### **Exploratory Factor Analysis**

Domain filtering is performed at this stage to determine the uniqueness of the domain based on Exploratory Factor Analysis (EFA). EFA analysis is an essential foundation for strengthening domain development (Schumacker & Lomax, 2010). The primary function of EFA is to identify whether the items are appropriate or not, modifying problematic items or dropping those items directly, and tracking the relationship structure between items according to the classification of variables. Therefore, EFA is very suitable to be used as a method of data identification or reduction (Hair et al., 2010).

According to Schumacker and Lomax (2010), EFA can be done when the researcher has a group of logical items that can help to form a concept and does not have a theoretical model that has been firmly established. Therefore, EFA is implemented on all items involving all three inventories as the researcher has made additional items to suit the context of the study. The researcher analysed the data using IBM SPSS Statistics 22. In this study, principal component analysis with orthogonal varimax rotation is used to determine the minimum number of factors required for prediction. The principal component analysis of the orthogonal varimax rotation method has chosen because it is the most popular and provides the best factor structure compared to other methods (Hair et al., 2010; and Pallant, 2007).

Table 1. Results of Exploratory Factor Analysis for PIQ Instruments

Item	Reliability value ( <i>Cronbach Alpha</i> )				
	1	2	3	4	5
1. Ask me about college	0.794				
2. Tell me about the importance of entering to college	0.639				
3. Care about my condition in college	0.835				
4. Keep updated with my achievements in college	0.814				
5. Discuss with my teacher over the phone		0.652			
6. Discuss with my teacher through email		0.820			
7. Discuss with my teacher through WhatsApp		0.783			
8. Discuss with my teacher through a letter		0.778			
9. Invite teachers to discuss my learning progress		0.689			
10. Attend activities organized by the college			0.565		
11. Give financial contributions to the college			0.693		
12. Give goods contribution to the college			0.612		
13. Attend college PTO meetings			0.888		
14. Read a book for me at home				0.536	
15. Listen to my reading				0.605	
16. Listen to my story				0.518	
17. Assist me in completing the assignment				0.701	
18. Assist me in doing a revision at home				0.746	
19. Talk about television shows				0.535	
20. Help me to plan my assignments				0.669	
21. Examine my assignments				0.652	
22. Provide a study space for me				0.486	
23. Take me to the library				0.566	
24. Conduct voluntary college activities					0.518
25. Give respond in college assessments					0.504

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26. Takes me to attend events involving the community	0.738
27. Encourage me to participate in community activities	0.698
28. Joining me to participate in community activities	0.714
29. Involved as a committee in community activities	0.657

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Note: Factor 1: Parenting, Factor 2: Communication, Factor 3: Volunteering, Factor 4: Involvement in home learning and Factor 5: Collaboration with the community

### Confirmatory Factor Analysis (CFA)

The Structure Equation Model (SEM) has two main aspects, namely the measurement model and the structural model. Both models determine a complete model. Two processes that must be done before testing the fit matching model is to estimate the measurement model first (Hair, 2010). Through the CFA approach, the researcher tests statistically whether the data sample can validate the proposed model or vice versa. The validity of the scales in the instruments used, in terms of the item must align with the operational definition of the domain. The validation factor analysis was conducted for each variable. CFA is undertaken to determine the number of items included in the domain in line with the statement of Byrne (2010).

All items in the CFA measurement model need to achieve convergent validity (Byrne, 2010; Hair et al., 2010). Three indicators were used to assess the convergence validity, i.e., based on the value of factor weighting exceeding  $>0.50$  (Hair et al., 2010), the average value of the Average Variance Extracted (AVE) for each domain  $>0.60$  (Hair et al., 2010) and domain reliability values  $>0.60$  (Hair et al., 2010). Moreover, the compatibility between domains and CFA model was determined based on a combination of at least one Absolute Fit Indices and one Incremental Fit Indices (Bentler, 2010; Hair et al., 2010; Hu & Li, 2015). In this study, the two-second stage CFA models were also generated to represent each study domain.

The CFA analysis for each domain is developed based on the dimensions that have been identified through the EFA process. Next, a modification process is carried out to ensure that each CFA model achieves model matching accuracy. Domain validity assessments are also performed to ensure that all items have convergent validity. The three indicators used are factor weighting value ( $\lambda$ ) $>0.50$  (Hair et., 2010), Extracted Average value (AVE)  $\geq 0.50$  (Fornell & Larcker, 1981; Hair et al., 2010), and domain reliability value ( $\alpha_c$ )  $>0.60$  (Hair et al., 2010).

The purpose of this analysis is to identify whether the six factors used to measure parental involvement meet the model matching criteria separately. The analysis is followed by convergent validity to ensure that all items contained comply with the validity of the construct. Among the indicators used for the validity process are (a) factor weighting value ( $\lambda$ ) $>0.50$  (Hair et al., 2010 and Hair, Black, Babin, & Anderson, 2009) (b) Average Variance Extracted value (AVE) $\geq 0.50$ , (Fornell & Larcker, 1981) and (c) construct reliability values ( $\rho_c$ ) $>0.60$

(Hair et al., 2010). When convergent validity and AVE values reach the discriminant validity values for each domain, this indicates that construct validity has been achieved. Then, the reliability of each item is measured by the Cronbach's Alpha ( $\alpha$ ) value based on the following Table 3.

The next step is to build a measurement model after the Confirmatory Factor Analysis is performed. As a result, all domains show convergent validity. According to Hair (2009); and Barrett (2007), before testing the actual model, estimation of the measurement model must be performed upon completion of the validity analysis. Through the Exploratory Factor Analysis approach, the analysed data can be tested statistically whether the data sample can confirm the proposed model or vice versa. The validity of this measurement model is a combination of empirical theory and evidence of new findings or vice versa (Zainudin, 2015).

Researchers refer to Modification Indices (MI), which indicate the validity of the model tested (Kline, 1998). The validity of each item was tested based on the MI values shown through the arrows in the SEM analysis. Theoretically, the items measured should correlate with each other to support the path. Zainuddin (2015) and Hair et al. (2010 and 2013) stated if the analysis conducted does not meet the required criteria, then the path should be dropped out. Here are three indicators of "goodness of fit indices" used by researchers to measure the consistency of items with research samples: See Table 3 below.

Table 3. Compatibility Model and Acceptance Level Indicators

Category	Index	Acceptance level	Reference
1. Absolute fit	RMSEA	RMSEA < 0.08 (Accepted)	Brown & Cudeck, 1993
	GFI	GFI > 0.90 (Accepted)	Joreskog and Sorbom (1984)
2. Incremental fit	CFI	CFI > 0.90 (Accepted)	Tucker & Lewis (1973)
	TLI	TLI > 0.90 (Accepted)	Bentler & Bonet (1980)
3. Parsimonious fit	Chisq/df	Chisq/df < 0.50 (Accepted)	Marsh & Hocever (1985)

In conclusion, the results of the conducted Confirmatory Factor Analysis have proved that this analysis has its uniqueness compared to other statistical analysis. Among the advantages identified is when validity is obtained, the researcher can construct a measurement model as a first step before building a structural model that will explain the causal relationship between the variables measured simultaneously in one model. Not just making a model, this analysis also confirms that each item found in the domain is empirically proven and accurately measured the model based on the level of acceptance (Hair et al., 2010; Hair, Hult, Ringle, & Sarstedt, 2014; and Zainudin, 2015). Therefore, the Confirmatory Factor Analysis was conducted to indicate the validity of each item within the measured domain.

### Research Findings

Exploratory Factor Analysis shows that the measured items are divided into five factors, which are parenting,

communication, parental involvement in helping home learning, and volunteering. A total of eight items are items 5, 11,12,13,14,23,26, and 29 have been withdrawing from the instrument. Each item that does not meet the criteria will be withdrawn. Items that will be dropped out when the weighting factor  $<0.50$  or if the item is more than two factors (Zainuddin, 2015 and Hair et al., 2013). Based on the principal axis factor analysis (PAFA) analysis, only 29 items were maintained.

Table 4. The value of the correlation coefficient and the Average Variance Extracted (AVE)

	1	2	3	4	5
<b>Factor 1</b>	(0.54)				
<b>Factor 2</b>	0.04	(.53)			
<b>Factor 3</b>	0.27	0.21	(0.50)		
<b>Factor 4</b>	0.13	0.18	0.37	(0.43)	
<b>Factor 5</b>	0.15	0.17	0.50	0.46	(0.40)

Note: Factor1: Parenting, Factor2: Communication, Factor3: Volunteering, Factor4: Involvement in home learning and Factor 5: Collaboration with the community

Through the Confirmatory Factor Analysis, the discriminant validity is obtained for each domain measured. The findings are shown in Table 4 above. Based on Table 4, the Average Variance Extracted (AVE) for factor 1 represents the parenting domain,  $AVE=0.533$ . Factor 2 represents the communication domain with  $AVE=0.533$ , and factor 4 represents the domain of home learning, shows the value of  $AVE=0.500$ . All of these domains achieved convergent validity when the AVE values  $>0.50$ . However, factor 4, which is the domain of home learning, has a value of  $AVE=0.443$ , and factor 5 represents the domain of cooperation with the community, has a value of  $AVE=0.404$ . The AVE value for the volunteer domain and community collaboration is  $<0.050$ , resulting in discriminant validity for the two domains that are not achieved.

Table 5. Validity for Each Parent Involvement Domain

No.	Domain	Item	Final Analysis					
			Min	S.D	$\Lambda$	SMC	AVE	<i>pc</i>
1.	Parenting	B1	3.5837	0.98767	0.78	0.61	.0543	0.819
		B2	3.3349	1.01248	0.60	0.36		
		B3	3.7907	0.95975	0.80	0.65		
		B4	4.0116	0.93487	0.75	0.56		
2.	Communication	B5	2.0721	1.07825	0.80	0.64	0.533	0.862
		B6	1.5395	0.95203	0.76	0.58		
		B7	1.7977	1.10877	0.80	0.64		
		B8	1.5488	.96134	0.65	0.42		
		B9	1.8837	1.12421	0.62	0.39		
3.	Volunteering	B14	2.6884	1.35722	0.77	0.77	0.443	0.763

		B15	2.7372	1.09598	0.55	0.55		
		B16	2.2465	1.14035	0.56	0.56		
		B17	1.8186	1.10503	0.74	0.74		
<b>4.</b>	Learning at home	B18	2.2023	1.22655	0.60	0.36	0.500	0.863
		B19	3.3047	1.30365	0.67	0.45		
		B20	2.8488	1.24145	0.49	0.24		
		B21	2.5163	1.18596	0.66	0.44		
		B22	2.7116	1.17297	0.69	0.48		
		B24	2.5023	1.20362	0.70	0.49		
		B25	2.2140	1.18096	0.73	0.53		
		B27	2.7651	1.32334	0.69	0.47		
<b>5.</b>	Collaboration with the community	B28	2.1767	1.33150	0.50	0.50	0.404	0.803
		B29	3.0674	1.22811	0.57	0.57		
		B30	2.6349	1.21152	0.81	0.81		
		B31	2.9837	1.24867	0.64	0.64		
		B32	2.4395	1.18649	0.65	0.65		
		B33	2.2558	1.27177	0.60	0.60		

However, the findings of the Confirmatory Factor Analysis comply with the requirements of the compatibility model, and the reliability value obtained is high, with the result  $\alpha=0.863$  for the home learning domain and  $\alpha=0.803$  for the community collaboration domain. Once the compatibility value has been obtained, the researcher can continue the analysis to the next level to test the validity of the discriminant. Refer to Table 5 below to identify the reliability values of each measured domain. The AVE value of 0.50 is not the only indication that the analyzed domain did not achieve discriminant validity. Most of the researchers will refer to the reliability value of each item for further analysis if the value of AVE  $<0.50$  (Ping, 2009).

Next, the validity analysis for each domain of parental involvement is shown in (Table 5) below. According to Hair et al. (2010), the reliability value for each domain has good value when the value of  $\alpha > 0.60$  ranges from 0.763 to 0.863. After the Exploratory Factor Analysis is executed and the measured items in the correct domain, the next process is Confirmatory Factor Analysis, which is separately conducted for each of the domains. Once the individual compatibility model for each domain is obtained, a model will be produced for validation. The final compatibility model will be implemented to continue the process of building the structural model.

Figure 1 shows the measurement model is a result of the Confirmatory Factor Analysis (CFA) to confirm parental involvement. The results of the CFA analysis showed Item 12, "getting to know my teacher in college," item 13 "attending my class in college," and item 14 "coming to college as a volunteer" were in the same factor. Items 5,11,12 and 29 have a factor weighting value of  $<0.50$ . Items that are in the same factor and have a factor weighting value of  $<0.50$  should be dropped out from the model (Zainuddin, 2015; and Hair et al., 2013). Meanwhile, items 13 and 14 can not be analysed because there are only two items left in one domain. The

minimum number of items to carry out the CFA is three to five items (Hair et al., 2013; Zainuddin, 2015). Item 23, "talking about television shows," and item 26, "provide a learning space for me," has "cross-validated" in the fourth factor that is the involvement of parents in helping child's learning at home with RMSEA=0.054, CFI=0.927, TLI=0.916 and Chisq/df=2.229.

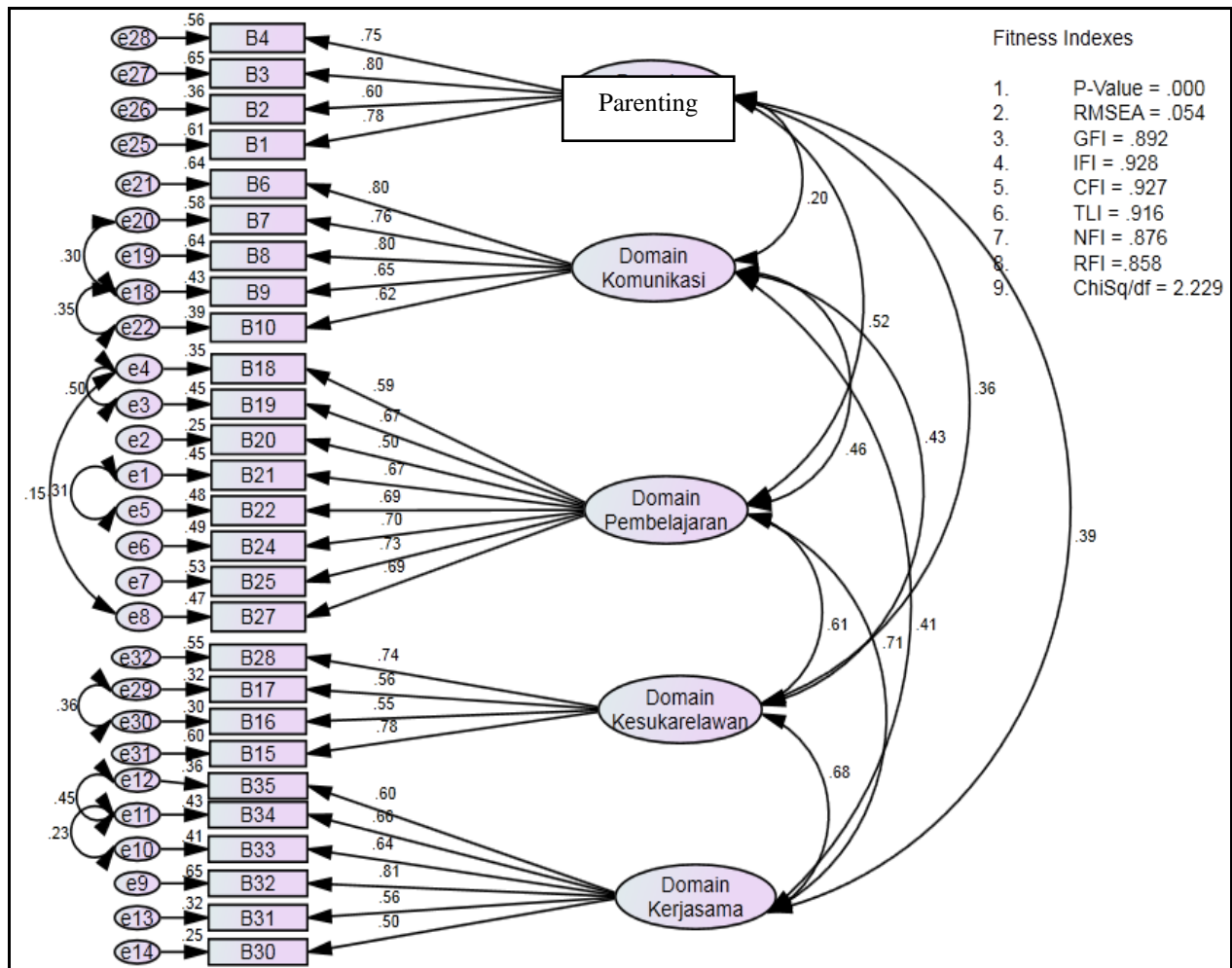


Figure 1. The Measurement Model of Parental Involvement among Vocational College Students

## Discussion

Exploratory Factor Analysis and Confirmatory Factor Analysis found that the items used in PIQ have formed five factors of parents' involvement, which are the aspects of parenting, communication, volunteering, involvement in children's learning at home, and cooperation with the community. It is in contrast to the findings from Salina & Epstein (1992b), who found that parental involvement is divided into six domains consists of parenting, communication, volunteering, involvement in children's learning at home, decision making, and community collaboration. The decision-making aspect was found that it is not giving a contribution to parental involvement of the entire item. Demographic, time, cultural and lifestyle factors cause differences in the

empirical evidence (Zainudin, 2015). Parents are less influential in making any decisions made by college-level management, such as directly involved in providing feedback on assessments conducted in college. Hence, permitting students to engage in any co-curricular activities. The students themselves decide the majority of the decisions.

Studies on parental involvement in Malaysia mostly measure the family context factors with students' academic achievement based on family management style (Arsat & Rozumah, 2011; Asmah, Nurulhuda, & Mascilla, 2011). In contrast, this study focuses on measuring more specific parental involvement, which are aspects of parenting, communication, volunteering, home learning, and community collaboration. Apart from that, previous studies also examined the socio-economic status (SSE) factor of the family with academic achievement conducted by Mohd. Zainal Mat (2004) and Suresh Kumar (2014). Similarly, a study on the level of parental education with parental involvement in school was conducted by Zahyah (2008) and parental involvement with academic achievement in rural areas (Rozumah & Nazlini, 1998; and Sofiah, 2007). Several recent studies measure parental involvement in the aspects of communication, discussion, and care of children at home (Zulkifli, Jamilah, Aminah, & Ismi Arif, 2011) and parental involvement through monitoring of homework (Abd. Razak & Noraini, 2011). All of these studies also did not use the same instrument despite measuring with almost identical domains. Therefore, PIQ is more suitable to apply in this study because it fits the domain that the researcher wants to explore. It is supported by findings from Salina & Epstein (1992, 1993, 2004, and 2008), which also used the same instrument to measure the same domain.

The results of the analysis show the model fit, which is the value of RMSEA attained is 0.054 indicates that the value is acceptable, the value of GFI=0.892 below the value of 0.9, where the value of GFI depends on the total of sample size. CFI values=0.927 and TLI=0.916 show good compatible values. According to Browne & Cudeck (1993), the RMSEA value of <0.05 is good, 0.05 to 0.08 is acceptable, and >0.10 is not acceptable. The chi-square/df value for this model is 2.229, means a good value with chi-square/df value <0.30 (Marsh, Balla, & McDonald, 1988; and Marsh & Hocevar, 1985).

Basically, an instrument is considered to have convergent validity when all factors of weighting values >0.70 (Hair et al., 2010). These items are items B1, B3, B4, B6, B7, B8, B24, B25, B15, B28, and B32 have a weighting factor >0.70. Meanwhile, 11 items: B2, B9, B10, B19, B21, B22, B25, B27, and B28 have a weighting factor between 0.60 to 0.70. The weighting factor for the items B18, B20, B16, B17, B30, and B31 is <0.60. Discriminant validity is achieved when the weighting factor reaches the value according to the fixed "rules of thumb" that is >0.50. Good discriminant validity is achieved when the AVE value >coefficient value ( $r^2$ ) for each factor is measured (Hair et al., 2010). However, inter-correlation relationships will exist when the value of discriminant validity is low; the inter-correlation value for each item must be <0.80 (Hair et al., 2010). In this model, two factors are the domain of home learning, and cooperation with the community has the value of AVE < $r^2$  (See Table 4). However, according to Ping (2009), if the value of AVE < $r^2$  and the analysed domain does not achieve discriminant, it may be because the study conducted is a new exploration. Therefore, further analysis can be carried out if the model achieves compatibility, and the value of reliability is accepted (Zainudin,



2015).

## Conclusion

Exploratory Factor Analysis is performed to measure whether the items for each domain are in the right factor. Confirmatory Factor Analysis analysis is carried out for the items according to the theory used compatible with the model used in the measurement model. The measurement model obtained in Figure 1 is matched and meets the fixed criteria. The findings also found many items from the original 35 items, eventually became to 27 items only. However, the validity analysis showed that those items are accepted for the structural model request to the next process. Thus, this indicates that the PIQ instrument can be used to measure the variables of parental involvement as it has reliability values, and the validity of items has been confirmed through exploratory and confirmatory factor validity analysis.

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## The Origin of Slaves from the Island of Sumatra Based on Records of the Slave Trade by the Dutch VOC in the 18<sup>th</sup> Century

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**Abstract:** This article reconstructs the origins of slaves traded in Batavia and Malaca, which were once the centers of the VOC empire and trading ports in the Malay Archipelago in the 18th century. Many people from within and outside the archipelago were bought and sold as slaves in and out with high intensity during that period. As shown in the results, the central and northern parts of Sumatra Island were among the origins of these slaves. The names of these areas today are identical to the names of several ethnic groups residing in the northern and central parts of Sumatra Island. Hence, these factors become indicators of the slave distribution map on the island. The historical method was employed in this paper by utilizing colonial records in the form of notarial deeds stored in the National Archives of the Republic of Indonesia in Jakarta and bundles of documents in the Malacca Records. All of the documents are primary historical sources.

**Keywords:** Ethnicity, Dutch VOC, Origin of slave, Slave trade records, Sumatra.

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### Introduction

The year of 1642 was an important moment in slavery history that was followed by slave trading activities. That year, VOC (*Verenigde Oost-Indische Compagnie*), a Dutch trade organization, issued a law that legalized slavery practice and slave trading in their colonized areas, including the Malay Archipelago. Since then, VOC

has owned its law force and freely continued both practices for about one and a half century later.

VOC not merely gained a foothold and easiness in applying the slavery practice, selling and purchasing slaves, but they also succeeded in possessing and controlling some regions as a settled foothold in the Malay Archipelago in the first half of the 17<sup>th</sup> century. VOC successively conquered the trading ports as well as the leading cities of Batavia on the island of Java and Malacca on the west coast of the Malay Peninsula. Batavia was first conquered by Dutch in 1619 (Kanumoyoso, 2008). In 1641, VOC also annexed Malacca from the Portuguese (Hussin, 2007). Both trading ports were located in the strategic regions as the route and the stopover places for merchants who carried out shipping and trading activities both locally and regionally as well as globally, who came from other countries far from the Malay Archipelago. Those countries were termed as the 'above the wind' countries that came to the Malay Archipelago or popularly called the countries of 'below the wind.' In reverse, the merchants from the 'below the wind' passed through the Java Sea, the Sunda Strait, and the Malacca Strait. One type of commodity trading at that time was humans with slave status.

Before the presence of the VOC, many communities living and spreading across the Malay Archipelago were already familiar with stratification, which is termed in Western references as the slaves and the slavery practices in society. The strata of slaves and the institution of slavery were mainly found in the ethnic groups that were still traditional. Many factors can trigger the emergence of the institution of slavery in society. Some factors are due to the legalization of the customary laws of each ethnic group, conflicts and wars, arrests, kidnappings, fraud, and so forth.

As times passed, a traditional society that was initially more closed then slowly opened itself to accept the arrival of other foreigners and their influences through political thought, trade, religious values, and other means. The presence of foreigners both from within the territory of the Malay Archipelago as well as from Asia and Europe, including the Dutch VOC had implications for the increasingly widespread slavery practice and the slave trade (Watson, 1980).

Since the beginning of the 17<sup>th</sup> century, two important ports on the strategic routes of shipping and international trade in the Malay Archipelago had been controlled by the VOC, namely Batavia and Malacca. In Batavia, the Governor General led the VOC headquartered, while Malacca was under the Governor. Each of them played an important role in the slave trade during the 17<sup>th</sup> to 18<sup>th</sup> centuries. With the *Bataviasche Statuten*, every transaction of sale and purchase slaves at trading ports was controlled by the VOC in Batavia and Malacca, including Makassar on the island of Sulawesi. The transaction was officially recorded on a piece of deed or note and known by the authorized officer.

There have been many studies on the activities of slavery and the slave trade. Some of them were conducted by Vink (2013) and Kanumoyoso (2008) who found that the activities of sale and purchase slaves in Batavia were derived from the slave trade in the central and eastern parts of Indonesia, such as Bali, Manggarai, Bugis, Buton, Makassar, Maluku and other eastern parts in Indonesia. This can be explained that the fall of Makassar city to

VOC in 1676 significantly increased the activities and traffic of the slave trade from eastern Indonesia to Batavia. On the other hand, slaves who came from the western part of Indonesia, namely Sumatra, had not yet received attention. In fact, in the records of slave trading transactions at the trading ports of Batavia and Malacca, the names of the slaves being traded were listed as coming from Sumatra. The question is, from which regions of Sumatra island did the slaves traded at the two trading ports of Batavia and Malacca come? This article attempts to identify several regions in Sumatra island as the origins of slaves traded in the 18th century, as stated in the deeds and notes on the selling and purchasing of slaves.

## Method

This article was written based on the historical research method by using archives as the primary source/data. There were two types of archives used. First, the VOC archives were collected by the National Archives of the Republic of Indonesia (ANRI) under the name *notariëel* (notarial). The Notariëel Archive, among other things, contains transactions of the slave trade in Batavia that were available in the form of notes written and issued by notaries. For more than two hundred years, from 1620 to 1828, more than 100 officials were appointed and taken an oath as public notaries in Batavia. Each of them had a varying duration of the term of office.

This study is firstly limited to the deeds issued by the three notaries who had served only in the first half of the 18<sup>th</sup> century. The names of the notaries were chosen at random, namely, Carel Schoute (1723-1742), Ludolph Volkman (1723-1726), and Anthonij Smonenar (1726-1729). Secondly, besides the notarial deeds of the Dutch VOC archives in Batavia, this article also uses historical sources derived from the Dutch VOC archives in Malacca, known as the *Melacca Records*. This Archive was written notes containing the slave trading transactions when the VOC ruled at the Malacca trading port.

## Findings and Discussion

Based on several Dutch VOC archival documents in Batavia or Malacca, several Sumatra regions' names often appeared and were written as the origins of slaves traded in Batavia and Malacca in the 18<sup>th</sup> century.

### Batak

Batak in the 19<sup>th</sup> century of Dutch terminology was called *Bataklanden* (Batak land). Its territory is located in the northern part of Sumatra Island, from the border of Aceh in the north to the borders of Riau and West Sumatra in the south (Tideman, 1915; Bangun, 1997). In slave trading transactions, both men and women, the word Batak often appears in the documents. However, in some official documents and transaction notes of the slaves' sale and purchase in Batavia and Malacca in the 18<sup>th</sup> century, the word Batak was written in various ways. There were three versions of writing the word Batak, namely 1) Batak; 2) *Bata*; and 3) *Batta*.



The term Batak, whose writing is the same as the word Batak used today, and the word *Bata* were only found in the slave trade transactions in Batavia. For example, in a Deed of Notary Carel Schoute, which was written and issued on 8 May 1724, it was written that there was a male slave named Sada. It was stated in the deed that Sada came from Batak. In addition, on 30 June 1725, the notary Schoute noted in his deed the sale and purchase of a female slave from Bata for 30 rds (*rijkdaalders*), Dutch currency at the time. On 6 April 1726, another male slave named Pagan from Batak was also sold for 50 rds.

The writing of the word *Bata* also appears in the notarial deed issued by Notary Anthonij Smonenar. On 16 May 1731, Smonenar issued two sheets of Notary Deed of the sale and purchase of slaves from *Bata* on behalf of Mungo, a male slave for 70 rds and a female slave named Dapaer for 90 rds, respectively. On 24 May 1731, in his deed, the same notary also noted that a slave girl from *Bata* named Malang was sold for 60 rds. Apart from that, there was also noted that the name of a slave from Batak was written the same as the name of the place where he came from. This name is stated in the notarial deed of Ludolph Volkman. On 5 April 1726, a male slave named Batak from Batak was sold for 60 rds.

In addition to the name of the same area, there were also several names of slaves identified using a smaller territorial name than that region. For example, a slave named Karoe from Batak, on 5 April 1726 was sold for 60 rds or a male slave named Panaij, also from Batak, was sold for 60 rds. As it is known, Karoe is the name of an area located in the northern part of Batak Land, namely Tanah Karo. At the same time, Panaij is the name of an area located on the eastern coast of the Batak Land.

Karoe has been given two meanings, namely, the name of the person as well as the name of the region. Karoe, in the term of the regional name, was written Karolanden in Dutch. The region was also located on the northern part of Sumatra Island. Both territorially and culturally, Karoe was a sub-territory of the Batak region and culture, namely the Karo Batak (Bangun...). In Batak Land, the institutions of slavery and slaves were found scattered in almost all regions, both in the northern and southern parts, such as Pakpak, Angkola, Toba, Mandailing, Karo, and others.

This phenomenon is not only found in the names of slaves from the island of Sumatra but also in other places. Several slaves originating from Bali island were recorded in the slave trading notes by the Dutch VOC in Batavia using the names of places on Bali Island, such as Tabanan, Buleleng, and Tsintamani.

In the 18<sup>th</sup> century, slaves from the Batak Land in Sumatra island were not only transported to Java and then traded in Batavia but were also brought across the Malacca Strait to be sold at the Malacca trading port. There was a slave trading network from Tanah Batak to Batavia and Malacca. The practice of the slave trading network was built by each party who was involved in the slavery practice and slave trade, such as, sellers, buyers, and slave agents in the region of origin. These parties were in the hinterland, the destined regions of the slaves, and the coastal ports. They really depended on the system and a set of rules that apply in each region. In the regions of slave origin, the inland elite who owned slaves, offered their slaves for sale. These elites built

partnerships with fellow elites who lived on the coastal regions and acted as agents for selling these slaves. They had mutually beneficial collaboration. The slave owners in the hinterland supplied the slaves. Meanwhile, agents on the coastal regions acted as intermediaries who would distribute the slaves to ship captains who used to anchor their ships at coastal ports. The captains also served as buyers.

Similar to Batavia, the word *Batak* in the records of the slave trade in Malacca was written as *Batta* and *Bata*. A slave sale transaction on a note dated 18 December 1786 stated that a female slave from *Batta* named Tjoe Lij was sold for 40 real. Meanwhile, on 17 February 1787, a slave girl from *Batta* named Pantoon was also sold for 45 real. As for the writing of the word *Bata* in the slave sale and purchase in Malacca, for example, it was found in a memorandum of a slave trade transaction that took place on 14 December 1786. At that time, it was recorded that a male slave named Bata was traded for 35 Real.

VOC authority in Malacca lasted from 1641 to 1795. After that, it was replaced by the British. When the British came to power in Malacca at the end of the 18<sup>th</sup> century, slave trading activities continued as before. A note in English stated that a female slave from *Batta* named Sismina was sold for 38 Sp (Spain) dollars. Although Malacca was politically taken a turn and controlled by Western nations, namely Portuguese (1511), Dutch (1641), and British (1795), slave trading activities continued legally.

Slaves from the Batak Land who were sent and traded in Malacca were initially brought from the inland to the eastern coast of Sumatra. The slaves from various villages (*huta*) in the Batak Land were first gathered and then taken through challenging routes from the inland to the ports on the northeastern coast. There were at least two slave travel routes to East Sumatra. First, the northern route, originating from areas in the northern part of Lake Toba, including Silalahi and Tongging around Lake Toba to Tanah Karo, was brought to East Sumatra via the Asahan River route. Second, the slaves who came from the inland of the southern part of Lake Toba, such as Panyabungan and Pertibi, were brought to eastern Sumatra via the Panai and Bila Rivers (Willer, 1849).

### **Minangkabau**

Apart from Batak, the name of the Minangkabau region, located in the center of Sumatra island, also appeared in the records of slave trading transactions in Batavia in the 18<sup>th</sup> century. Since the 19<sup>th</sup> century, Minangkabau or Ranah Minang has been roughly identical to the territorial Gouvernement region of *Sumatra's Westkust* or West Sumatra (Mansoer, 1970). Minangkabau originally came from the name of a Malay kingdom in Sumatera, which was centered in Pagaruyung, Batusangkar, and included in the Luhak Tanah Datar.

Somewhat similar to the writing of the word *Batak*, there were also two versions of writing the word *Minangkabau* in the records of the deed of sale and purchase of slaves by the Dutch VOC in the 18<sup>th</sup> century. First, the word Minangkabau was written *Manangcabo*, and the second one is written *Manamcabo*. However, as far as the slave trading transaction documents were found, none of the Minangkabau region names were written precisely similar to the word of *Minangkabau* that is known today.

The following is an example of a slave sale and purchase transaction from *Manangcabo* recorded in the Notary Deed of Carel Schoute dated 14 May 1725, namely a male slave named Mardjan. Then, a male slave from *Manangcabo* named Mandjani in 1726 sold for 40 rds. Meanwhile, the name Minangkabau written in *Manamcabo*, appeared in the Deed of Notary of Ludolp Volkman dated 11 June 1726. A male slave named Singkang from *Manamcabo* was sold for 45 rds.

In addition to writing the word *Minangkabau*, there was also a variant name for a slave from the same territory as the Minangkabau, namely Padang. As it is well known, Padang used to be a part of the overseas territory of the Minangkabau. Since the 17th century, Padang was built as a VOC headquarters by the Dutch in the western part of Sumatra Island. It was also active in the slave trade. Since the VOC succeeded in replacing the role and domination of the Aceh Kingdom on the west coast of Sumatra, they have used the services of Chinese as retail traders. In Padang, Chinese merchants who were living in this city involved in the practice of the slave trade. Indeed, the VOC's trade policies kept changing. Sometimes, they used native beach brokers, but on the other times, the VOC used the services of the Chinese. According to Christine Dobbin, some of the coastal brokers from Padang port were Chinese.

The Dutch encouraged and gave support to the Chinese to trade on the West Coast of Sumatra. The Chinese obtained permits to trade up to the northern part of the island, including for the purposes of the slave trade. Official permits were issued directly by the government of *Sumatra's Westkust*.

This transaction occurred on 17 March 1725 in the name of a male slave named Saijo in the Noratis Carel Schoute Deed. Then, on 16 May 1731, a male slave named Baroet from Padang was also sold for 77 rds. A regional name in Minangkabau, namely Padanglua, was also identified in the deed. Padanglua(r) is the region name in the Luhak Agam region near the foot of Mount Singgalang. It was written that on 1 July 1724, a male slave named Saba from Padanglua was sold for 66 rds.

To date, the discovery of selling and buying slaves from Minangkabau in the 18<sup>th</sup> century is the latest finding because previous studies on the slave trade have not yet found the slaves from Minangkabau being traded. Although slavery at the trading port of Padang in the coastal regions of Minangkabau lasted in the 18th century, the slaves commonly originated from outside regions of Minangkabau land. The narratives of the slavery history in Minangkabau generally appeared a century later, namely in the 19<sup>th</sup> century when and after the Padri War (1821-1837) broke up. Then, slavery continued when the Dutch East Indies government controlled this region.

## Malay

Apart from Batak and Minangkabau, a number of sale and purchase deeds of slaves also stated the origin of the slaves from Malays. The term Malay in the deed was written *Malaijer*. Transactions on slaves of Malay origin were found in notarial deeds in Batavia. A notarial deed of Carel Schoute dated 30 July 1725 stated that a slave named Genahus from Malay was sold for 65 rds. Then in the deed dated 1 April 1726, Notary Ludolph Volkman

also explained that a Malay slave girl named Sarrie was sold for 90 rds. On 3 April 1726, the notary Ludolph Volkman again noted in the deed issued on the same date that three Malay slaves were being sold, consisting of two women and one man. Each was on behalf of Indaa for 56 rds, Sapia for 50 rds, and Anas for 60 rds.

Especially for the slaves of Malay origin, it is not easy to claim that they came from Sumatra or other islands in the archipelago in the context of the vast Malay world. Quoting the ethnologist Logan (1849), on Sumatra island, most of the Malays settled in the central region, stretching from Rokan to Palembang on the eastern coast and Air Bangis to Kataun on the western coast. Malays are also the majority population in the Riau Archipelago and the Malacca Peninsula. Malay slaves appeared in a number of slave trade transactions in Malacca, as shown by the two trade receipts at the end of the 18th century below.

On 26 August 1786, a Malay slave girl named Poejoe was sold by Dahoel, as quoted from the following receipt:

*Den Malaijer Dahoel inw. Tot Siak heeft zijne aangebragte slavin gent Poejoe/ casta Malaijer/ verkogt aan.....*

(A Malay named Dohoel living in Siak brought a slave girl named Poejoe/ from Malay/ to sell to her....)

Then, another Malay female slave named Noviar was also sold on 18 August 1798 by Nakhodah Sleman; the receipt is below:

“Malacca, 18th August 1798

This is to certify that Naqueda Sleman, a Malay, has sold to Catharina Elizabeth Jansen, a Malay slave girl named Noviar, for the sum...”

The Malay names in the two receipts above do not specifically mention the origins associated with regional names, even though Malay is a society that has many ethnic groups. Malay terminology includes the entire Malay family, such as Malay-Riau, Malay-Minangkabau, Malay-Jambi, Malay-Palembang, Malay-Peninsula, and others, summarized in the same descent, namely Malay descent (Hashim, 1988). So where were the slaves’ origin areas in Malay land?

The 18<sup>th</sup> century was important for the Dutch VOC and the British EIC (East India Company). British EIC first controlled some regions on the western coast of Sumatra, starting from Natal in the north, Muko-Muko, Ketaun to Kaur and Seluma in the south. The center of authority is in Fort Marlborough Bengkulu. Just like the VOC, the EIC also implemented the practice of slavery and the slave trade in its territory legally. Slave labor was mainly used by the British to manage the pepper plantation sector on the western coast of Sumatra.

The slaves who worked there came from various regions, including Malay slaves. Others came from Nias and were imported from India and some regions in the African continent (Sumatra Factory Records, vol. 23-24). From this description, it can be assumed that the Malays who were recorded as the origin of the slaves came from Sumatra because both Batavia and Bengkulu were relatively close to the Sumatran Malay world.

## Nias

Another region name that is often recorded in slave trade transactions in Batavia is Nias. The writing of Nias in the 18th century and now is the same. In the Dutch spelling of the VOC in Batavia, the word Nias was written the same, namely *Nias*.

Nias is different from Batak and Minangkabau. The territorial geography of the two regions mentioned latter is located in the part of the mainland of Sumatera island. Not so is with Nias. Nias is also an island in a group of islands in the Indian Ocean off the west coast of Sumatra. Although it is much smaller in size than Sumatra, Nias is the largest island among the group of islands in the region, starting from Simeulue Island in the northernmost part, then Nias, Tello, Siberut, Sikakap, North Pagai, South Pagai, to Enggano Island in the southern tip. All of them are parallel to Sumatra Island. The closest coastal city and a seaport on the west coast of Sumatra to Nias is Sibolga, with a distance of about 85 miles.

In the past, Nias was always associated with the issue of slaves and slavery. This is due to the high intensity of selling and sending slaves from the island. Various sources regarding slavery and the slave trade came from within the Nias island itself and outside, where the slaves were sent.

Similarly, with the cases of slaves from other areas in Sumatra, as previously described, the presence of slaves from Nias in Batavia in the 18th century was also recorded in a notarial deed. On 17 August 1724, Notary Carel Schoute noted a slave girl named Biha from Nias. On 28 May 1725, a Nias female slave named Pieglien was also sold for 60 rds. Then on 1 June 1725, in his deed, Schoute again noted that a male slave from Nias was sold for 70 rds, And on 16 July 1725, a female slave named Soendi was sold for 70 rds. Taking the average of the four sale and purchase slaves from Nias as recorded at the notary Carel Schoute's office from April to July 1725, then every month, there was one person from Nias who was traded in Batavia.

Since the 17<sup>th</sup> century, many slaves from Nias have left their hometowns and sailed across the Indian Ocean to various places, especially to the coastal cities of Sumatra Island, especially Aceh, Padang, and Bengkulu. In the new places, both male and female slaves were used to work in various sectors, such as gold mining in Salido (near Padang), agriculture in Aceh, pepper plantations in Bengkulu, and others, including working in the public and domestic sectors.

The following figure is a topography of the slaves origin in Sumatra island and the other surrounding regions whose inhabitants were also found in Sumatra. In Figure 1, there were 4 regions of slave origin from Sumatra alone, namely Batak, Minangkabau, Padang and Malay. Meanwhile, Figure 2 shows that the regions of slave origin from Sumatra were also spread to other regions. Especially for Malay slaves, besides having their place of origin on the Sumatra island, this ethnic group also came from the Malay Peninsula. Meanwhile, the slaves from Nias, although they originally came from Nias Island, since the 17th century, the Dutch VOC and Chinese traders brought these slaves to Sumatra Island, especially to the city of Padang.



**Figure 1.** The Slaves Origin on Sumatra Island Regions, traded by the Dutch VOC in Batavia and Malacca in the 18th Century



**Figure 2.** The Slaves Origin on Sumatra Island and the Surrounding Regions, traded by the Dutch East Indies (VOC) in Batavia and Malacca of the 18<sup>th</sup> Century

**Conclussion**

In general, the names of the origin regions of the slaves, both those stated in the notarial deed in Batavia and the notes on the sale and purchase of slaves in Malacca in the 18<sup>th</sup> century, are now identical to the names of the

tribes (ethnicity) of the slaves concerned. The names of four regions of slaves' origin are known by the following ethnic names: Batak, Minangkabau, Nias, and Malay ethnics. It means that the origin regions' names were equivalent to the ethnic names or the identity of each slave who was traded. They had two identities simultaneously, the name of the region of origin and the name of the ethnic group.

The two identities could happen because, until the 18<sup>th</sup> century, the Dutch VOC still needed to carry out the massive political intervention in the inland of Sumatra Island. Therefore, Dutch VOC officers did not have the appropriate term when they referred to the regions of origin of the slaves. Hence, they equated the designation of ethnic names with regional names. Unlike a century later, namely the 19<sup>th</sup> century, when the Dutch East Indies colonial government gradually succeeded in conquering these regions, the names of the administrative regions of government in Sumatra were formed. At least two administrative regions supervised the ethnic groups of slaves who came from the regions in Sumatra island, namely *Sumatra Westkust* to refer to the western coast of Sumatra, whose territory included Minangkabau, Padang, parts of Batak, and Nias. Meanwhile, some Malays and Bataks who live on the eastern coast of northern Sumatra were called *Sumatra Oostkust*.

Slaves from Batak were sent and spread to two Dutch VOC centers, namely Batavia and Malacca. Meanwhile, slaves from Minangkabau (including Padang), Malay, and Nias were only transported and traded to Batavia. The sale of slaves from the Batak Lands to Batavia and Malacca depended on each region's geographical and territorial conditions. The location of Malacca was only bordered by the Malacca Strait. Throughout the 18<sup>th</sup> up to mid of 19<sup>th</sup> centuries, many seaports along the eastern coast of northern Sumatra Island were the places for sending slaves to Malacca. The slaves from the Batak Lands were sent and sold to Batavia, either by taking the eastern route of Sumatra Island or having the other alternative via the western route of Sumatra Island. They sailed from the ports of Barus, Singkil, Sibolga and stopped at Padang. Batak slaves transported by ships to Batavia on this route could have been joined with the slaves from Nias, Minangkabau, and Padang. After more than 300 years until now, shipping routes that have been formed since the Dutch VOC era are still being maintained. The route starts from the port of Tanjung Periuk in Jakarta to the seaport of Teluk Bayur in Padang, continuing to Sibolga, ending at the port of Gunungsitoli, and turning back via the same route and ports to transport goods and passengers along the west coast of Sumatra.

Finally, especially for slaves from Nias, Batavia was the farthest destination from Nias. To get there, the slaves had to travel more than 1,000 miles by sea across three waters: the Indian Ocean, the Sunda Strait, and the Java Sea. In previous studies, in the 18<sup>th</sup> century, the slaves from Nias were only traded in cities and trading ports on the western coast of Sumatra.

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## Evaluating Tiktok's Social Media From Islamic Perspectives With Technology Acceptance Model

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**Abstract:** TikTok has become the most popular platform among younger people in 2020. Some people use TikTok to express their ideas, promote their businesses and so on. With a variety of options, the platform encourages its users to create content. Digital technologies and platforms such as TikTok give social media influencers and other users the opportunity to create, consume and share religious content with various online communities. The aim of this study is to examine the relationship between perceived usefulness, perceived ease of use and perceived Islamic ethics on the acceptance of the TikTok application using the Technology Acceptance Model (TAM). The method used in this study is a survey and the data is analysed quantitatively, including descriptive data analysis that includes data reduction, data visualisation and drawing conclusions. Based on the frequency distribution of 196 respondents (N=196), the results show that 92 respondents believe that TikTok must respect users' privacy by not sharing personal information with third parties. In addition, 103 respondents think that TikTok should respect privacy so that users cannot easily interfere in others' affairs. The result also shows a value of  $r=0.813$ , with the positive linear relationship being significant at the  $p = .000$  level of significance. This shows that there is a strong positive linear relationship between perceived usefulness and perceived Islamic ethics among Muslim users of TikTok.

**Keywords:** Tiktok, Technology Acceptance Model (TAM), Islamic ethics, Social media

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## Introduction

Forging healthy relationships can bring people both sustenance and good, according to Islam. It should come as no surprise that the proliferation of social media is seen as beneficial to the process of cultivating stronger relationships with one another (Wilkins & Jasmi, 2019). The Islamic religion is not just a sentimental theory disconnected from reality, but a technique that explains all aspects of existence as social behaviour and an integrated way of human life (Mona et al., 2018). In today's age of information technology, countries with a majority Muslim population are witnessing the rapid spread and adoption of social media platforms such as Facebook, Twitter and YouTube. Through TikTok, users can connect with each other and build relationships with other users.

According to (Plaisime et al., 2020), the increasing popularity of social media among young people can be measured by their ability to engage on various social media platforms. There are many application apps such as Instagram, Facebook and Twitter that have the potential to teach people new things that include guidance for those who want to learn more. TikTok is one of the most popular platforms with a large user base because it is user-friendly. Moreover, TikTok users who want to use the platform for teaching can do so by using the application with the available features to deliver unique and fascinating learning content and enable the audience to learn about Islam in an effective way. In addition, some researchers from Indonesia are also looking into this platform as it is very popular in their country as it offers both educational and entertainment aspects (Maulida et al., 2021).

Like most other societies, Muslims have also increased their use of social media in recent years. These social media platforms have had a profound impact on the social lives of Muslims, including religious practises, religiosity, religious decision-making and the formation of virtual communities in Muslim-majority countries (Islam, 2019), and have brought about changes that have had a significant impact on the individual and societal levels of Muslim society. Moreover, communication is an extremely important factor that determines social and political behaviour. However, according to Islamic teachings, these interpersonal behaviours must be in accordance with the Qur'an and the Sunnah. This conformity is shown in adab and akhlaq, which is another word for ethics. This relationship between people is established through the relationship between people and Allah, which leads to the performance of ibadah and the attainment of taqwa (Norwawi et al., 2014). This shows that it is important for users to have Islamic ethics in social media.

## Problem Statement

Nowadays, comfort and convenience have increased with the advancement of technology, especially in the field of communication. A social media platform can be considered as a service or platform offered to enable

efficient communication and interaction. It is also known as "social media," which refers to the way individuals interact to create, share and/or exchange information and ideas in online networks and communities. For both personal and professional use, social media has become an essential part of our lives. Individuals use social media for a wide range of purposes, including communication, sharing experiences, exchanging information, etc. Likewise, businesses use social media to promote and market themselves (Akram et al., 2017). Moreover, by providing new feeds with unlimited pages, infinite scrolling on social media will increase users' interest. Social media has become a need for many people in today's fast-paced world because of its ease of use and accessibility (Lane & Coleman, 2012). Through the use of blogs, social networks, wikis and forums, social media users can participate, share and produce content themselves.

On the other hand, TikTok is the subject of this research study. As the technology has evolved, TikTok has exposed users to different types of content. However, these contents have both good and bad effects (Zubair et al., 2020). For example, it has encouraged pornography, public abuse, bullying, sharing false information, setting off false alarms, immoral acts and sayings, wasting time, distracting people from useful and religious topics and acts, and sparking violence in society. In addition, there are particularly offensive statements and publications against Islam and Prophet Muhammad (SAW) as well as obscenities, an increase in violence in the media and the violation of people's privacy through the use of social media (Shehu et al., 2017).

Most of the underlying issues can change generations of Muslims through social media activities and attitudes (Islam, 2019). Moreover, it also has a negative side that allows users to do things that violate Islamic principles and norms, as some TikTok users are willing to ignore the unpleasant aspects of social media in exchange for the potential benefits of fame, and the present researcher could not find complete Islamic ethical guidelines for the use of this social media platform. Due to the lack of control and just measures, this platform has been abused by some individuals. (Rauniar & Johnson, 2014) suggested using the TAM model when evaluating social media. Therefore, this study will evaluate the TikTok platform from an Islamic perspective using the technology acceptance model.

#### *Definition of Social Media*

A social media platform can be considered as a service or platform offered for the purpose of facilitating efficient communication and interaction. It is also known as "social media," which refers to the way people connect with each other to create, share and/or exchange information and ideas in online networks and communities (Huda & Nur, 2021). The way users build connections and relationships with each other has been greatly influenced and revolutionised by the emergence of social networking websites. According to (Norwawi et al., 2014), information in social networks is not stored on the user's computer but in a decentralised manner. Social networks offer the opportunity to keep in touch with friends, expand one's network and find others who share the same interests and outlook on life as oneself. Online communities can be divided into several broad groups, such as those related to information, professionals, education, education and hobbies, academics and news.

In today's digital age, social media has become a real manifestation of the development of knowledge and technology. As a result, the culture of the community undergoes a transformation when all its activities depend on and require social media, and may become addictive (Abd et al., 2019). Under these conditions, the development of social media is accompanied not only by various benefits and conveniences, but also by a number of problems that accompany it (Zubair et al., 2020). In the eyes of Muslim organisations, social media is undoubtedly an advance in the scientific world that requires their cooperation. However, from an Islamic perspective, the use of social media must be in line with ethical principles.

#### *Definition of TikTok's application*

TikTok has undoubtedly become a popular platform, especially among users of a younger age group during the lockdown, and this growth has occurred despite the restrictions. The TikTok application serves as a platform that allows users to produce short videos that can then be shared with a wider audience. These videos can be accompanied by music. The way news and entertainment is shared has changed and the internet itself has become more connected. TikTok's features, as well as users' desire to become more famous, are contributing to their interest in using social media platforms (Busurkina, 2021). TikTok is undoubtedly more interesting than other social media platforms because it offers a variety of video effects.

As a result, users will feel a greater urge to create videos through the TikTok platform. This application also provides users with the opportunity to use their skills and improve their creativity so that they can be able to use TikTok. Considering that TikTok is a relatively new and widely used application, achieving popularity is likely to be one of the goals that each user has with the application. The monopolistic nature of TikTok has contributed to the creation of a massive agency by facilitating the transformation of the current sharing tool (Busurkina, 2021). TikTok can also be considered one of the most important social platforms and is discussed in both historical and contemporary contexts to illustrate how it is changing the way people communicate with each other on the internet and how TikTok affects its users (Margarita et al. 2022).

In creating and interacting with videos over time, TikTok feels more like an active playground than a quiet video-sharing platform. TikTok's content is largely made up of short skits, memos and, most importantly, dances based on musical or other audio samples offered on the platform.

#### **Definition of Islamic Perspectives**

The increasing popularity of social media among young people can be measured by their ability to engage them on various social media platforms (Plaisime, 2020). These social media platforms have a profound impact on the social lives of Muslims, including religious practises, religiosity, religious decision-making and the formation of virtual communities in countries where Muslims are in the majority or in countries where Muslims are in the diaspora (Islam, 2019). In the current age of information technology, countries with Muslim-majority populations are witnessing the rapid spread and adoption of social media platforms such as Facebook, Twitter

and YouTube. Through Tik Tok, which allows users to connect with each other and build relationships with other users, they can interact with each other. Building healthy relationships can both nourish people and be good for them, according to Islam. It should come as no surprise that the proliferation of social media is seen as beneficial to the process of cultivating closer relationships with one another (Wilkins & Jasmi, 2019).

In the past, there were not nearly enough methods of communication available, which made it difficult for Islamic knowledge to spread throughout the Muslim world. Books served as the primary vehicle for the dissemination of Islamic literary works. Written manuscripts were the only way to access a variety of Islamic sources, including translations of the Qur'an, tajweed, hadith, tafseer and fiqh. However, thanks to advances in information and communication technology, an environment has been created in which Islamic resources can be easily converted into digital forms and disseminated worldwide. Education is always associated with technology (Majid et al., 2019), (Nasruddin et al., 2022).

Moreover, it has been noted by (Huda & Nur, 2022) that in the Islamic perspective on the culture of social media use, the Quran contains an important term related to communication. For example, the term "al-bayan" is mentioned several times in the Quran, which means "the power to communicate". In addition, the Quran provides the important word al-qaul, which can be expanded to the concept of qaulan sadida, which refers to a person's ability to communicate appropriately and effectively. Humans are able to develop their personality, build networks of social contacts and express themselves. Communication experts agree with psychologists that failure in communication can have devastating effects on both the individual and the group (Amanullah, 2015).

### **Definition of Technology Acceptance Model (TAM)**

Technology acceptance models and other various theories have been extensively used to identify and understand user behaviour and intention to use across a variety of disciplines such as consumer satisfaction, purchase behaviour and technology (Surendran, 2012). Several studies have developed models and frameworks such as the Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA), the Extended Technology Acceptance Model (TAM2) and the Unified Theory of Technology Acceptance and Use (UTAUT) to explain and examine the factors that influence users' adoption of various new technologies. Numerous studies have adopted these models unchanged, while others have further developed these models by combining several previously used models or by extending them with additional constructs (Alshammari & Rosli, 2020), (Mokhsin et al., 2015).

As discussed by (Mona et al., 2018), the technology acceptance model is specifically concerned with the aspects that influence people's decisions regarding the use of information systems. TAM and its various iterations are widely known as a powerful theoretical model for explaining the use of information systems (Ariffin et al., 2014). This model is also useful for industry professionals in predicting the adoption of new information technologies (Yadav & Tarhini, 2016).

Furthermore, the Technology Acceptance Model (TAM) is a popular model in IT acceptance research and the current standard theoretical framework for understanding why and how people use social media, (Wirtz & Gottel, 2016). (Davis, 1989) is responsible for creating one of the most widely used information system acceptance models, known as the technology acceptance model (Venkatesh et al., 2003). According to Davis, the two main criteria that have the greatest influence on usage are perceived usefulness and perceived ease of use. The Theory of Reasoned Action (TRA), which studies general human behaviour by focusing on the intentions of individuals, serves as the basis for the creation of TAM.

After reviewing the literature on social media, (Wirtz & Gottel, 2016) found that most researchers focused on and agreed on the importance of TAM in the context of social media use. In addition, (Lane & Coleman, 2012) highlighted that TAM has a significant impact on social media as an increase in perceived ease of use increases perceived usefulness, which in turn leads to more intensive use of social media. It has also been suggested that TAM is the best model for social media (Rauniar & Johnson, 2014).

#### **Definition of Adab(Manner) and Akhlaq**

Islam often uses the Arabic word akhlaq, meaning "morality" or "ethical behaviour", to describe moral principles and standards. The Islamic faith places great emphasis on the observance of akhlaq. Good manners and moral principles are inseparable components of the Islamic scholarly tradition. The Islamic understanding of reality and truth is presented here. In the future, it will serve as the basis for success in any field or social setting (Rahmawati et al., 2019).

Quranic verse 96: "Verily, you are of exalted character" uses the word Akhlaq to describe the Prophet (SAW) (Quran, Al-Qalam: 4). Many hadiths emphasise the importance of ethics in Islam, and Akhlaq is frequently mentioned in these texts. The hadith attributed to Muhammad (SAW) is: "The one of you whom Allah loves the most is the one who has the best character" (Bukhari). Moreover, akhlaq is highly valued in Islam; our Prophet Muhammad SAW taught it before tauhid (Allah is the only God). According to him, a Muslim who has good akhlaq is equal to someone who fasts and prays, and Allah has promised him paradise in return (Waqfin & Tarno, 2021).

It is our duty as Muslims to follow the example of the Prophet (SAW) and treat all people with kindness, whether they practise Islam or not. Good akhlaq involves being sincere, truthful and honest in all aspects of one's life, not just in one's religious practises (such as almsgiving, salah, Qur'anic recitation and tawbah). We should approach Allah (swt) in a way that pleases Him, because good behaviour is something He values. According to "Akhlaq: Ethical Theory in Islam" (2023), a person's good character and good akhlaq are the qualities that bring him closer to Allah Ta'ala and thus closer to Jannah. It offers a Muslim perspective on the concepts of akhlaq (morality) and adab (etiquette) and emphasises the importance of integrating them into one's life in order to develop one's virtue and attain perfection.

**Research Model**

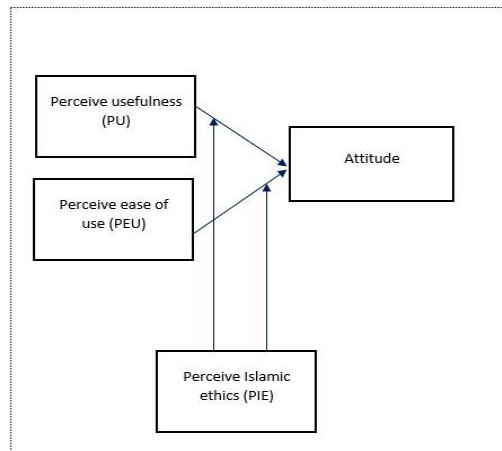


Figure 1. Modified technology acceptance model (TAM)

Figure 1 illustrates the modified technology acceptance model used in this research. The TAM model is one of the most popular models in IT acceptance research and the current standard theoretical framework for understanding why and how people use social media (Wirtz & Gottel, 2016). According to (Davis, 1989), the two main criteria that have the greatest influence on usage are perceived usefulness and perceived ease of use. We propose to modify the model TAM to gain insights into perceived Islamic ethics. The use of the features offered by TikTok must have both positive and negative effects in some way. It is imperative that the Islamic standards issued by TikTok are adhered to in order to prevent users of the platform from engaging in inappropriate activities.

**Research Method**

This study uses a quantitative descriptive method. This method attempts to explore how the use of TikTok is viewed from an Islamic perspective. The subject of this study is TikTok application and the object is the relationship between perceived usefulness, perceived ease of use and perceived Islamic ethics.

The data collection for this study is done in two stages: The first stage is primary data obtained from the TikTok application, consisting mainly of Islamic content; the second stage is secondary data collected through an online survey. 196 students are selected to participate in the study to determine the sample size and selection process. For the distribution of the questionnaire, the researcher uses a method known as purposive sampling. This study will be conducted using various research tools such as questionnaires and documentation. First, the researcher will study the TikTok platform to determine the types of content available within the TikTok application. Secondly, the researcher will conduct an online survey using Google forms among 196 students of FSKM in UiTM Shah Alam to find out their opinions about the use of TikTok application in Islamic ethics. Finally, the third study is the documentary analysis, which consists of, among other things, reading a variety of different

forms of literature after completing the research. To conduct the statistical analysis, the researchers in this study use the tools of IBM SPSS Analysis. There are several analyses that are carried out, namely.

Correlation analysis – examining the relationship between perceived usefulness, perceived ease of use and perceived Islamic ethics among Muslim users of TikTok. In addition, secondary data refers to the information acquired from supporting literature that complements the primary data.

### Sampling Technique

In this study, the purposive sampling method is used because it is assumed that the population has an equal chance of being included in the sample and the result will be unbiased. This method is easy to use and the results are predictable (Taherdoost, H., 2016).

#### Sampling Size

It is crucial to consider the sample size required to achieve the objectives of the study. For this study, the sample size is calculated using a Raosoft sample. The acceptable margin of error is set at 7%, while the confidence level required for this study is 95% to tolerate the level of uncertainty. The response distribution is set at 50%. The algorithm behind this tool automatically calculates the recommended sample size after you enter the population to set the sample size for the survey.

### Research Hypothesis

Assumptions can be tested by means of hypotheses, which are called preliminary answers to problems that require further investigation (Puspitasari, N. et al., 2019). Based on the model TAM, three hypotheses were formulated and tested (see Table 1):

Table 1: *Research Hypothesis*

No	Hypothesis
H1	There is significant relationship between perceived of usefulness and perceived of ease of use among Muslims' users in TikTok
H2	There is significant relationship between perceived of usefulness and perceived of Islamic ethics among Muslims' users in TikTok
H3	There is significant relationship between perceived of ease of use and perceived of Islamic ethics among Muslims' users in TikTok

### Research Instrument

A research instrument is a tool used to collect data for an investigation. For the purpose of this study, the research tool used is an online survey as shown in Table 2. The survey questionnaire used for data collection will be created using Google Forms. The questionnaire will be distributed to a total of 196 respondents who will



answer it using Google Form. The data from the questionnaires will be analysed using the software IBM SPSS Statistics as it can help the researcher to understand the data, analyse trends and validate assumptions and draw accurate results and conclusions. The first section contains the demographic data of the participants. In addition, the next three sections consist of 20 questions measuring the constructs of this research with a linear scale of 1 to 5 ranging from 'strongly disagree' to 'strongly agree'.

Table 2: *Constructing Research's Questionnaires*

Variables	Description of Items	Source
Perceived of Usefulness	PU1: TikTok's application motivates me to accomplish the tasks in a short period	(Lewis, 2019)
	PU2: TikTok's application has motivated me to improve my job performance	(Lewis, 2019)
	PU3: TikTok's application is able to produce productive people in creating effective contents	(Jumaili et al., 2017)
	PU4: TikTok teaches me to keep in touch with people even in long distance with the contents that I create for them so I can sustain my relationship with them	(Jumaili et al., 2017)
	PU5: I find TikTok has motivated me to enhance my job effectiveness by figuring out the skills in creative problem solving	(Lewis, 2019)
Perceived of Ease of Use	PEU1: I find TikTok is easy to operate so it motivates me to create good and high quality contents	(Lewis, 2019)
	PEU2: It is convenient and flexible to view contents as it always recommends the things that I am interested based on my browsing history so I can easily come up with new great ideas	(Jumaili et al., 2017)
	PEU3: It creates my curiosity to dig deeper in TikTok as I find it is easy for me to become skillful in a short time	(Lewis, 2019)
	PEU4: I think my interaction with TikTok is very clear so it helps me to understand the features without having to rely on people when I use this application	(Lewis, 2019)
	PEU5: I find TikTok motivates me to express creativity and freedom with the different built-in filters, text, sound and music effects in TikTok	(Jumaili et al., 2017)
Perceived of Islamic Ethics	PIE1: TikTok's contents does not lead to communication with the opposite gender	(Amanullah, 2015)
	PIE2: TikTok's application does not spread false information and news towards people	(Amanullah, 2015)
	PIE3: TikTok's contents does not depict disbelief in Islam	(Amanullah, 2015)

PIE4: TikTok's contents does not use profane or harsh words	(Amanullah, 2015)
PIE5: TikTok's contents should not violate the privacy and respect towards others	(Amanullah, 2015)

### *Pilot Study*

Before a larger experiment, researchers often conduct a preliminary study on a smaller scale, called a "pilot study," to see how things go. The rule of thumb (Sheatsley, 1983) is that between 12 and 50 people should be interviewed before piloting the survey. Before the questionnaire was published, it had to be piloted to see whether or not it was reliable for use in this study to avoid unwarranted results. The survey comprises 20 questions, each relating to one of the four (4) constructs (perceived usefulness, perceived ease of use and perceived Islamic ethics) of the system. The internal consistency of a quantitative study needs to be examined to ensure its validity. In this study, the validity of questionnaires is investigated by giving out 15 samples to a representative group of respondents and analysing the results.

The most commonly used instrument to analyse reliability is Cronbach's Alpha (Kader, R. A. et al., 2009). Cronbach's alpha is determined by averaging the correlations between the questions of a questionnaire and the corresponding answers. The reliability of a scale is usually considered high when the alpha value is greater than 0.75 and moderate when the alpha value is between 0.5 and 0.75. Previous research has shown that reliability values above 0.6 are generally accepted (Salim, B., 2012).

## **Result And Findings**

### **Demographic's Analysis**

The demographic's results for this research are as shown in Table 3:

Table 3. Gender

Choose your gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	119	60.7	60.7	60.7
	Male	77	39.3	39.3	100.0
	Total	196	100.0	100.0	

The table shows the total number and percentage of respondents by gender. The total number of respondents is 196, of which 77 are male and 119 female.

Table 4. Age's range

**Choose your age**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 18 - 24	79	40.3	40.3	40.3
25 - 30	75	38.3	38.3	78.6
30 and above	42	21.4	21.4	100.0
Total	196	100.0	100.0	

This study focuses on Muslim users of FSKM in UiTM Shah Alam aged 18 years and above. Majority of the respondents, namely 79 respondents (40.3%), are aged between 18 and 24 years, while 75 respondents aged between 25 and 30 years participated in this research. 42 respondents (21.4%) were 30 years and older, which is considered the smallest percentage that participated in this research.

Table 5. Time spent on TikTok's application in a day

**How much time you spend on TikTok's application in a day?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1 to 3 hours	91	46.4	46.4	46.4
3 hours and above	67	34.2	34.2	80.6
Less than an hour	38	19.4	19.4	100.0
Total	196	100.0	100.0	

Table 5 illustrates the time spent per day using the TikTok application. Most respondents, 91 respondents (46.4%), spent one to three (1 to 3) hours using TikTok. After that, only 67 out of 196 respondents (34.2%) spent three hours or more using the TikTok application. The lowest number of people who have spent less than one hour on TikTok is 38, which is 19.4%.

Table 6. Types of contents that people viewed in TikTok's application.

**What type of the most favorite contents that you always view in TikTok's application?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Cooking, news or business contents	36	18.4	18.4	18.4
Entertainment such as music and dancing contents	72	36.7	36.7	55.1
Islamic contents such as 'Ceramah'	43	21.9	21.9	77.0
Personal contents such as daily life vlogs	45	23.0	23.0	100.0
Total	196	100.0	100.0	

In general, there are four types of content viewed on TikTok, for example, personal content, cooking, news or business content, entertainment and Islamic content. The content that has the most viewers is entertainment with 72 respondents (36.7%), while the content that has the least viewers is cooking, news or business content with 36 respondents (18.4%). After that, only 45 respondents watch personal content, which is 23%. Last but not least, 43 out of 196 respondents (21.9%) chose to watch Islamic content in their daily lives.

### Descriptive analysis (mean and standard deviation)

The following are the results of the descriptive analysis to determine the factors influencing Islamic ethics on the use of TikTok among Muslim users.

Table 7. Elements of influence in Islamic ethics

No.	Elements of of influence in Islamic ethics on the usage of TikTok
1.	Communication with opposite gender
2.	Spread false information and news
3.	Depict disbelief
4.	Use profane or harsh words
5.	Violate privacy and respect

Table 7 shows the factors of influence of Islamic ethics (communicating with the opposite sex, spreading false information and news, displaying disbelief, using profane or harsh words, and violating privacy and respect) on the use of TikTok among Muslim users.

Table 8. Mean and standard deviation of the element of influence in Islamic ethics

**Descriptive Statistics**

	N	Mean	Std. Deviation
Communication	196	3.9133	.78127
FalseInformation	196	4.2832	.69811
DepictDisbelief	196	4.3546	.67408
Profane	196	4.4031	.62903
Privacy	196	4.3724	.68054
Valid N (listwise)	196		

Table 8 illustrates the descriptive statistics (mean and standard deviation) for the factors influencing Islamic ethics. Of the five elements of Islamic ethics, communication with the opposite sex has the lowest mean value, while spreading false information or news has the highest standard deviation value.

Based on the frequency distribution of 196 respondents (N=196), 39 respondents strongly agree with TikTok's

idea of limiting negative comments to encourage people to post only positive comments. 70 of TikTok users prefer to see content posted by creators who know their social boundaries, as this helps them develop a positive character.

Table 9. Descriptive Statistics for PIE1 (Communication with the opposite gender)

Question/Likert scale	1	2	3	4	5
1. I advocate TikTok to encourages other users to make only positive comments	1 0.5%	4 2%	69 35.2%	83 42.3%	39 19.9%
2. I favor content posts by creators who are aware of their social boundaries	1 0.5%	8 4%	44 22.4%	73 37.2%	70 35.7%

Table 10: Descriptive Statistics for PIE2 (Spread false information and news)

Question /Likert scale	3. I prefer to see TikTok not spreading misleading information as it helps in shaping people to be a moral person	4. I prefer to read the contents that give new and valuable knowledge in TikTok as I can develop my ability to accept and respect people's different points of view.
1	2 (1%)	1(0.5%)
2	4(2%)	3(1.5%)
3	26(13.3%)	20(10.2%)
4	77(39.3%)	79(40.3%)
5	87(44.4%)	93 (47.4%)

The frequency distribution shows that 87 out of 196 respondents think that TikTok disseminates true information and that the majority of respondents prefer to read content that helps them gain knowledge so that they can accept and respect other people's way of thinking.

Table 11. Descriptive Statistics for PIE3 (Depict disbelief in Islam

Question /Likert scale	Strongly Disagree – 1	Disagree – 2	Neutral – 3	Agree – 4	Strongly agree – 5
5. I prefer to see content that does not expose one's bad deeds (aib) in order to educate people not to say negative things about others	1 0.5%	4 2%	22 11.2%	83 42.3%	86 43.9%

6. I prefer to view contents that does not involve any element of making fun of Islam to show an attitude of respect	1 0.5%	8 4%	4 2%	74 37.8%	109 55.6%
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Based on the frequency distribution of 196 respondents (N=196), 86 respondents fully agree that they want to see content that does not show bad deeds so that they can educate those around them not to say bad things. In addition, 109 users prefer transparent content that does not contain elements of mockery of Islam.

Table 12. Descriptive Statistics for PIE4 (Use profane or harsh words)

Question /Likert scale	Strongly Disagree – 1	Disagree – 2	Neutral – 3	Agree – 4	Strongly agree – 5
7. I prefer to see meaningful contents that complies to Islamic compliance in order to shape good manners	1 0.5%	3 1.5%	12 6.1%	90 45.9%	90 45.9%
8. I favor viewing TikTok's contents that use polite words to build a good impression of ourselves	1 0.5%	3 1.5%	11 5.6%	72 36.7%	109 55.6%

The frequency distribution of the 196 respondents (N=196) shows that only one person disagrees with seeing meaningful content that complies with Islamic rules. However, 109 people approve of viewing content that uses polite words.

Table 13. Descriptive Statistics for PIE5 (Violate the privacy and respect)

Question /Likert scale	Strongly Disagree – 1	Disagree – 2	Neutral – 3	Agree – 4	Strongly agree – 5
9. I urge TikTok to respect users' privacy by not sharing any personal information without their permission to show that seeking consent before uploading anything is crucial.	1 0.5%	3 1.5%	14 7.1%	86 43.9%	92 46.9%

10. I favor TikTok to have the element of privacy so it can teach users not to interfere with other people's matters	1 0.5%	9 4.6%	5 2.6%	78 39.8%	103 52.6%
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The frequency distribution of the 196 respondents (N=196) shows that 92 respondents believe that TikTok must respect users' privacy by not sharing personal information with third parties. In addition, 103 respondents strongly support TikTok respecting privacy so that users do not simply meddle in other people's affairs.

### Correlation Analysis

In research, correlation analysis is a statistical method used to measure the intensity of the linear relationship between two variables and to calculate the correlation that exists between them. Correlation analysis can be used to calculate the extent to which one variable is changed by the change in the other variable. Of all the test statistics available, Pearson's correlation coefficient is the standard for determining the strength of a statistical relationship or association between two continuous variables.

To calculate the Pearson correlation coefficient, the assumption must be made that the relationship between the two variables is linear. If the r-value of the two variables in question is above 0.7, it is assumed that there is a strong relationship between the variables. However, when both variables are quantitative or categorical, Pearson correlations usually provide the most reliable results. The table below shows the results of the Pearson correlation analysis conducted using SPSS software to examine the relationship between the variables.

Table 14. Correlation analysis on perceived of usefulness and perceived of easy to use among Muslims' users on TikTok.

	Perceived of Usefulness	
Perceived of Easy	Pearson Correlation	.768**
	Sig. (2 tailed)	.000
	N	196

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation test was conducted to answer the second research objective, i.e. to investigate the relationship between perceived usefulness, perceived ease of use and perceived Islamic ethics among Muslim users of TikTok. Table 7 shows that the Pearson correlation result has a value of  $r=.768$ . The positive linear relationship is significant at the  $p=.000$  level of significance. This shows that there is a strong positive linear relationship between perceived usefulness and perceived ease of use among Muslim users of TikTok. The higher the perceived usefulness, the higher the perceived ease of use among Muslim TikTok users. There is a significant relationship between perceived usefulness and perceived ease of use among Muslim users of TikTok.

Therefore, hypothesis 1 is accepted.

The second Pearson correlation test was conducted to examine the relationship between perceived usefulness and perceived Islamic ethics among Muslim users of TikTok. The result shows a value of  $r = .813$ , with the positive linear relationship being significant at a significant level of  $p = .000$ . This shows that there is a strong positive linear relationship between perceived usefulness and perceived Islamic ethics among Muslim users of TikTok. The higher the perceived usefulness, the higher the perceived Islamic ethics among Muslim users of TikTok. There is a significant relationship between perceived usefulness and perceived Islamic ethics among Muslim users of TikTok. Therefore, hypothesis 2 is accepted.

Table 15. Correlation analysis on perceived of usefulness and perceived of Islamic ethics among Muslims' users on TikTok

		Perceived of Usefulness
Perceived of Islamic Ethics	Pearson Correlation	.813**
	Sig. (2 tailed)	.000
	N	196

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Table 16. Correlation analysis perceived of easy to use and perceived of Islamic ethics among Muslims' users on TikTok.

		Perceived of Easy to Use
Perceived of Islamic Ethics	Pearson Correlation	.568**
	Sig. (2 tailed)	.000
	N	196

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The final Pearson correlation test was conducted to examine the relationship between perceived ease of use and perceived Islamic ethics among Muslim users of TikTok. The result shows a value of  $r = .568$  with a positive linear relationship that is significant at  $p = .000$  level. This shows that there is a strong positive linear relationship between perceived ease of use and perceived Islamic ethics among Muslim users of TikTok. When perceived ease of use increases, perceived Islamic ethics among Muslim users of TikTok also increases. There is a significant relationship between perceived ease of use and perceived Islamic ethics among Muslim users of TikTok. Therefore, hypothesis 3 is accepted.

According to Cohen (1988), a correlation coefficient of .10 indicates a weak relationship, .30 indicates a moderate relationship and .50 indicates a strong relationship. Based on the above hypotheses, there is a significant relationship between perceived usefulness, perceived ease of use and perceived Islamic ethics among Muslim users of TikTok.



Table 17. Results of correlation between perceived of usefulness, perceived of ease of use and perceived of Islamic ethics

**Correlations**

		PE	PEOU	PIE
PE	Pearson Correlation	1	.768**	.568**
	Sig. (2-tailed)		.000	.000
	N	196	196	196
PEOU	Pearson Correlation	.768**	1	.813**
	Sig. (2-tailed)	.000		.000
	N	196	196	196
PIE	Pearson Correlation	.568**	.813**	1
	Sig. (2-tailed)	.000	.000	
	N	196	196	196

\*\* Correlation is significant at the 0.01 level (2-tailed).

## Conclusion

This research evaluates the use of TikTok from an Islamic perspective using the technology acceptance model. This research concludes that the elements of Islamic ethics influence TikTok adoption among users. Future work should also examine a wide range of social media sites such as Instagram and Twitter to determine the relationship between the influencing factors of Islamic ethics and Muslim users' attitudes. In addition, the different backgrounds or cultures of Muslim users should be analysed in order to compare them with the current study.

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# Evaluation of Features on Mobile Investment Application using Kano Model

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**Abstract:** The use of smartphones has become a primary need in supporting human daily activities. With the presence of a smartphone, various activities can be carried out only through an application. One application that is currently popular with Indonesians is an investment application with products such as stocks, mutual funds, and crypto. The presence of investment applications in the past few years has made the investment process easier to do. However, the age of the application development company which is still quite young makes the application have a lot of room for improvement, such as the features offered in the application. This study aims to evaluate the effect of the features available on one of the investment applications in Indonesia with the Kano model approach. The kano model is used to classify the existing features based on their influence on user satisfaction. 21 features associated with the application are defined. The survey was taken to 104 participants to identify user perspective of each feature on user satisfaction. The result of this study reveals that there are 12 features classified as Indifferent, 6 features are classified as One-dimensional and 3 features are classified as Reverse which means there are rooms for improvement of the features that will improve the user satisfaction.

**Keywords:** Kano Model, Investment Application, User Satisfaction, Features

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## Introduction

Digital innovation has made its way into various aspects of human life. One sector that has experienced notable transformations through digital innovation over the past ten years is the financial sector (Zavolokina et al., n.d.). The process of digital innovation, closely tied to technology implementation, is commonly referred to as fintech (financial technology) within the financial industry. Fintech predominantly encompasses technology-based startup companies operating in finance, utilizing internet-based automated information processing to pioneer new business models within the financial sector. The advent of fintech has introduced a fresh perspective to the financial sector, challenging long-standing traditional perceptions by showcasing the transformative power of

technology implementation. The evolving consumer perception towards a more modernized financial industry has significantly influenced the advancement of the fintech sector. Chinese-based fintech company, Eastmoney, has witnessed a remarkable four-fold increase in active users since 2015 (Chen et al., 2023). This rapid growth is fueled by various factors, such as the convenience of online access for consumers to conduct diverse transactions. The swift progress in the fintech industry is not limited to foreign entities alone, as Indonesia has also seen the rise of numerous homegrown fintech companies in recent years.

Fintech companies operating in Indonesia provide a wide range of distinct business products, including online-based loans, investment transactions, digital wallets, and more. Among these offerings, investment products have gained considerable popularity. The volume of investment transactions has witnessed a notable surge compared to previous years. According to data from the Financial Services Authority (*Otoritas Jasa Keuangan*), there were approximately 319 million stock transactions in 2021, a significant increase from the 169 million transactions recorded in 2020 (OJK, 2021). The accessibility and ease of conducting transactions have played a significant role in driving the growth of investment product transactions.

Prior to the arrival of fintech companies offering investment products like stocks, investors had to engage in face-to-face stock transactions at the Indonesia Stock Exchange (BEI). Additionally, the stock transaction process was carried out using conventional methods involving physical boards and paper as supporting tools. This lack of accessibility hindered the efficient execution of stock transactions, limiting investor participation to only a few segments of society at that time.

However, since the late 2010s, the presence of fintech companies offering investment products has transformed the landscape. This shift has revolutionized the mechanism of investment transactions, making them accessible online and in real-time. According to a mid-year report in 2022 from the Indonesia Central Securities Depository (KSEI), the number of stock investors in Indonesia has reached 4 million during the first half of 2022. This represents a 15.96% increase from the end of 2021 (KSEI, 2022). The report also highlights that the majority of stock investors are now dominated by the millennial generation, more than 50%.

The convenience of accessing stock transactions became a pivotal factor in the rise of millennial investors' dominance in the late 2010s. This shift coincided with the emergence of fintech companies offering investment products. These fintech companies have obtained legitimate licenses from regulatory bodies like the OJK, instilling confidence in investors when engaging in various investment transactions. In Indonesia, there are now fintech companies that facilitate a substantial volume of stock transactions. For instance, a company established in 2018 has garnered over 2 million users since 2022. The company's remarkable achievement of engaging 50% of all stock investors in Indonesia in 2022 has contributed to its promising growth trajectory. However, as a relatively young company, there is still considerable potential for improvement. One aspect that could be enhanced is the feature of the application.

This study aims to review the available features based on user preferences using the approach kano model.

## Literature Review

### Fintech

Fintech is a term derived from the combination of "finance" and "technology," indicating the integration of technology into the financial sector's business processes (Zavolokina et al., n.d.). The rise of fintech companies has been significant over the past decade, including in Indonesia. Indonesia has witnessed rapid growth in its fintech industry, following the trajectory of China (Davis et al., 2017). This accelerated expansion can be attributed to the convenience fintech offers to the lower-middle-class population, including financing solutions for Micro, Small, and Medium Enterprises (MSMEs) and instant loans for individuals in need. Such market segmentation aligns well with Indonesia's status as a developing nation.

There are several types of fintech products that are quite popular with the public. Several types of fintech products are as follows:

1. Digital payment

This one fintech product is the most popular among the public. With the existence of digital payment products, the use of cash as a transaction tool has begun to be abandoned. Generally, almost everyone has an account with digital payment products such as e-wallets and other digital payment products.

2. Peer-to-peer lending

P2P lending has a business model that is providing access to loans to the public. The presence of P2P lending slowly provides competition to conventional financial institutions so that people do not only have to depend on conventional financial institutions in applying for loans.

3. Online investment

This fintech product allows users to make investment transactions in financial instruments such as stocks, mutual funds, bonds, and crypto. The presence of online investment products has provided easy access to investing.

4. Financial Management

Financial management applications assist individuals in managing personal finances which include activities for making financial budgets, tracking financial flows, and providing personalized financial management advice.

5. Donation platform

Donating can be done anywhere and anytime. The donation platform allows donation activities to be carried out collectively for specific purposes without having to do it directly because it is connected to other fintech products, namely digital payments.

### Fintech Growth in Indonesia

Based on data from AFTECH (Fintech Association of Indonesia), the officially recognized Association of Digital Financial Innovation Providers appointed by OJK (Financial Services Authority), there are 352 fintech companies in Indonesia as of 2022. These 352 fintech companies offer diverse business products, such as online



loans, crowdfunding, digital wallets, investments, and more. The ease of transaction is a key factor for fintech users, along with the assurance of regulatory compliance provided by authorized regulators.

The convenience provided by fintech companies in transaction processes has proven to have a significant impact on the majority of the Indonesian population. The geographical nature of Indonesia, with its thousands of islands, creates difficulties in conducting conventional transactions due to uneven financial infrastructure. Fintech companies operating online have emerged as a solution to address the limitations of the financial infrastructure in Indonesia. Their ability to facilitate online and real-time transactions has become a crucial advantage that conventional banks cannot offer (Davis et al., 2017).

### **Identify Application Features**

Mobile apps or applications have become a major spearhead in every type of fintech business product. Because an application is a differentiator between the financial industry that is still traditional and that is based on fintech. The presence of applications in the fintech industry has cut boundaries including distance, time, and access which are problems in the traditional financial industry. Each application consists of features that are based on the purpose of the application. The existence of features in the application needs to be based on various considerations. Because the presence of features in the application besides affecting user satisfaction with the application will also directly affect the performance of the application itself.

The investment application has several features that can support the investment transaction process in the application. The features available are as follows:

1. Investment Information
2. Buying Power
3. Watchlist Stocks & Mutual fund
4. Explore
5. Index
6. Schedule
7. Latest Stocks Analysis
8. Trending
9. Stocks based on Category
10. Stocks Sector
11. IPO Offering
12. ETF
13. Top Performer Mutual fund
14. Type of Mutual fund
15. Investment Manager
16. Instrument
17. Portfolio

- 18. Order
- 19. History
- 20. Chat
- 21. News

### **Human Computer Interaction (HCI)**

Human-Computer Interaction (HCI) is a multidisciplinary field rooted in psychology that explores the interaction between humans and computer design. It encompasses the creation, evaluation, and implementation of computer systems that effectively engage with humans, considering the key phenomena involved (Preece, 1994). The objective of HCI is to establish a framework that combines human psychology and computer science to design features that are efficient and user-friendly.

The four recurring phases of analysis, design, implementation, and evaluation in HCI have been widely recognized and understood (Butler et al., 1998). These four crucial stages are taken into account when developing a user interface design. The user interface plays a vital role in the field of HCI and can be validated through testing. Hence, it is important to possess good techniques and skills in user interface design to create a functionally effective system for human-computer interaction.

### **Kano Model**

The Kano model was discovered by Professor Kano and his colleagues, who introduced a two-dimensional framework that takes into account the asymmetric and nonlinear relationship between the performance of a product or service and customer satisfaction. Originally, the Kano model was employed by mobile phone companies to develop new products (A. Shahin and M. Zairi, 2019). However, the use of the Kano model has expanded beyond tangible products and can now be applied to a variety of intangible products, including services. Currently, the Kano model is widely utilized to evaluate customer satisfaction by considering the quality attributes of a product or service, and subsequently categorizing them into one of the following five quality categories:

#### 1. Must-be

The following attributes are very important to fulfill because customers will be very dissatisfied if these attributes are not met. The following attributes are the basic criteria for a product or service with a description of a certain minimum level of quality for the product or service that must be achieved by the provider.

#### 2. One dimensional

The following attributes are typically clearly expressed by customers, as they directly impact customer satisfaction based on the extent to which the related attributes are fulfilled or not.

#### 3. Attractive

Fulfillment of the following attributes leads to an increase in satisfaction that is more than it should be because these attributes are difficult to identify because they are latent and initially not expected by the customer.

However, if these attributes are not met, it will not cause dissatisfaction with the customer.

4. Indifferent

The following attributes do not affect the level of satisfaction significantly, whether or not these attributes are present.

5. Reverse

The presence of attributes can cause dissatisfaction, but if these attributes are not present, it can increase satisfaction.

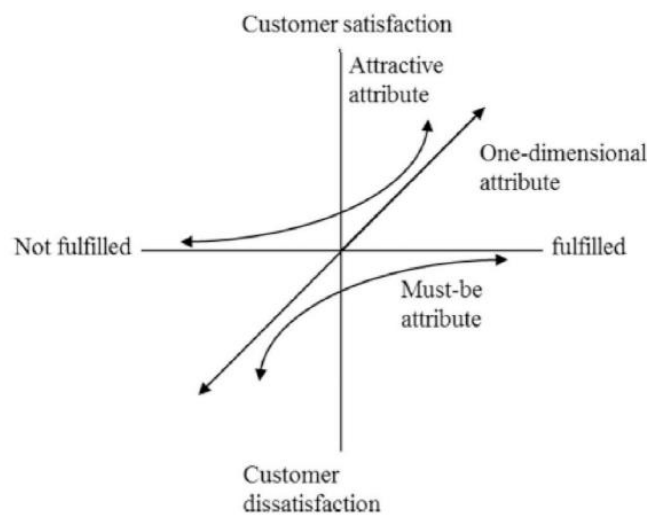


Figure 1. Kano Model Diagram (Lin, et al., 2017)

**Methodology**

**Data Collection**

The initial step taken in this research is data collection. This process is carried out to collect the primary data needed during the research, then the primary data is processed in order to obtain results that are in accordance with the initial objectives of this research. Primary data were obtained from respondents who were involved in various data collection series in this study.

In this study, the Kano model method is used to identify the features available in investment applications. From the identification of the available features, further analysis will be carried out. The data collection process for the Kano model was carried out through questionnaires distributed to respondents. The Kano model questionnaire that was distributed consisted of 3 parts, namely persona, functional question, and dysfunctional question in the form of semantic differentials. The questionnaire questions used a Likert scale of 5 to determine the respondent's perception of the features that became an aspect of the analysis. The attribute classification of the available features will be assessed based on the assessment of the functional question and dysfunctional question sections which will be mapped based on the kano model attribute classification matrix as shown in the Figure 2.

Service Attribute		Dysfunctional				
		1. like	2. must-be	3. neutral	4. live with	5. dislike
Functional	1. like	Q	A	A	A	O
	2. must-be	R	I	I	I	M
	3. neutral	R	I	I	I	M
	4. live with	R	I	I	I	M
	5. dislike	R	R	R	R	Q

Kano Categories: A (Attractive), O (One-Dimensional), M (Must-be), I (Indifferent), Q (Questionable) and R (Reverse)

Figure 2. Kano Model Attribute Classification Matrix

To determine the sample size that can represent the population, the formula proposed by Krejcie & Morgan (1970) is used to ensure the validity of the questionnaire and its suitability as a primary data source for the study. The calculation for the minimum sample size is as follows:

$$n = \frac{x p (1 - p)}{e^2} \div \left( 1 + \frac{x^2 p (1 - 0,5)}{e^2 N} \right)$$

$$96 = \frac{2,706^2 \times 0,5 (1 - 0,5)}{0,1^2} \div \left( 1 + \frac{2,706^2 \times 0,5 (1 - 0,5)}{0,1^2 (2.000.000)} \right)$$

Figure 3. Krejcie & Morgan Formula

Notes:

- N = Total Population
- P = Population Proportion
- e = Margin of Error
- x = Chi-square Score Table
- n = Number of Sample

With a population size of 2,000,000 representing the number of application users and an error rate of 10%, based on the calculation above, it can be determined that the minimum sample size is 96 respondents. The Kano model questionnaire that has been distributed obtained a total of 104 respondents. Therefore, the minimum required number of responses for collecting Kano model data has been met.

**Data Processing**

The collected data is then processed according to the applicable data processing methods. Before the data can be processed, the primary data collected through the questionnaire will undergo validity and reliability testing to ensure its authenticity and credibility, enabling it to be further processed using the relevant methods.

### Validity and Reliability Testing

To ensure the reliability and validity of the questionnaire data, two methods are used for testing: Cronbach's Alpha is employed to assess data reliability, while the Kaiser-Meyer Olkin (KMO) measure is utilized for evaluating data validity. The reliability test aims to examine the consistency of the questionnaire's indicators, ensuring that the questionnaire provides dependable measurements of the intended variables and maintains consistency within specific groups. On the other hand, the validity test is conducted to assess how accurately the measurement tool captures the desired concept. By employing both of these tests, it is possible to ensure that the questionnaire used is of high quality and can be relied upon as a reliable means of data collection (Hair et al., 2019). The following is the result of measuring the validity and reliability of the Kano model questionnaire that has been distributed.

Table 1. Keyser Meyer Olkin and Cronbach's Alpha

Indicator	Functional	Dysfunctional
KMO	0.906	0.946
Cronbach's Alpha	0.908	0.949

According to the guidelines provided by Field (2018), Hair et al. (2019), and Tavakol & Dennick (2011), a KMO value greater than 0.6 is considered acceptable for testing validity, and a Cronbach's Alpha value higher than 0.7 is considered acceptable for testing reliability. Based on the measurements conducted on the questionnaire data, it can be concluded that the data used in this study is statistically valid and reliable.

### Results and Discussions

Based on the grouping of the results of the Kano model questionnaire, the features available in investment applications that are collected as a result of the functional and dysfunctional questions are classified based on the Kano model attribute classification table in Table 2.

Table 2. Application Features Classification

No	Feature	M	O	A	I	R	Category
1	Investment Information	11	45	10	37	0	O
2	Buying Power	19	35	19	30	1	O
3	Watchlist Stock & Mutual Fund	31	31	9	32	0	I
4	Explore	3	10	2	26	63	R
5	Index	25	30	10	38	0	I
6	Schedule	26	28	15	34	0	I
7	Latest Stock Analysis	28	24	17	34	0	I
8	Trending	23	36	8	35	1	O

	www.icres.net	May 18-21, 2023	Cappadocia, Turkiye		www.istes.org	
9	Stock based on Category	26	27	17	33	0 I
10	Stock Category	27	30	7	38	1 I
11	IPO Offering	24	35	9	35	0 I
12	ETF	2	10	3	24	64 R
13	Top Performer Mutual Fund	25	26	11	41	0 I
14	Type of Mutual Fund	28	29	9	37	0 I
15	Investment Manager	24	30	12	37	0 I
16	Instrument	3	10	2	25	64 R
17	Portfolio	36	19	8	38	2 I
18	Order	21	32	20	30	0 O
19	History	24	34	13	32	0 O
20	Chat	29	21	11	40	3 I
21	News	21	19	15	42	3 I

Based on the results of data processing in table 2, there are 13 features that are classified as indifferent attributes. There are 5 features that are classified as one-dimensional attributes. And there are 3 features that are classified as reverse attributes. The reverse attribute can have a negative impact on user satisfaction. The 3 features that are classified as reverse attributes are Explore, ETFs, and Instruments. This research focuses on eliminating features that can have a negative impact on user satisfaction, so that these three features will not be

## Conclusion

There are 3 features that are classified as Reverse: Explore, ETF and Instrument. Reverse has an effect that is inversely proportional to the level of satisfaction. Therefore, it would be better if the attributes classified as Reverse are not involved. By not involving those 3 features, it could increase user satisfaction.

## Recommendations

This study is limited to identifying the user satisfaction based on available features without testing it on a backend system. The testing phase in subsequent research can be integrated with the backend system so that the result can be carried out more accurately.

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## Machine Learning based Financial Management Mobile Application to enhance College Students' Financial Literacy

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**Abstract:** This paper presents a mobile application aimed at enhancing the financial literacy of college students by monitoring their spending patterns and promoting better decision-making. The application is developed using the agile methodology with Android Studio and Flutter as development tools and Firebase as a database. The app is divided into sub-applications, with the home page serving as the program's integration point, displaying a summary of the user's financial progress. The app generates valuable insights into the user's current and future financial success, utilizing data analytics and machine learning to provide detailed and summary insights into the user's financial progress. The machine-learning algorithm used in this app is linear regression, which predicts the user's income and expenses for the upcoming month based on their historical spending data. In addition, the app highlights deals and student discounts in the user's vicinity and links to financial articles that promote better financial planning and decision-making. By promoting responsible spending habits and providing valuable financial insights, this mobile application aims to help students become financially literate and make informed financial decisions for future.

**Keywords:** Predictive Machine Learning, Financial Management, Mobile Application, Data Analysis, Financial Planning,

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### Introduction

Financial management is an essential skill for people of all age groups, but college students, in particular, face unique challenges as they navigate their way through a time of significant transformation in their lives. Often taking out student loans to pay for their education, these students are expected to pay back their debts while also striving to establish their identity and independence in society. However, their lack of financial literacy and planning skills frequently leads to increased debts and inadequate savings, making it difficult for them to

achieve financial independence (Widener, 2017).

The cost of higher education in the United States has been steadily rising for decades, with tuition and fees increasing faster than the rate of inflation (Baum, Ma, & Payea, 2015). As a result, college students are increasingly reliant on student loans to finance their education, and many are struggling to pay back these loans after graduation. In fact, recent studies have found that college graduates are entering the workforce burdened with significant student loan debt, with the average borrower owing over \$30,000 in student loans (Baum et al., 2016). Unfortunately, many college graduates are finding it difficult to manage their debt, with a significant proportion of borrowers experiencing delinquency or default on their student loans (Houle & Berger, 2017). This not only has negative financial consequences for borrowers, but it can also impact their mental and emotional well-being, with studies finding that high levels of student loan debt are associated with increased levels of stress, anxiety, and depression (Eisenberg, Hunt, & Speer, 2013).

Furthermore, college students are not only struggling with paying back their loans, but they are also not saving enough for their future. A recent survey found that only 24% of college students are saving for retirement, and 21% have no savings at all (TIAA, 2021). This lack of financial preparedness can have long-term consequences, as it may delay important milestones such as purchasing a home or starting a family.

According to iontuition, less than 45% of university students believe they understand basic financial concepts, while more than 50% believe they do not practice or understand financial management (iontuition, 2016). This lack of financial literacy can lead to poor financial decisions, which can have significant consequences for their financial well-being. As a result, there is a pressing need to bridge the gap in financial literacy among college students.

To address these issues, a personal financial management mobile application has been developed to assist college-going students in managing their finances using technology and data. The mobile application aims to help college students become more financially literate and mindful spenders by assisting them in budgeting for their expenses, providing insights into their spending habits, and offering guidance on managing their debts .

This journal article explores the background and motivation for developing the financial management mobile application, and the importance of financial literacy for college students. (Times New Roman, 10)

## **Literature Review**

In the article, Widener (2017) argues that college students struggle to keep up with their finances due to a lack of financial literacy and awareness. The author supports the argument by citing studies and literature reviews. According to Kopusko et al. (2016), students were highly aware of the importance of planning their financial futures and their retirement, but they were not committed to putting their financial knowledge into practice. On

the other hand, Goetz et al. (2011) discovered a demand for personal finance courses among students, indicating that students have both the desire and the awareness to gain financial knowledge. However, some students even after having the necessary knowledge, fail to use it for their futures due to reasons such as financial background and lack of awareness.

The author points out that students are not up-to-date with financial management, lack discipline for proper financial planning, and are prone to overspending (Archuleta, Dale, & Spann, 2013). The students' over-reliance on credit cards, low income, and irrational spending habits lead them to financial disaster (Goetz et al., 2011). The lack of financial planning among students often leads them to be in debt even after completing their degree, affecting their financial well-being and security and having a negative psychological impact that continues to affect their confidence in managing their finances. The author further adds that the lack of financial literacy among college students is due to various factors such as demographics, family influence, and backgrounds. Furthermore, students' financial decisions are influenced by their lack of parental support, their own financial choices, or both. The transition from dependent to independent living frequently leads to hasty financial decisions, and sound financial planning may help avoid excessive spending.

According to recent data from the Federal Reserve, as of 2021, the total outstanding student loan debt in the United States is \$1.57 trillion, and the average student loan debt for borrowers in the class of 2019 is \$29,900. This is a significant burden on young people who are just starting their careers, and it is particularly challenging for those who are already struggling with low wages and a high cost of living. A recent study by the National Center for Education Statistics found that only 39% of undergraduate students in the U.S. graduate without any student loan debt. This means that the majority of students are entering the workforce with a significant amount of debt to pay off.

Moreover, even after graduation, college students are facing difficulties in paying back their loans. The latest report by the Federal Reserve Bank of New York shows that as of 2021, 9.9% of student loan borrowers are delinquent or in default on their loans. Additionally, studies show that many college students are not saving enough money for their future. A recent survey by Bank of America found that 41% of millennial (ages 24 to 41) have less than \$5,000 in savings, which is not enough to cover even a few months' worth of living expenses. One study found that students who receive financial education are more likely to have positive financial behaviours, such as saving money and paying bills on time (Hastings et al., 2013). This underscores the importance of financial literacy education for college students, as it can help them develop the necessary skills to manage their finances effectively.

Another study found that students who have a high level of financial knowledge are more likely to save money and less likely to carry credit card debt (Robb and Woodyard, 2011). This suggests that financial education can have a significant impact on a student's financial behaviours and outcomes. Furthermore, research has shown that financial stress can have negative impacts on students' academic performance and mental health (Huston et al., 2010; Wilmarth, 2019). This highlights the need for college students to develop strong financial

management skills to avoid financial stress and its associated negative consequences.

Regarding the impact of parental support on a student's financial management, a study found that parental financial support can have both positive and negative effects on a student's financial behaviours (Lawrence and Ritchie, 2017). While parental support can provide a safety net for students, it can also lead to a lack of financial responsibility and independence.

Finally, a report by the Consumer Financial Protection Bureau found that financial education programs can have a positive impact on students' financial behaviours, such as saving money and avoiding excessive debt (Consumer Financial Protection Bureau, 2014). The report recommends that financial education be incorporated into college curriculums to better equip students with the skills and knowledge necessary to manage their finances effectively.

Overall, these studies and reports support the claims made in the literature review regarding the importance of financial education and the negative consequences that can result from poor financial management. They highlight the need for college students to develop strong financial management skills and for educational institutions to incorporate financial education into their curriculums.

Hiebl and Weber (2017) conducted a study to explore the role of mobile apps in financial management for college students. The study recognized the increasing importance of financial literacy and management for college students, as they transition from being dependents to managing their own finances. The study identified that financial management apps can help students monitor their expenses, budget their finances, and track their spending. Additionally, these apps can provide helpful tips for managing finances and give students a better understanding of their financial situation.

The authors highlighted that mobile apps have the potential to assist college students in managing their finances, especially since most college students already rely heavily on their mobile devices. The study revealed that these apps can help students to keep track of their expenses and gain a better understanding of their financial situation, which in turn can help them make informed decisions about their financial future.

The study also highlighted that financial management apps can help reduce financial stress among college students. The authors noted that financial stress can lead to poor academic performance and lower graduation rates, so reducing financial stress is crucial to improving academic outcomes. The authors recommended that universities promote financial management apps to their students to help them manage their finances effectively. They also suggested that financial management apps should be made user-friendly and should incorporate gamification elements to encourage students to use them regularly.

Another study by Ahmed and Malik (2020) investigated the impact of financial education and financial management apps on the financial literacy of college students in Pakistan. The study found that the use of financial management apps significantly increased the financial literacy of college students. The authors

recommended that financial management apps be integrated into the financial education curriculum for college students. Similarly, a study by Lee et al. (2018) examined the effectiveness of a financial management app in enhancing financial literacy among college students in South Korea. The study revealed that the use of the financial management app significantly increased the financial literacy of college students. The authors recommended that universities incorporate financial management apps into their financial education curriculum to enhance financial literacy among their students.

Overall, the literature suggests that financial management apps have the potential to assist college students in managing their finances effectively, reducing financial stress, and improving academic outcomes. The use of financial management apps can also enhance financial literacy among college students, which is crucial for their financial well-being. The integration of financial management apps into financial education curriculums is recommended to promote financial literacy and effective financial management among college students.

The study by Cao et al. (2019) investigated the effectiveness of a financial management app on college students' financial management skills, financial literacy, savings, and debt reduction. The app included several features such as financial goal-setting, budgeting, expense tracking, and financial education.

The study recruited 180 college students who were divided into two groups: a treatment group that used the financial management app and a control group that did not use the app. The study lasted for 12 weeks, during which the treatment group received training on how to use the app effectively. At the end of the study, the researchers found that the treatment group had a higher level of financial literacy compared to the control group. The treatment group also reported a significant improvement in their financial management skills, such as budgeting and expense tracking. Moreover, students who used the app were able to save more money compared to the control group. The researchers also found that the use of the app helped students to reduce their debt. The findings of the study are consistent with previous research on the effectiveness of financial management apps. For example, a study by Hira and Loibl (2005) found that using financial management software is associated with increased financial knowledge, improved budgeting, and debt reduction. Similarly, a study by Lusardi and Mitchell (2014) found that using a financial education website improved financial literacy and savings behavior.

Overall, the study by Cao et al. (2019) suggests that financial management apps can be effective tools for improving financial management skills and increasing financial literacy among college students. Financial management apps can also help students save money and reduce debt, which are crucial skills for achieving financial stability and success in the future.

## **Design and Implementation**

The financial management mobile application is designed to provide a comprehensive set of tools and resources to manage finances effectively. Based on an extensive literature review of budgeting and financial management

techniques, this user-friendly application consists of several sub-applications as shown in figure 1.

### User Interface Design

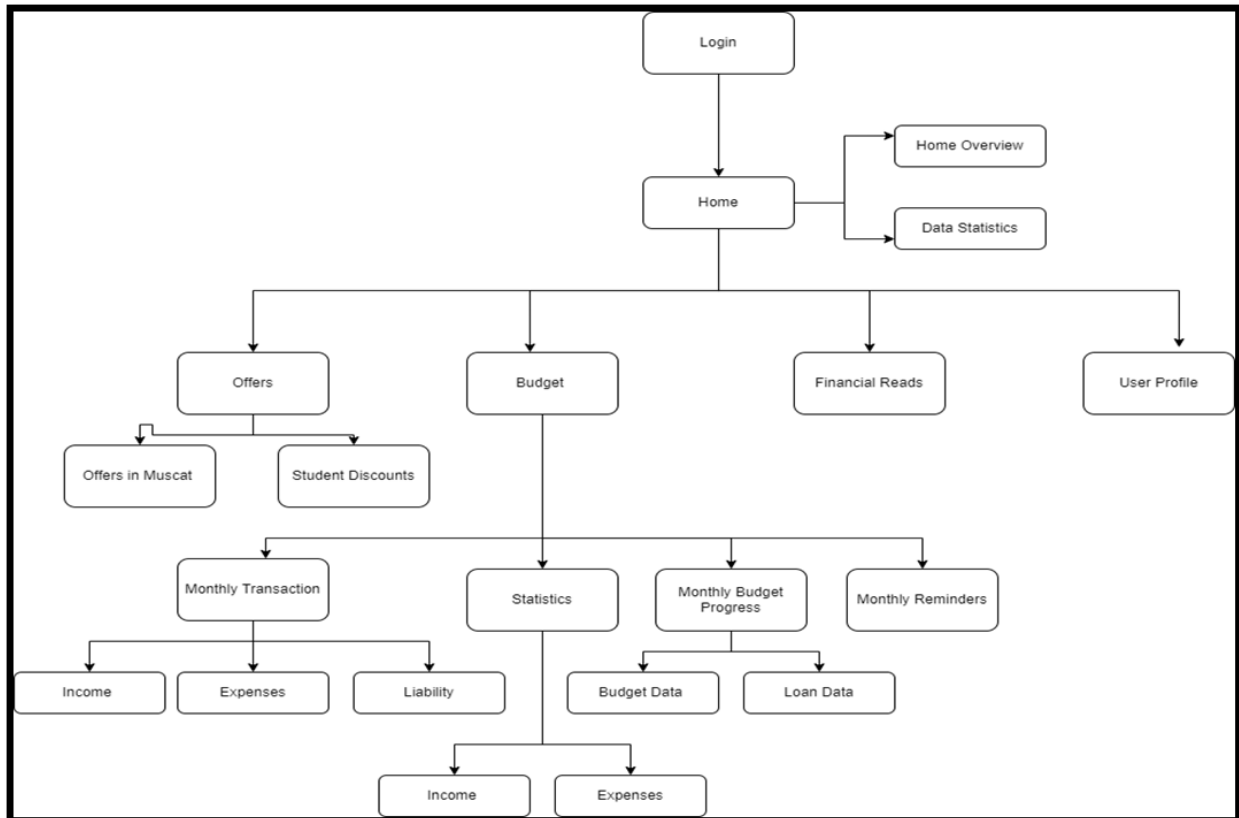


Figure 2. Application prototype flow chart

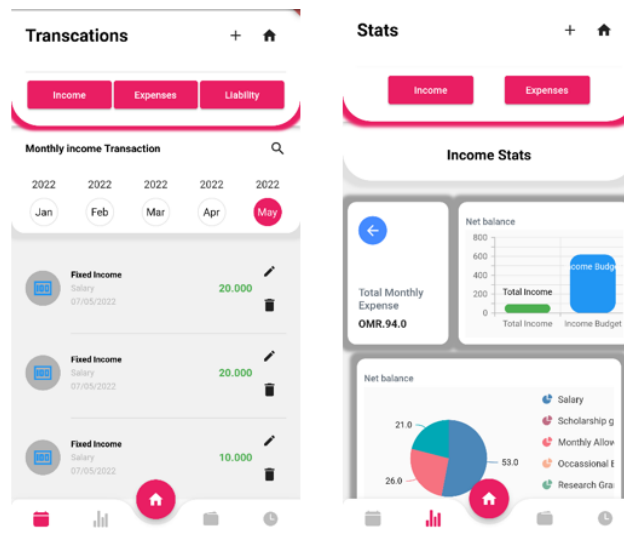
- The Home app acts as the central dashboard that connects all other sub-applications. It showcases the user's current financial performance and uses machine learning to predict their next month's financial performance. The home page showcases the user progress, reminders and their predicted income and expense for the upcoming month.
- The budget app is structured in a way that allows users to access many features of the application via the footer and directs them to the Home page and other sections of the budget app.
- The monthly transaction page in the budget app displays the user's monthly income, expenses, and liabilities/loans taken for the current and previous months. The monthly statistics page provides users with data visualizations such as graphs and pie charts, allowing them to have a glance look into their monthly performance.
- The budget progress page displays budgeted income and expense and savings progress through a progress bar. It also displays the user's total liabilities, loan details, and the progress of each section to clearing their loans.
- The reminders section in the budget app allows users to set recurring and non-recurring reminders with

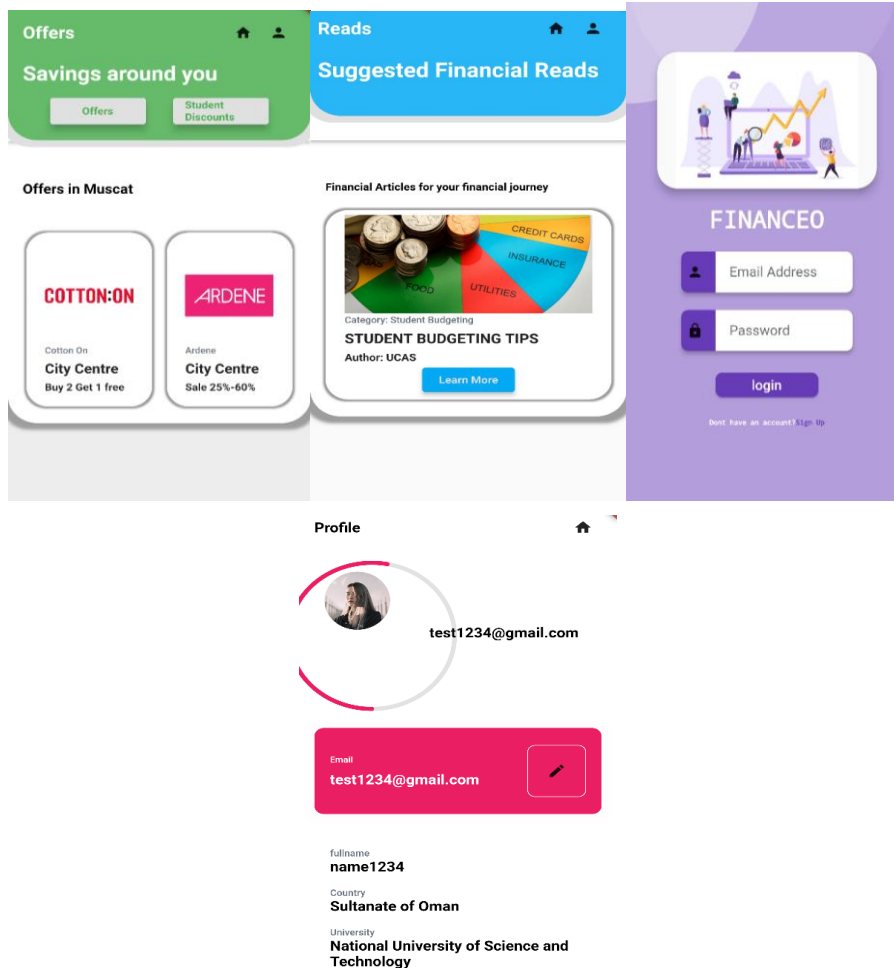
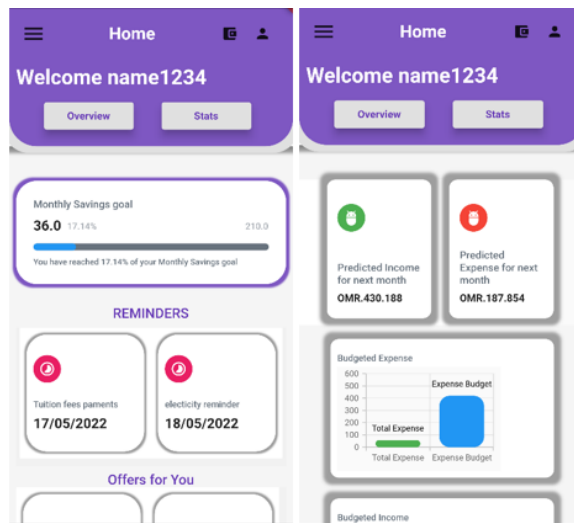


notes to remind them of any payments or commitments of the month.

- The Offers app provides users with exciting offers and discounts available in the user’s city that they can avail to save more. In the same app, users can also view discounts available to them as students only, helping the users to make and save the most out of being students in general. This section is also an important section as the application can showcase advertisements targeted towards college students.
- The Financial Reads section of the application is designed to help college students learn more about finance and improve their financial literacy. This section is a great addition to the application as financial literacy is important for young adults, especially college students who are starting to become more financially independent. By providing easy access to financial articles, the application can help college students make informed financial decisions. The app provides users with a range of topics such as investment, budgeting, saving, credit score, and much more. The articles are updated regularly, providing users with fresh and updated financial knowledge.
- The Profile and Login sub-applications provide users with an option to set up their profile and log in to access the application.

The UI design of the mobile application is shown in figure 2 is intended to provide users with a simple, accessible, and enjoyable experience. Close attention is paid to the colour scheme and design of each sub-app to ensure that users can easily differentiate between them. The UI design is based on users' expectations in terms of accessibility, aesthetics, and simplicity of use, which will help keep users engaged with the app.





**(a). Home Page UI**

**(b) Budget app UI**

**(c).Offers Page UI**

**(d) Financial Reads UI**

**(e) Login Section Design**

**(f) User Page UI**

Figure 2. User Interface Design

**Database Design**

The Financial Management app's database design is created to meet the requirements of the application. Firebase Real-time Database is used as the database for the application. Firebase has the ability to create new accounts and utilizes Firebase authentication to determine whether the user's email address and password are correct before allowing access to their home page. All user accounts are stored in the Authentication section, where the admin can also disable or delete user accounts. Overall, the use of Firebase Real-time Database and Firestore database in the Financial Management app allowed for efficient and real-time syncing of data between the mobile and other clients. The app's database design as shown in Figure 3, also enabled the app to store and manage users' data effectively while ensuring data security and privacy.

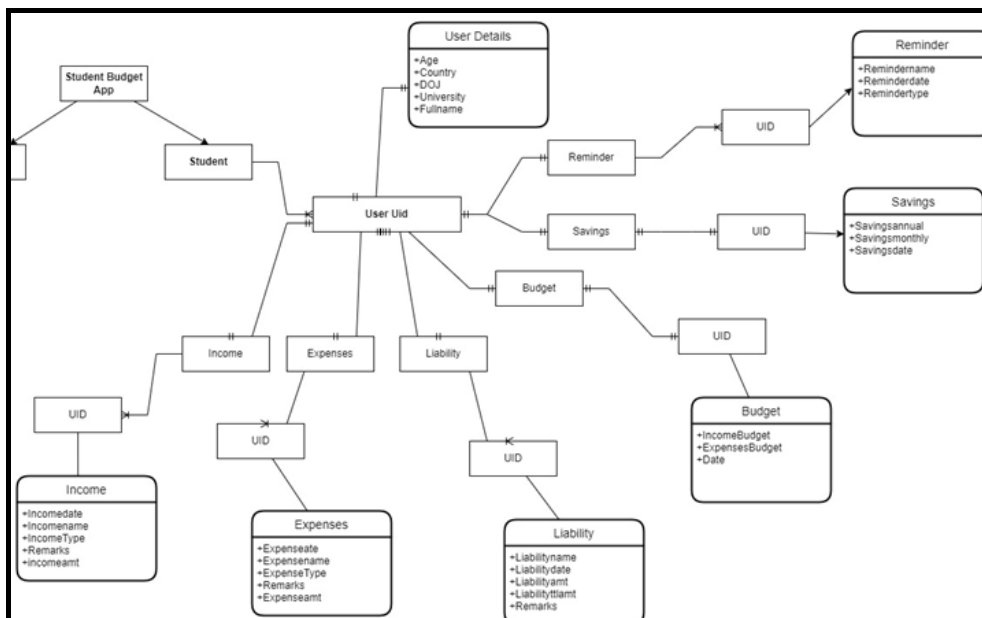


Figure 3. Database design

**Implementation**

The financial management application for college students is implemented using Flutter as the framework and Dart as the programming language. Android Studio is used as the Integrated Development Environment (IDE) for the project. Various libraries were used to enhance the user interface (UI) and add functionality to the application. Once a user logs in or registers, they will be led to the home page, which is the main page of the application. The Home page ties everything together and serves as a dashboard for the user. It contains the user's personal information, income, expenses, liabilities, budget, and savings information which are shown in Figure 4 and Figure 5.

In conclusion, the financial management mobile application for college students has several essential features that enable students to improve their financial literacy and can provide college students with a comprehensive

tool to manage their finances effectively.

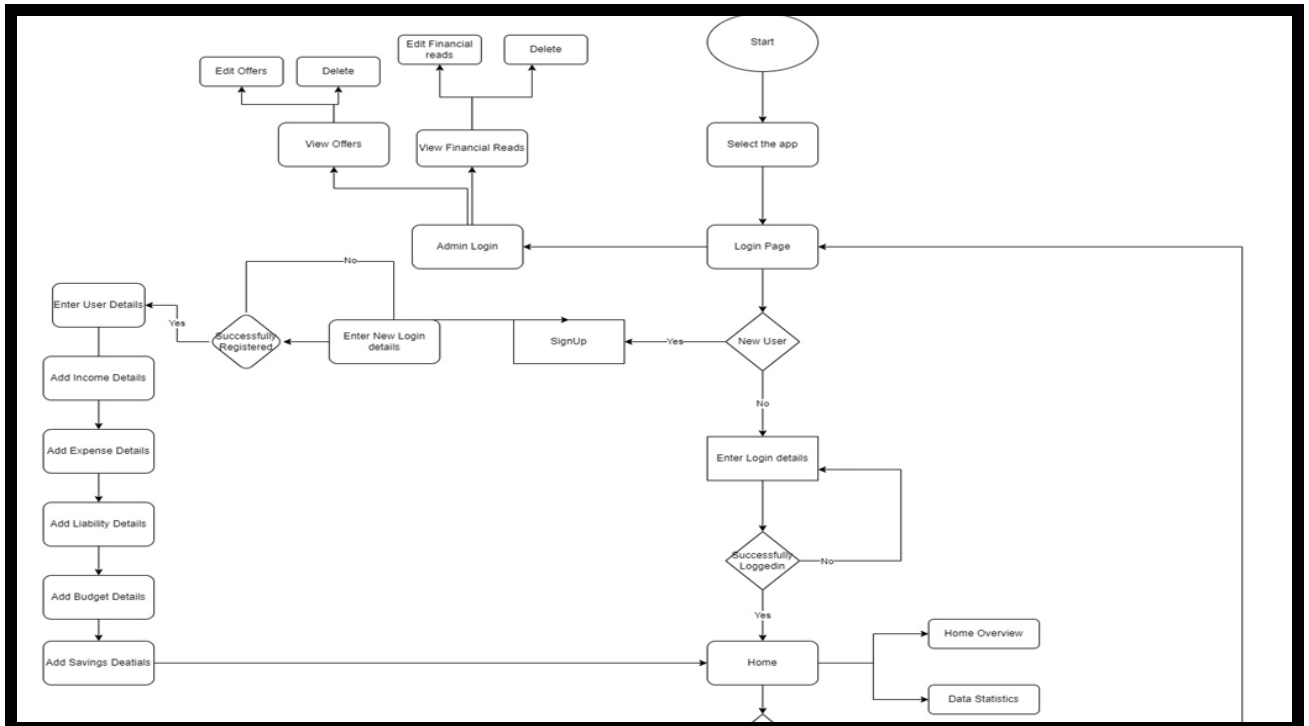


Figure 4. Application Flow chart Part-1

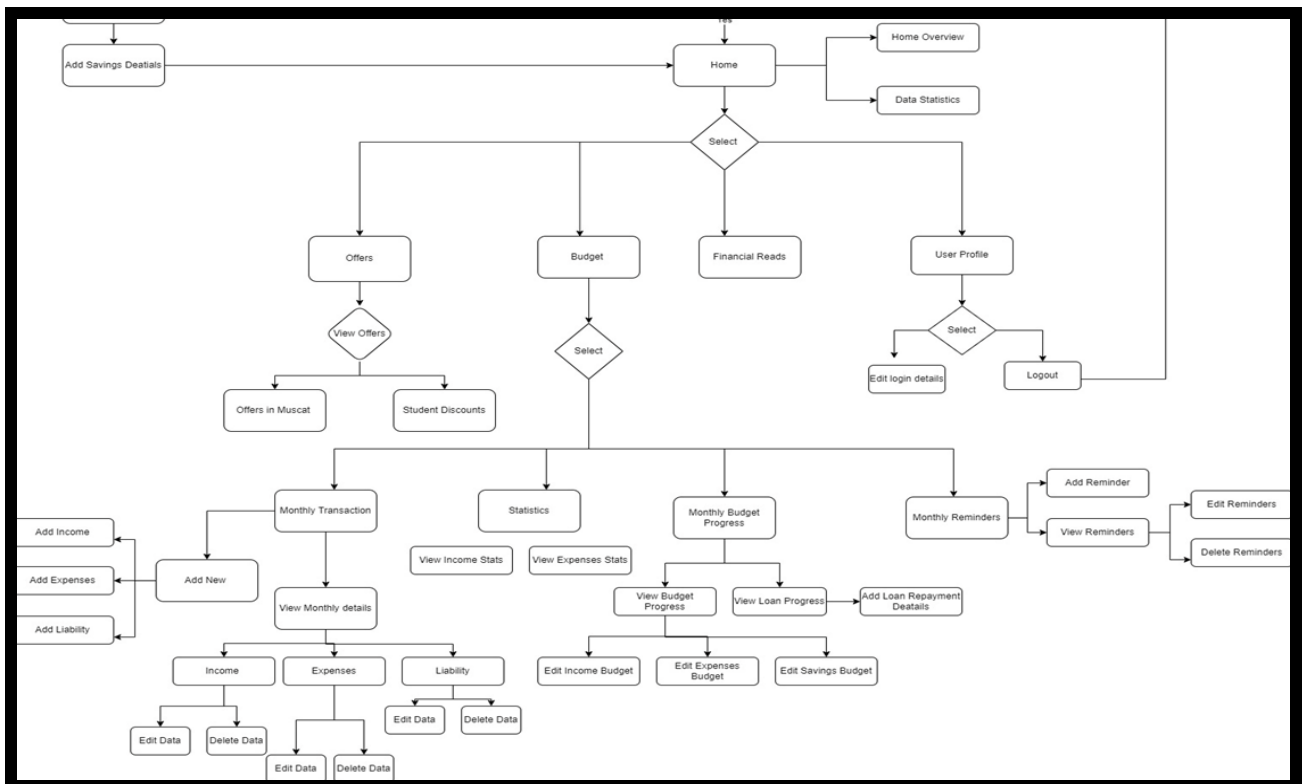


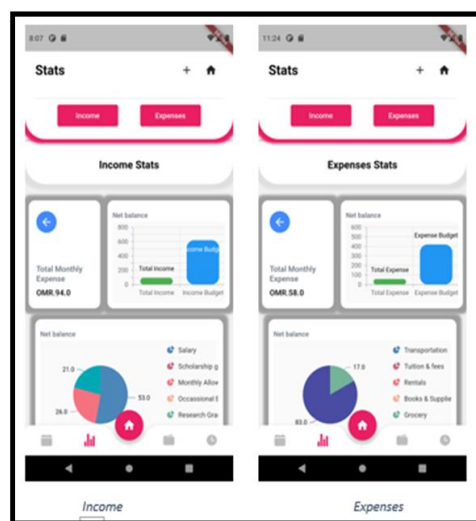
Figure 5. Application flow chart Part-2

## Results & Discussions

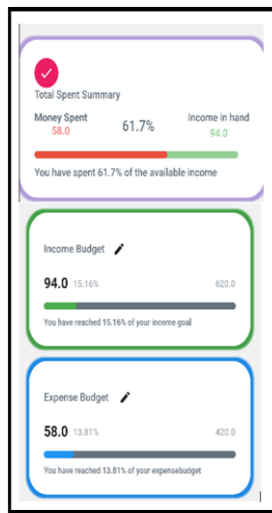
The application effectively employs data analytics and machine learning to evaluate user data and provide detailed and summary insights into the user's income, spending patterns, budgeting progress, and credit or loan status.

### User Data Analysis Results

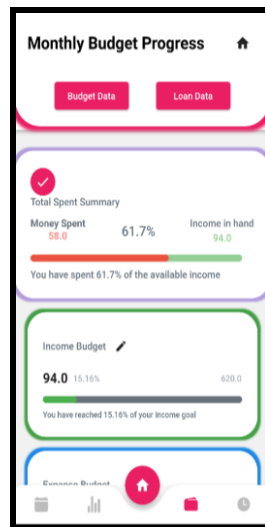
Data analysis is the process of summarizing acquired data, interpreting the data acquired using analytical and logical reasoning to find patterns, connections, or trends (Coursera, 2022). In this application, data analysis is used to summarize user data and provide insights that users can quickly examine their past and present progress via graphs, summaries, and progress bars. This helps users become more financially aware and make informed financial decisions without requiring too many financial details that could potentially confuse them, saving the user time and motivating the user to make wise financial decisions. Graphs are used to summarize the user's income and expenses for the month. The data analysis for income and expenses using graphs is shown in Figure 6(a). This feature aims to let the user know their income and expenses performance at a glance. To visualize the user's progress toward their spending and budget goals, the program employs a progress bar, as shown in Figure 6(b). Each progress bar also provides a percentage and a word summary for further understanding of their progress. Progress bars are also used to analyze the user's savings progress, as shown on the home overview page and budget page, as shown in Figure 6(c). Loans are also a significant aspect of a person's life, and paying on time and keeping track of the loan progress is critical. This application promotes and assists the user in making timely loan repayments while also keeping them aware of their commitments or obligations. Figure 6(d) depicts how a progress bar and summaries were utilized to display user loan progress for simple examination. The green color highlights good progress or the percentage of the loan paid, whereas the red color highlights poor progress or the percentage of loan to liable to pay.



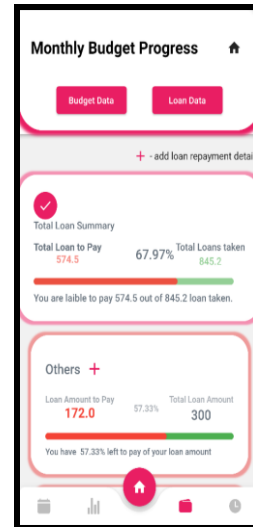
(a) Income and expenses data analysis



(b) Progress Bar Income and expenses



(c) Savings progress



(d) Loan progress

Figure 6. User data analysis

### Machine Learning

The use of machine learning in a mobile application can greatly enhance college students' financial literacy. The application predicts a user's income and expenses for the upcoming month based on their past spending patterns, with the goal of providing them with a forecast of their financial performance for the upcoming month. This feature is not developed to display the users' accurate performance (income & expense) for the next month, but is used to make future predictions based on their past spending patterns. Thus helping the users make changes to their present spending and saving habits based on how their financial patterns have been in the past and make better and more responsible financial decisions.

The machine learning libraries within Flutter, such as the `ml_algo` and `ml_dataframe` libraries, were utilized to predict the user's income and expenses for the upcoming month. Linear regression is chosen as the most appropriate machine learning algorithm for the prediction, given its simplicity and ability to model a linear relationship between dependent and independent variables.

To predict the user's next month's income and expenses, the application categorizes the data provided by the user by month, and the machine learning algorithm is trained on this data to generate a prediction for the next month's income and expenses. The prediction is updated every time the user enters new data into the application. The machine learning prediction feature is displayed on the home stats page, where it summarizes the user's financial statistics progress. The predicted value is displayed at the top of the home stats page, allowing the user to view their predicted next month's performance at a glance.

Figure 7 illustrates the machine learning prediction feature on the home stats page. The income data is retrieved

from the Firestore database in Firebase and used to calculate the total sum of income for each month. The get sum method is executed to add up the total sum of income for each month, which is displayed on the home stats page.

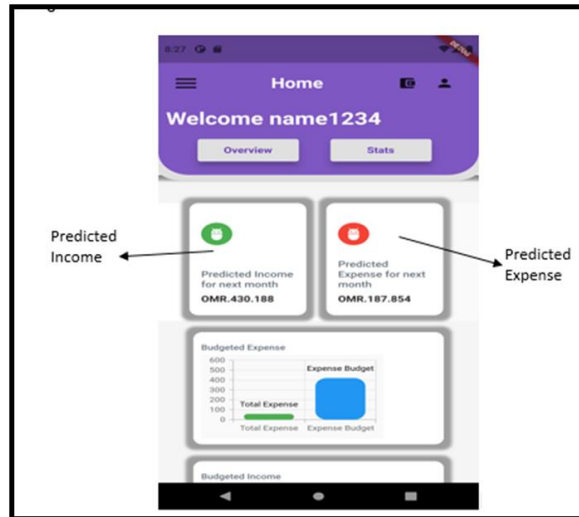


Figure 7. Predicting Income & Expense

The process of implementing the machine learning functionality in a Flutter application involves the following steps as shown in Figure 8:

**Data Collection:** The application collects data from the user through a form where users can enter their income and expenses for each month. The application saves this data to the firebase database along with the corresponding date.

**Prepare the Training Dataset:** The application prepares the training dataset for the linear regression model. To prepare the training dataset, The application accesses the users' data and sorts the income/expense based on month (X) and adds the total income/expense of each month into a list (Y). This involves collecting the user data from the database and organizing it into a set of X (month) and Y (income and expenses) values. Each row of the dataset represents one month of income (Y<sub>i</sub>) and expenses (Y<sub>i</sub>') data.

**Train the Linear Regression Model:** The application trains the linear regression model using the prepared dataset. This involves using the Dart library for linear regression, such as the "linear regression" package, to fit the data to a linear regression model. The model will learn the relationship between the month (X) and income and expenses (Y) values and create a line of best fit.

**Predict the Next Month's Income and Expenses:** Once the model is trained, the application can use it to predict the income (Y<sub>n</sub>) and expenses (Y<sub>n</sub>') for the next month (X<sub>n</sub>). To do this, the application can use the month value of the next month (X<sub>n</sub>) as the input (X), and the model will output the predicted income/ expenses values (Y<sub>n</sub>, Y<sub>n</sub>').

**Display the Predicted Income and Expenses:** The predicted income (Y<sub>n</sub>) and expenses (Y<sub>n</sub>') for the next month (X<sub>n</sub>) are displayed on the home page of the application.

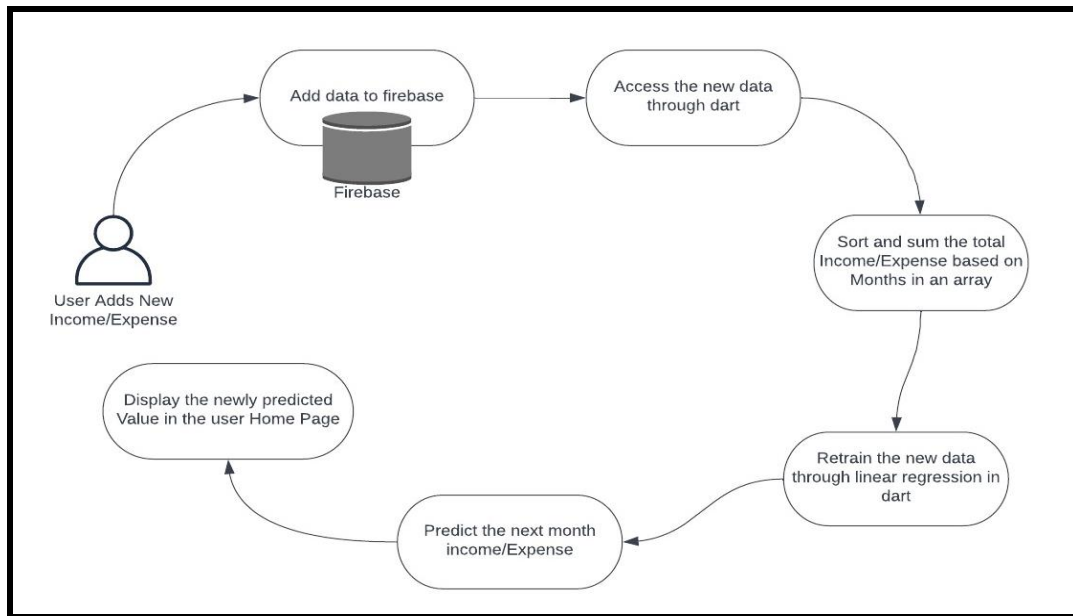


Figure 8 . Predicting user income using linear regression and past data

The accuracy of the predictions depends on the quality and quantity of the data provided by the user. As the application collects more data over time, the accuracy of the model is expected to improve. The Mean Square Error (MSE) and Mean Absolute Error (MAE) are used to evaluate the performance of the models. MAE and MSE values are shown in figure 9. The MAE and MSE are measures of the difference between the predicted and actual values of the dependent variable, so a lower MAE and MSE indicate that the predictions are closer to the actual values. Therefore, lower values of MAE and MSE indicate that the model is performing better in terms of its predictive accuracy.

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MAE for 36-month prediction: 697.4929351400388
MSE for 36-month prediction: 689945.366606091
  
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Figure 9. 36 Month prediction performance

The application's ability to accurately predict income and expenses is expected to improve as more data is collected from users over time.

In the future to further improve the accuracy of the model, the application could also incorporate additional features such as the user's current account balance, recurring expenses, and income sources. This would provide the model with more data points to learn from and make more accurate predictions. In addition, as the data and accuracy of the predictions improve the application could also provide users with suggestions for saving money, such as reducing unnecessary expenses or increasing income sources. This could help users to improve their financial situation and make more responsible financial decisions.

In conclusion, the machine learning-based financial management mobile application developed for college



students aims to enhance their financial literacy by providing them with a forecast of their financial performance for the upcoming month. The application uses machine learning algorithms such as linear regression to predict the user's income and expenses based on their past spending patterns. The accuracy of the predictions is expected to improve as the application collects more data from users over time. Overall, the application can help college students better understand their finances and make informed financial decisions.

## Conclusion

In conclusion, it is critical to prepare college students financially, as they will represent and contribute to the country's future. The mobile application developed for college-going young students aims to assist them in becoming more financially literate by tracking their spending habits, offering insights into their purchasing habits, and suggesting financial articles for them to read. The program also promotes savings by showing student discounts and deals in the user's city. Several studies have emphasized the importance of financial planning among the youth and the role of mobile applications in achieving this goal. Machine learning is employed to analyze and predict data, providing users with relevant and straightforward insights to make better financial decisions. The use of the agile development technique, implemented using the flutter framework based on the Dart programming language, allows for a flexible and collaborative approach to software development. Finally, a comparison of the prototype with other existing budgeting applications shows its advantages and limitations. Overall, the project's aim is to prepare college students in Oman for financial success and self-sufficiency.

## Limitations and Future Studies

Based on the results of the application, several enhancements will be made to improve its performance and user experience. Firstly, the application will provide annual statistics and a monthly user summary to help users track their financial progress more effectively. Additionally, an API will be developed to automate the conversion of user bank statements into data for the Firebase database, reducing the need for manual data input. The program will also be linked to the user's bank account for automatic data syncing, making the app more convenient to use. To further improve the application's accuracy and efficiency, the machine learning algorithm will be evaluated and refined. This will enhance the application's predictive capabilities and improve its overall performance.

In order to gather user feedback and ensure the application meets the needs of college students, the app will be tested for at least one month. This testing period will help to identify any issues and make necessary improvements before launching the application.

The applications financial reads section will provide customized article recommendations based on the student's savings performance. For instance, if a student has saved enough money, investment articles will be

recommended to help them learn more about investing and growing their wealth. If a student does not have any savings, the app will recommend savings articles to help them learn about budgeting and saving money.

Furthermore, the offers and discounts section will not only feature shops where students can save money but will also display discount advertisements tailored to the student's city of registration. This will enable the app to generate revenue while also providing students with relevant and useful information about available discounts and offers.

The ultimate goal of the application is to promote financial literacy and independence among young people. By empowering college students with the tools and knowledge they need to manage their finances effectively, the application aims to make a meaningful contribution towards building a financially aware and responsible generation.

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## Developing The Perspective of Preservice Mathematics Teachers Through Early Field Experience

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**Abstract:** Field experience is done to provide an opportunity to preservice teachers to develop pedagogic, professional competencies, personality, and social holistically through classroom learning and interactions outside the classroom. The purpose of this study is to describe what preservice teachers observe and what their perspective process they get during an early field experience. The subjects were sixteen preservice mathematics teachers who do field experience in separate schools and data collected by questionnaire, reflection and interview. Questionnaire data analyze with quantitative method using dependent t-test to compare their perspective before and after early field experience. Data from reflection and interview analyze with descriptive qualitative method. The results that there is difference of perspective before and after field experience. Through observation and learning class and school environment makes perspective preservice teachers' growth in their readiness be a teacher, design curriculum, teaching strategies, self-confidence.

**Keywords:** Curriculum design, Teaching strategies.

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### Introduction

The formation process in student grows according to the input given to them. To produce capable students in accordance with the expected skills or outputs, it is necessary to provide adequate learning during their education. During lectures, mathematics education students have been given theoretical knowledge, but it is not enough just only theory, it is necessary to give them meaningful experience learning for themselves to prepare to become professional teachers. This is a challenge in preparing teachers, how to prepare prospective teachers by linking educational theories and teaching practice (Eutsler, L, 2019). So practical learning is needed by participate a field experience program so that students teachers can learn from the school environment (Heafner et al., 2014). Field experience is provided to bridge the theory-practice gap by transforming professional knowledge into instructional practice. Conversely, for field experience to be effective, prospective teacher must also start with in-depth professional knowledge (Kulgemeyer, C, 2020).

The results of Nelson's research (2019) found that there is a positive impact of field experience for prospective teachers on their beliefs and intentions because of seeing technology that usually used by professional teachers with a meaningful learning approach. A student needs to be equipped practically to equip them with various skills as designed in the curriculum. In addition, their growth also needs to be evaluated for progress, not to compare with other students but to compare before and after getting lectures or programs that have been given. The goal of any field experience program undertaken is to prepare qualified future teachers (Anderson, J. 2022). Students, education staff, curriculum, learning facilities and educational environment are some of aspect that affect the educational process (Syofyan, 2022)

Seeing the importance of field learning experiences for prospective teacher, it is necessary to hold a field experience program that provides opportunities for prospective teachers to learn from the school environment. However, Turmuzi's (2021) findings that prospective mathematics teacher at Faculty Teachers College Mataram University feel that they are not ready to do Field Experience Program (FE) at school because many of them do not master with teaching materials. They also do not understand the learning strategies that are in accordance with the teaching materials. They tend to implement new learning strategies based on their understanding and do not pay attention to the student's situation. Moreover, Schiucheeti (2019) findings that although students' teachers self-efficacy levels vary each semester, statistically there is increasing in self-efficacy levels when compared with before participating in field experiences. Despite the increase in student self-efficacy, students teachers stated that they still need field experience programs.

By seeing the importance of students learning practically and their readiness to become a teachers, the field experience program at Faculty Teachers Collage - Pelita Harapan University was carried out two times to equip prospective mathematics teacher to develop their teaching skills and prepare them to become professional teachers. First, prospective teacher are given learning opportunities through participatory and collaborative observation with mentor teachers. Students teacher are expected to observe the entire process of preparation, learning and assessment holistically where they are guided by mentor teachers at school. In the series of observations, students teachers must also discuss the results of their observations with the mentor teacher. The number of teachers observed by students must be more than one teacher, so it is possible that prospective teacher students can learn more from teachers mentor and the school environment. Mentor teachers assist prospective teacher students in understanding a series of learning plans designed according to the learning context at school, assist students in understanding work ethic and school expectations, giving feedback from teacher students performance with orally and writing.

Not only mentor teachers, the Principal also plays a role in shaping the professionalism of student teacher because be a intercedes communication between the school and the Faculty, ensuring that organizational arrangements and other things that need to be available properly, so that students teacher have access to the school's online platform, access to teaching materials, and other access in school activities, ensure that the mentor teacher knows and performs well his duties and roles. Before student teachers start their experience in school, student teachers also briefed on all procedures in implementing Field Experiences and explaining what

must they will done and prepared during Field Experiences. Students teacher are given a handbook to assist them in carrying out all the tasks given. Students teacher not only supervised by mentors and principals, but also guided by Lecturer as a supervisors who will monitor the implementation of field experience programs and contribute to the development of students teacher by helping them appreciate the relationship between theory and practice, work with them collaboratively, to form, to direct, to challenge and to encourage them to develop their teaching competencies, build relationships with student teacher in order to create effective communication, provide support by providing fair, honest, and specific oral and/or written feedback that can assist students teachers in developing their observation skills carried out online, provide assessments based on student teacher observation experiences through e-portfolios.

During the field experience program, students teacher learn from the school environment, whether from students, teachers, principals or others in the school environment. Students teachers observe all school activities that help in preparing themselves to become a professional teachers. In addition, students teachers also reflect on all their experiences by assessing themselves, strengths and weaknesses and actions that will be taken in the future, willingness to learn, clear focus taken for the next step to become a professional teacher. Through self-reflection, students are expected to experience growth from their field experiences (Mohebi, L. 2022; Abdel-Basset et al., 2018). Not only reflection, students teacher also get feedback from teacher mentors about their skills, ability to collaborate, initiative, confidence, polite appearance, and confidence. This feedback expected students teachers also focus on aspects that they need to be developed and maintained in the process of preparing themselves to become professional future teachers (Gibson and Musti-Rao, 2016; Gürkan, 2018).

After doing field experience at school, students teachers are expected to gain experience as their provision before being entrusted to be teachers and how students construct a perspective as a prospective teacher and how that view is constructed. Perspective is the process in which individuals are aware when making decisions and how to respond to accepted stimuli or as a point of view on how to see observed phenomena (Aw, 2011; Martono 2010; Sihite, MR, & Rangkuti, LA, 2023; Wardhana, WB, Suryaningrum, CW, & Romdhani, RW, 2022). The purpose of this study is to describe what experiences students gained during early Field Experience Program and how their perspectives developed after finishing early Field Experience.

## Method

The research method used using quantitative methods by looking at the development of students' teachers perspectives before and after Field Experience Program (Ramdhan, M, 2021). Data was collected from sixteen mathematics education students who attended the Field Experience program at the school. Data on student's teachers perspectives were collected through questionnaires, reflections and closed interviews. Meanwhile, the data from reflections and interviews were analyzed descriptively. After the questionnaire data was collected, the data was processed using a non-parametric test using the Wilcoxon test using the help of SPSS to see the difference of students' perspectives before and after Field Experience Program (Unaradjan, DD, 2019).

**Results and Discussion**

Data from students' teachers perspectives before and after participating in the field experience program were compared and analyzed with the help of SPSS. Here is the data from SPSS processing:

**Test Statistics<sup>a</sup>**

	After_Field_Experience	Before_Field_Experience
Z	-3.191 <sup>b</sup>	
Asymp. Sig. (2-tailed)	.001	

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

From the research data, it was obtained that the average perspective of students teachers before early Field Experience program was 29.91, but after participating in the program, the experience increased to 33.06. This shows that students' perspectives develop after taking Field Experience program. By looking at the results of statistical tests, it was found that there was a significant difference between the perspective of students teachers before and after early Field Experience Program was conducted. It can be seen that the sig value of  $0.001 < 0.05$  means that there is a significant change in their perspective before and after Field Experience Program. This shows that early Field Experience Program has a significant impact in shaping their professionalism. Here is the development of student perspectives from each aspect:

**A. Readiness to Become a Teacher**

Data on student readiness to become teachers before and after early Field Experience Program can be illustrated in the following bar chart:

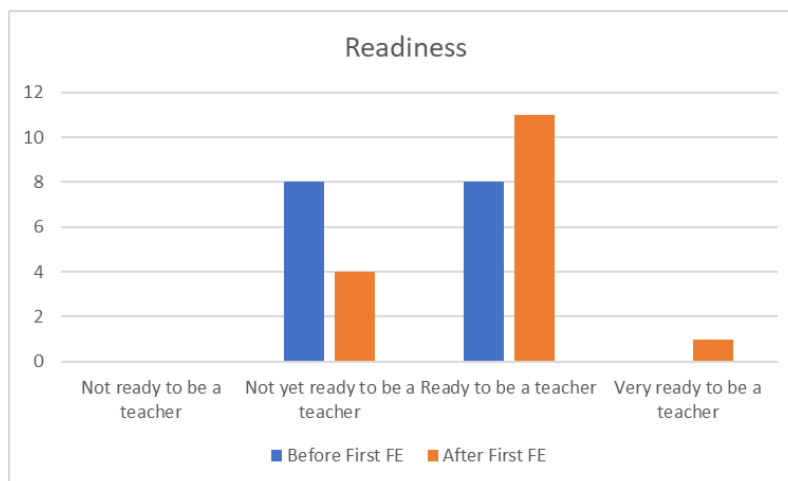


Figure 1. Graph Readiness to Become a Teacher

Before early Field Experience Program, there were 8 students who were not ready to become teachers and 8 students were ready to become teachers. However, after early Field Experience Program saw an increase to 11 people ready to become professional mathematics teachers and 1 student felt very ready to become a teacher.

Before early Field Experience Program, students teachers still had doubts about their ability to master mathematics content, learning methods, class mastery, self-mastery, were not able to direct students correctly, still needed to have a better personality, responsibility, discipline. However, after early Field Experience Program students teachers learn a lot to prepare communication skills and how to manage classes by well, learn to place themselves as a guide so that they can guide students to grow to know themselves, more able to control their emotions so they can handle the classroom learning process, need to prepare material and methods to delivery the content. Studentteachers are increasingly confident and prepared to become professional teachers who can be role models, good guides and guides for their students.

### B. Ability to Design Curriculum

The following data describes on students' ability to design learning before and after early Field Experience Program:

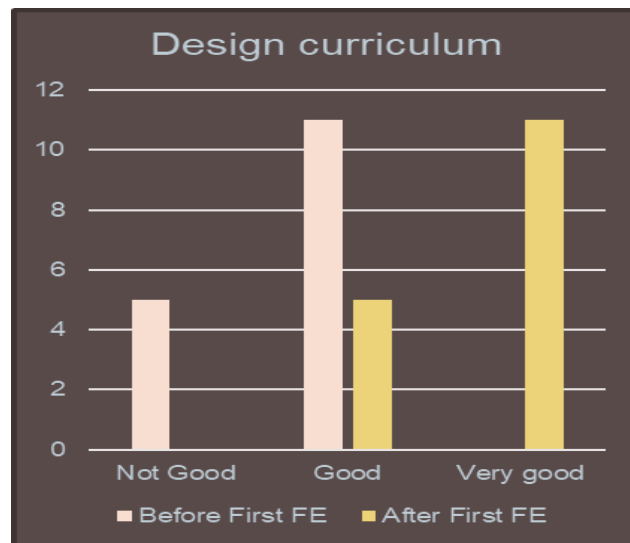


Figure 2. Graph Ability to Design Curriculum

From the results of the questionnaire, 12 students teacher considered the ability to design learning or curriculum design in a good category, while 5 students teachers were not good. However, after the early Field Experience Program there were 5 students teacher who thought that their ability to design learning or curriculum was very good, while 11 other students teacher were in a good category.

Before early Field Experience Program students teachers were able to compose material and learn mathematics quite well but were not proficient/trained. Students have also studied it theoretically in other curriculum and pedagogy courses, but students still need to learn direct observation of good curriculum or learning design.



There are students teacher who feel that their ability to design lessons is not good because when presenting in previous class, students teacher have not been able to master the methods and ways of teaching properly. Some of them still do not understand very well how to compile a curriculum that is more interesting and useful for students. However, after early Field Experience Program, students teacher increasingly understand that they need to have good relationships with students, understand class characteristics, class situations and conditions and get to know each student's personality so that they can get to know students' methods, strategies and learning styles so that they can be attractive to students. Students teachers need to design learning with a lifelong understanding that is useful in learning and understand the important essence associated with contextual issues, make teaching preparations including mastering teaching materials very well. Besides that, there needs to be a willingness and effort to adapt, change, and try various ways to make the class even better. In addition, students are committed to be more enthusiastic about learning because it is very useful and will become their provision later. This is in line with the results of Akvovo's research (2020) that students teacher learn to absorb culture during early Field Experience Program to facilitate their learning.

**C. Teaching Strategy**

The ability of students to design teaching strategies before and after conducting early Field Experience Program is illustrated in the following bar chart:

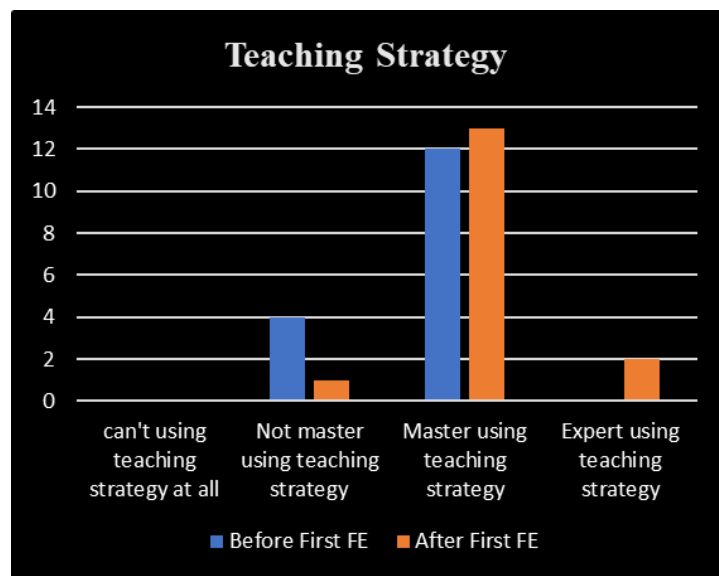


Figure 3. Graph Teaching Strategy

From the results of the questionnaire, before early Field Experience Program as many as 12 students teacher had the ability to master good mathematics teaching methods and strategies, while 4 students teacher had not mastered. After the early Field Experience Program there were 13 students teachers who had the ability to master mathematics learning methods/strategies well, 2 students teacher were very good at it and there was one student who still did not have the ability to master mathematics learning methods or strategies by well.

Before early Field Experience Program there were student teacher who thought that they had mastered teaching strategies well because they had learned from previous experiences in learning mathematics, even though it needed to be improved further, some students teacher found it difficult to apply and had not been able to teach well because they lacked mastery of the material and needed teaching observation. Students teacher often meet student who do not really like math. As a result they are not very active, quiet, maybe even noisy in learning. After early Field Experience Program, students teacher think that they can learn how teachers must be able to design and master the strategic methods that will be used for teaching so that learning is conveyed in a clear and structured manner and facilitates each of the unique characteristics of student learning. Students teacher learn a lot, through strategies that make students understand, how to make students want to be open to teachers about their difficulties, their opinions so that learning is interesting and runs interactively, not monotonously. Students teacher need to master math content well, so they can divide topics and develop learning plans and time allocations properly.

**D. Self Confidence**

The developing of students teacher self-confidence before and after participating in early Field Experience Program is illustrated in the following diagram:

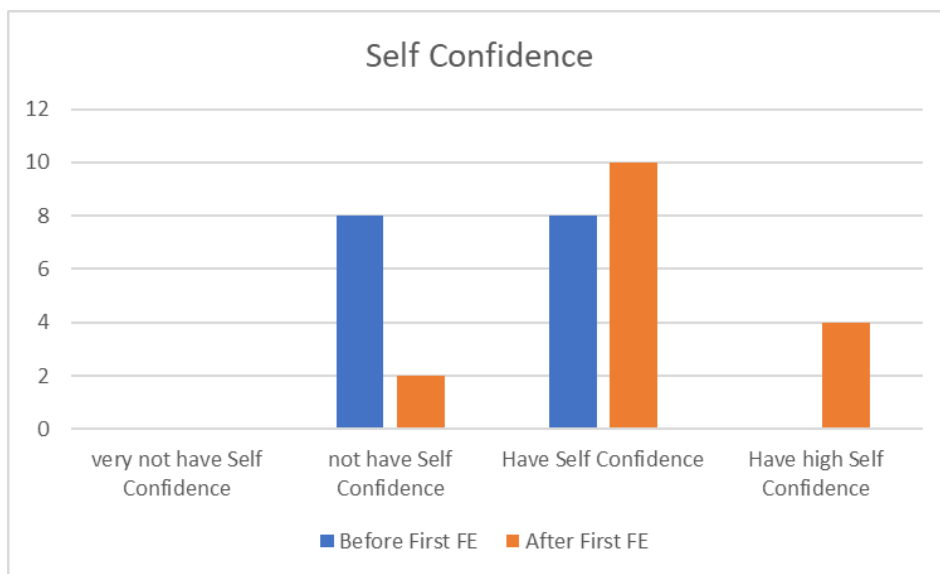


Figure 4. Graph Self Confidence

The results of the quistionare show that 8 students teacher were not confident before early Field Experience Program, 8 students teacher were already confident to become teachers. However, after the early Field Experience Program there were 2 students teacher who were not confident, 10 students teacher became confident and 4 students teacher were very confident.

Before early Field Experience Program students teacher lacked confidence because their math skills were still weak and their teaching skills weren't good enough, they weren't able to solve questions correctly, they didn't have good communication skills, when in front of the class because it allowed them to meet students with abilities mathematics smarter than them so that there is a feeling of fear of being judged if they make a mistake, some of students teacher feel comfortable when teaching others. However, after early Field Experience Program students teacher are confident in teaching, their speaking skills increase, student teacher perceive that the reality they encounter is not as bad as what they previously thought. Students teacher feel that they need to continue studying because they still have time to learn and improving their skill. Students teacher realize that self-confidence is very important for a teacher. Students teacher already have an overview of the school and the classroom learning process. The good experience of students teacher make them grow in self-confidence because they are able to relate to students and they are very pleasant.

Through the early Field Experience Program, students teacher grow and are equipped to become professional teachers (Shelton, R. (2020); Hamilton, E.R. 2019; Zeichner et al. 2015). This is in line with the results of Azwar's research (2019) which found that field experience programs make prospective teachers more confident in their teaching. The results of Sumartini's research (2020) show that prospective mathematics teachers have confidence in mastering mathematical knowledge, but feel less confident that they are able to convey mathematics material to students. This lack of confidence takes a toll on them pedagogical abilities.

Students teacher learn a lot from their experience program. Students' perspectives get better after finishing the early field experience program. Students' teacher perspectives are formed from their experience learning directly in the field how to become professional teachers. This perspective is formed when interacting with students, teachers, principals. This process shapes their readiness to become teachers (Ping, C, 2018). After directly interacting with students, students teacher feel more prepared to become a professional teachers because of their experience while at school. After participating in a series of lessons and learning from mentor teachers who guide them, students teacher feel more capable to designing lessons and more mastering learning strategies. In addition, early field experience has an impact to make better students teacher self-confidence. Students teacher feel more familiar with the school environment and more confident to become a teacher.

## **Conclusion**

The early Field Experience Program has had a significant impact on changing perspectives for the better for students teacher. The perspective of students teacher changed after completing early Field Experience Program. Students teachers feel more ready to become professional teachers, the ability to design learning, teaching strategies and also their confidence is getting better after completing the field experience program. Students teachers who take part in the field experience feel the emergence of new skills, including experience, self-reflection habits, skills and knowledge for job interviews, and comfort with the observation process, better understanding the school context (Bartolome, S.J. (2017; Koubek, E. 2021).

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## International Communication of Chinese Costume Culture: Taking Chinese Cheongsam (qipao) as an Example

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**Abstract:** Chinese traditional costume culture is regarded as a part of Chinese culture. Inheriting and propagating traditional Chinese costume culture around the world are the missions of the times for the Chinese people. China in the 21<sup>st</sup> century is infinitely close to the center of the world stage because of its rapid economic growth, which inevitably asks for the corresponding share of international discourse. Therefore, China's external communication should not only be considered in the political and economic aspects but should pay more attention to its traditional culture, which makes it easier to change foreigners' impression of China from the inward. Taking cheongsam (also called *qipao*) as an example, this paper aims to research the development of Chinese traditional costume culture and to explore the fresh approaches of the international communication of Chinese traditional costume culture under the background of a new era, increasing the international influence of traditional Chinese costume culture.

**Key words:** Traditional Chinese Costume Culture, Cheongsam, International Communication

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### Introduction

China, a country with a profound cultural atmosphere, has experienced the historical evolution and cultural inheritance and development of ancient and modern times and now has shown a new appearance of thriving and vigorous growth. People's lives are inseparable from clothing, food, shelter and transportation. Clothing ranked first, known as China's national dress cheongsam, in the waves of sand, constantly evolving, and eventually being retained over time. Chinese traditional cheongsam, as a symbol of beauty, fully displays female

temperament beauty and pliable beauty. It has survived the ups and downs of development, which is closely related to the charm of Chinese traditional culture.

For the traditional Chinese costume—cheongsam—there do not seem to be enough books for people to read or study. On the local market in China, the books about cheongsam can be divided into three categories: the first category is literature books, such as the novels written by Zhang Ailing, Dong Qiao and other authors. In the novels, the descriptions of the characters usually involve some elements of cheongsam. For example, the book *But I just love cheongsam* was written by the writer Shi Liu and covers a comprehensive range of cheongsam from cheongsam lovers to cheongsam craftsmen and to cheongsam customization workplaces on the street and lanes; the second is books on the introduction and appreciation of cheongsam craft, such as the book *cheongsam and Famous Women* written by Chen Yunfei; the third is only a pure introduction to cheongsam craft, such as *cheongsam Sewing Methods*, *Cheongsam Special Techniques*, and *Encyclopaedia of Chinese Costume Production* written by Yang Chenggui, a master cheongsam maker. However, all of these books have not been translated into English, and some of them are written in traditional Chinese characters, but not simplified ones, which greatly hinders the international spread of Chinese cheongsam and discourages foreign readers.

International communication is an very important way of transforming culture into soft power, so the aim of this article is to explore the development of traditional Chinese costume, taking cheongsam as an example, and its international communication, hoping to be helpful in the spread of Chinese costume culture abroad on the basis of previous studies.

### **The Origin and Development Of Chinese Cheongsam**

After years of development, through continuous innovation, Chinese cheongsam has been shining on the land of China. However, its origin and development over the years are worth discussing.

#### *A. The Origin of Chinese Cheongsam*

Cheongsam is generally regarded as a kind of upper and lower one-piece clothing of the Manchu ethnic minority in northeastern China. In the beginning, cheongsam originated from Manchu costume in the Qing Dynasty. In the Qing Dynasty, Manchu people were called “Banner People or *qi ren* who are one of Chinese minorities, so the clothing inherited from them has been called as cheongsam or *qi pao*.

#### *B. The Development of Chinese Cheongsam*

In the middle of the Qing Dynasty (1728–1820), as a series of ethnic policies aimed at promoting the integration of the two ethnic groups were issued in the early Qing Dynasty, the Manchu and Han ethnic groups began to follow suit, resulting in changes in clothing. As the first large-scale social reform movement in the 20th century, the "New Deal of the late Qing Dynasty" has milestone significance in the early modernization of China. At the same time, the New Deal also provided great opportunities for the further integration of Manchu and Han nationalities.

Great changes have taken place in the costumes of the Manchu and the Han groups, and both of them followed the example of the Manchu cheongsam, which became increasingly popular. At the beginning of the 20th century, under the influence of the Western feminist movement and the New Culture Movement, which swept China alternately, influencing a lot, Chinese female students set off a civilized new dress trend in fashion. The so-called civilized new dress is plain clothes without jewelry but with a long black skirt without patterns underneath (Tan Ting, 2020). Shanghai, as the forefront of the national trend, is increasingly innovative in the development of cheongsam under the influence of foreign fashion and multiple regions. On April 16, 1929, the Central Government of the day in China promulgated a regulation on the dress system for the first time, which officially confirmed the status of the cheongsam as a national apparel and put it in law for the first time (Zeng Yaqi, 2017).

The 1930s and 1940s has been called the golden age of the development of Chinese cheongsam, and the famous "Shanghai cheongsam" also developed during this period. In the 1940s, the style of cheongsam became increasingly convenient. After the 1940s, the popularity of cheongsam slowed down due to the war, but it was still the favorite suit among women. The biggest feature of cheongsam in the 1940s was that it changed from plane cutting to three-dimensional cutting. The original cheongsam was cut in such a way that the sleeves and the body were joined together, and a piece was added below the elbow. By the 1950s, women generally wore clothes that were easier to move, so cheongsam was rarely worn in women's daily lives, but many dignitaries still chose cheongsam when attending some special or important occasions, such as wedding banquets, Spring Festival celebrations and international gatherings. As a kind of old culture or custom, cheongsam suffered greatly from the movement of the "Four Olds Break" during the 10 years of the Great Cultural Revolution of China. During the height of Chinese revolutionary zeal from the 1960s to 1970s, cheongsam almost disappeared in China. It was not until the late 1980s, with China's reform and opening-up and economic recovery, that cheongsam came back to people's attention. In 1984, cheongsam was designated by The State Council as the dress for female diplomats, which shows its important status and acceptance to the people. On May 23, 2011, the handmade process of cheongsam was approved by the State Council of China and announced as one of the third batches of national intangible cultural heritage. In November 2014, at the 22nd APEC meeting held in Beijing, the Chinese government chose cheongsam as the dress of the wives of participating leaders<sup>[13]</sup>. Currently, the development of cheongsam in China can be said to be brilliant. After going through untold hardships, cheongsam in Today's China has gained its own place, not only in different colors and styles but also in patterns with various elements, containing the oriental beauty of Chinese women. As a traditional Chinese costume, it is on the basis of cultural confidence that cheongsam has been popular around the world for its infinite attraction and charm.

### *C. The popularity of Chinese Cheongsam Around the World*

Chinese cheongsam is a very familiar and favourite dress for Chinese people and has been regarded as the national dress in the whole country. Many Chinese women are extremely fond of wearing cheongsam on some official occasions, which can reveal unique personality charm and is considered respectful to other people.



But what's the impression of it in the foreign countries? It is understood that as China has persistently spread Chinese excellent traditional culture and an increasing number of international cultural elements have increasingly been absorbed in Chinese cheongsam, cheongsam is also constantly bombarded with the world's attention. In fact, early Chinese cheongsam was affected by Western culture, which led to its modern thriving, and the culture of Chinese cheongsam is also very popular in the world. Many Western dress designers are also gradually combining cheongsam culture with modern Western costume cultural elements, such as the conveyance of the core idea of clothing needing more advanced thoughts. The designer of Dior brand, which represents the highest spirit of Paris haute couture, was the first to choose Chinese cheongsam. With the background of golden Shanghai in its prime, China and the West were combined to design international fancy dress with Chinese characteristics, which made the world once again marvel at the wisdom of Chinese people and the superb works of designers and showed the charm of Chinese cheongsam to the international vision.

Furthermore, the use of Chinese cheongsam is more diverse, such as a large number of women in the wedding ceremony choosing cheongsam as wedding clothes and so many television hostesses in the variety show wearing cheongsam. The shape of cheongsam is more westernized, such as some local details of processing, using deep U-shaped collar, a zigzag collar boldly exposed front chest, using Rococo style with layers of lace flared cuffs, or "grafting" with Western dresses, the upper body and lower body skirt to form two styles of East and West. Not only will Chinese women choose such a cheongsam, but a large number of Western women also like the new style of cheongsam with an oriental flavor, and some Hollywood stars have repeatedly chosen both elegant and fashionable cheongsam as a dress on the red carpet. These all prove once again that Chinese cheongsam is still popular internationally (Wei Yulong, 2013).

### **Drawbacks In Cheongsam's International Communicaton**

With the growing soft power of Chinese culture, the international spread of Chinese traditional costumes, especially cheongsam, has become increasingly extensive and diversified. However, in the process of the international spreading practice of cheongsam, there are still many internal and external drawbacks to be addressed, which can be considered from the following three aspects.

First, the global COVID-19 pandemic outburst from the end of 2019 has hindered international economic interactions. The import and export trade are still under strict control. Although Chinese cheongsam originated a long time ago, the occupation of its international supermarket share is not a matter of overnight; furthermore, the current epidemic, which has been torturing the whole world, makes the international spread of cheongsam difficult.

Second, China's economic fast development has led to many "China threat arguments" in the international arena of economy, which make some politicians call for a boycott of the international communication of Chinese culture, including traditional costumes, completely unacknowledging or ignoring the international contribution of Chinese people's wisdom reflected from cheongsam, even though Chinese people have actually made

remarkable achievements for the whole people. In fact, it is not China's problem that is called the China Threat but the worries of the people who are afraid of the impact of China's rise, which dose obviously mean to the world.

Last but not least, the lack of internationally renowned and competitive fashion designers in China, especially local couture designers, seriously hinders Chinese cheongsam international communication. Designers of cheongsam should have to adapt to the style of a new generation of international women and try the best to include the international popular cultural elements in their design but not be content with staying where one is all. Since the reappearance of cheongsam in the 1980s, it has not recovered its former popularity because of less modification according to wearers' needs. The reason why Paris is thought of as the paradise for fashion designers throughout the world is just because of the endless stream of world-famous fashion designers. Chinese fashion started later than Paris, Italy, etc. Furthermore, Chinese cultural elements are very complex to design in clothing; if the design is not good enough, it is not easy for designers to be superstar, and dressing is difficult to attract people to wear in daily life. In addition, training a high-end fashion designer is very long-term and requires long-term planning funds and energy support. Many fashion designers will switch to other majors if they do not have good employment opportunities or development prospects after they finish their studies, which is seriously inconsistent with the ability to tell a good Chinese story in international communication.

### **Proper Name Translation**

With the international spreading process of Chinese cheongsam, an increasing number of foreign people have begun to pay close attention to and enjoy traditional Chinese clothes (Chen Xianhong & Song Fazhi, 2019), but because of inappropriate spreading approaches and international discourse modes, the external spread of traditional Chinese clothing is still not sufficient. In particular, the translation of some terminologies is very important in the process of cheongsam's international communication, which is worth the communicator's thinking of how to regulate the translation discourse.

#### *A. The Translation of Cheongsam Itself*

There are several different translations of Chinese 旗袍: *cheongsam*, *Qipao*, *Qi Pao*, *Chipao*, *Chirpaur*, *Mandarin Gown*, and *Chinese dress*. Among the seven translations, the first five are derived from the transliteration of "长衫" and "旗袍" in Chinese, and the last two are explanatory translations based on the external characteristics of cheongsam. *Qipao*, *Chi-Pao*, *cheongsam*, and *Mandarin gown* can be found on page 1340 in the Chinese-English Dictionary of the New Century. *Qipao* and *Qi Pao* are transliterated according to the Chinese Pinyin scheme; *Chi-pao* and *Chirpaur* are derived from the Cantonese dialect pronunciation of "旗袍".

According to the statistics of Chinese scholars Peng Chaozhong and Rao Ping (2016), when searching the English translation of "旗袍" on Amazon, a well-known online shopping platform, there were various search

results. Not only could the English translation of the name not be unified, but even the pictures attached to the search results were not Chinese cheongsam. However, searching the English translation of cheongsam on CNKI (China National Knowledge Infrastructure), the situation is similar. Chinese scholars have not even made a unified transliteration of 旗袍 until now.

The lack of uniformity in the English translation of the name of Chinese cheongsam inevitably confuses the readership, which is obviously not conducive to the promotion of Chinese costume culture and runs counter to the concept of "telling the Chinese story" and "letting Chinese culture go global" advocated by China. To unify the English translation of Chinese cheongsam, Chinese disseminators should study the cultural connotation of clothing from the domestic and draw enough attention from academia (Peng Chaozhong & Rao Ping, 2016). To promote Chinese costume culture worldwide, Chinese people should not only be sensitive to the word "cheongsam" but also be able to quickly identify this traditional Chinese dress as cheongsam.

#### *B. The translation of Cheongsam's Pankou*

Cheongsam itself is a work of art with tailoring, sewing and patterns all having their own characteristics, which embody the essence of Chinese people's thoughts, wisdom and talents. Therefore, when attaching importance to the English translation name of cheongsam, one should not forget the English translation of its own elements.

Take *pankou* as an example. As one of the most representative elements of cheongsam, similar to "cheongsam", its English translation is not universally accepted by the public. In the article of *Qipao 2.0* published on August 12, 2012, in *China Daily*, *Frog button* is described as follows: Sometimes its ubiquitous skirt slit is nowhere to be found, and its customary front overlap and loop frog buttons do not actually come undone (Tiffany Tan, 2012); and in another article of *China catwalk* published on January 9, 2011, in *China Daily*, Pankou was mentioned as Mandarin collars and frog-buttons, Qipao-inspired body-hugging shifts; what's more, in the article of *Confucianism is more about way of life* written By Yao Ying on January 14, 2010, there is a sentence like this: In his crimson Tang suit with frog buttons, Kung looks more like a man from the late Qing Dynasty (Yao Ying, 2010). The frog button is used to refer to the *pankou*.

However, the transliteration method Pankou is becoming more common and acceptable and is still not regulated, but it greatly reduces some confusion in cheongsam's international communication. Therefore, in the future, it is necessary to standardize some terminologies for greater efficiency of traditional cultural out-spreading.

#### **Cultural Characteristics Implied in Cheongsam**

The way for cheongsam to be an internationally renowned fashion is to pay more attention to propagating the culture of cheongsam, not only the patterns and quality. The international communication of cheongsam must be based on well-telling Chinese traditional stories and thoughts, which can make cheongsam accepted by other countries' people. In particular, modern cheongsam usually has its own traditional auspicious Chinese symbols and stories with profound imagery.

As the world's second largest economy, China's history, culture and economy have largely attracted the world's interest. China is a country with its own distinct national cultural characteristics. From ancient times to the present, Chinese culture of Confucius and Mencius, *Four Books* and *Five Classics*, as well as the 56 nationalities of China's own national culture, and the vast regional culture of the earth have made Chinese culture well-known in the world.

Similar to other countries' clothing culture, China's clothing culture has its own national characteristics compared with the world's clothing culture, especially with the clothing culture in Europe and the United States, but China's traditional classic cheongsam is not as popular as famous international clothing brands. Therefore, it is necessary for Chinese designers and managers to learn from those successful brands in the world (Guan Yin & Xue Yanwei, 2009), such as Nike and other big names, for their approaches of development, costume culture, business ideas and models. Chinese clothing culture is diverse, and China has more formed national costumes, such as cheongsam, Hanfu, and Zhongshan suit, which are the most prominent embodiments of traditional Chinese clothing, but these Chinese clothing brands to the world are a minority. Looking around the world, there are many major internationally renowned clothing brands, such as Chanel, Louis Vuitton, Dior, Versace, and Prada. However, Chinese fashion brands that are popular in the world can be counted on one's fingers. Of course, the Chinese sports brand Li Ning, with the mission of "igniting passion with sports", has been one of the biggest sponsors of Chinese athletes' clothing in the Olympic Games for many years and has gradually become known by the world, showing the spirit of Chinese athletes who are striving for glory for their country.

Therefore, in the international communication of Chinese cheongsam, it is worth learning from the development of the Lin Ning brand. In some momentous occasions, such as international gatherings such as toasts, award ceremonies, world sporting events, etc. hosted by China, female officials, hostess, lecturers, ceremony attendants, and ritual girls can choose to dress cheongsam as a type of "uniform", which is helpful to circulate or diffuse Chinese cheongsam, making it known to the world people and letting foreigners experience the implied Chinese cultural elements. However, although some Chinese clothing brands with ethnic styles and modernity have caught the attention of Hollywood celebrities, and Nicolas Cage, Angelina Jolie, Keanu Reeves, Naomi Campbell and Kate Moss, which are all big fans of Shanghai Tang's chic Chinese style (Gan Tian, 2011), and what's more, an increasing number of famous people or foreigner officials make their appearances on clothes rooted in Chinese culture and history, the case is that most of the suit is not designed by Chinese local designers. Traditional Chinese cultural characteristics have not been actively explored and fully shown to the world. To tell the Chinese story well, the most important thing is based on Chinese cultural self-confidence, making their own national clothing brands with the most cultural characteristics. Therefore, it is very important to integrate Chinese cultural characteristics into the cheongsam brand to establish its international brand and reputation.

### **Approaches And Methodologies In Communicating Chinese Costume Culture**

There are various cultural elements in China's traditional costume. In the process of telling Chinese stories well through the Chinese costume's international spread, it cannot pay too much attention to the approaches and

methodologies in the international communication of Chinese costumes.

#### *A. Cultural Communication Through Films and Television Works*

In fact, there are few traditional Chinese costumes, such as cheongsam, appearing in film and television works, which is not conducive to the spread of traditional Chinese costume culture. It is true that there are some films such as the movie *Lust and Caution* (adapted from Zhang Ailing's novel of *Love after Love*) directed by Ang Lee, in which the Qipao worn by Wang Jiazhi, the heroine, is similar to the original description in the novel: The indigo blue, water-soaked texture and satin cheongsam with knee-length, paired with small rounded collar which is only half an inch high, looks like a Western-style clothes, which shows the beauty of Chinese cheongsam for the audience. The intoxicating beauty, aptly reflecting the beauty in the bone also in the skin, plucks the audience's heartstrings, showing the charm of Chinese cheongsam.

Another Chinese movie, *Mood for Love*, is also a classical movie that includes 23 pieces of cheongsam worn by Maggie Cheung (Zhang Manyu, a famous Hong Kong female artist). Beautiful scenes of the costume in the movie show us the beauty of the Shanghai-style cheongsam, and the style of cheongsam varies, making people marvelous at the charm of cheongsam. The knee-high style of cheongsam in the movie is the fruit of the development of Shanghai-style cheongsam in Hong Kong for years, and the colors of cheongsam are very popular in Hong Kong at that time, rather than the classic Shanghai cheongsam look (Anonymity, 2012). There are other more female roles in Chinese films and television works, whose portrayals with the clothes of cheongsam are photographed, such as Ni Ni in *The Flowers Of War* and Jing Tian in *Rattan*, both of which are from the Chinese mainland. The stage photos of the two female protagonists with cheongsam deeply impressed the audience. It quickly became people's dinner-party material in the world in 2021. The variety of styles of cheongsam makes audiences immersed in the miracle of Chinese cheongsam culture when they appreciate the storyline of the film. Chinese films with traditional cheongsam show the world the great beauty of Chinese costume culture, which is also a kind of national cultural confidence that can greatly enhance the international popularity of cheongsam.

Therefore, the excellent output of film and television works plays a very important role in the international communication of Chinese cheongsam culture. Of course, during the course, apt subtitle translation is necessary and cannot overemphasize too much, which actually does good to the popularity of Chinese traditional culture and which requires translators' strong bilingual ability and subjective initiative. Translators' professional knowledge matching to the corresponding field must be addressed, and Chinese traditional culture conveyed in the film subtitles must never be overlooked in the course of translation.

#### *B. Cultural Communication Through Exhibitions*

With the rapid development of China's economy and the deepening of China's reform and opening up, the Chinese people are increasingly confident in their national culture, and the contribution of Chinese culture to the

world is firmly believed by Chinese and world cultural circles. It is important to re-understand and spread the charm of traditional Chinese costume cheongsam as people's daily cultural life has become increasingly rich and colorful. After numerous improvements in Chinese costume, Cheongsam has become a daily wear for Chinese females and is no longer only dressed on various important occasions. Moreover, as Chinese clothing such as Tang suits and Han clothes go global, an increasing number of people outside China have begun to notice the beauty of cheongsam.

It is well known that clothing exhibits at the major fashion weeks in the world are the most important chances for any brands of clothes going abroad. In recent years, Chinese creations on fashion have constantly gained increasing attention from the world, and under the efforts of local Chinese fashion designers, through blending with international costume development trends and continuous improvement, the costume with Chinese cultural elements has become the highlight of many fashion shows. The gradual attention of Tang suits and Han clothes gained in the West is proof of this.

Therefore, China should actively and frequently take part in all kinds of large-scale fashion exhibitions constantly carried out, showing cheongsam to the world and letting many more foreigners perceive the beauty of cheongsam. Of course, for its domestic fashion weeks, cheongsam shows are also important, as they can help citizens better understand the charm and cultural elements of Chinese cheongsam, strengthening their national costume cultural confidence. Participating in exhibitions held at home and abroad benefits local designers keeping up with the times and close to the audience's aesthetic needs, encouraging local designers to have an overall consideration of the design of the lapel, collar, sleeves, skirt and other parts of cheongsam for people's attention and acceptance, thus continuously improving the style and pattern of cheongsam by absorbing the exotic atmosphere, taking as many opportunities and possibilities as it can to make cheongsam known to all over the world.

### *C. Cultural Communication in Confucius Institutes in the World*

Confucius Institutes, from their statutes, are not only educational institutions for teaching and promoting Chinese language to foreign countries but also an important channel for Chinese cultural communication and exchange with foreign countries. In the process of intercultural communication, the key point is to find cultural common ground and universal values and to further expand the space for sharing meanings. Any cultural "exclusivity" is undesirable (Yu Yibing & Zhang Yelin, 2021).

Many studies have shown that the establishment of Confucius Institutes plays a crucial role in spreading Chinese culture, including Chinese paper-cut culture, Chinese opera culture, Chinese tea culture and other traditional Chinese culture, such as Chinese traditional ideas of "precious harmony", "harmony in diversity" and "the unity of heaven and man", which have spread widely and left a deep impression on other countries' people. Confucius Institutes, as an important cultural bridge between the East and the West, have made many contributions to traditional Chinese culture and have attracted an increasing number of people around the world

to take a keen interest in Chinese traditional culture. In view of the great influence of Confucius Institutes, it is practicable to augment the varieties of the content on Chinese costumes. By carrying out some clothing handmade activities, in the practice course of cutting, sewing, pattern designing and the presentation of final works, students from different countries can experience the infinite charm of traditional Chinese costume production technology and the traditional Chinese costume cultural elements considered. In addition, the variety performance and fashion show in the Confucius Institute are also important forms of blending traditional Chinese costume culture with other countries' costume cultural quintessence in harmony, and comparable with exotic dress, Chinese cheongsam can take full advantage of the opportunity to be aware of its own strengths and weaknesses for future improvement and dissemination. Undoubtedly, the display of Chinese cheongsam at the Confucius Institute is the most favorable way of external communication because the various forms of cheongsam on students can make audiences possess an intuitive and profound sense of what cheongsam is, especially the intellectuality and the grace reflected from the women with cheongsam.

#### *D. Cultural Communication in the Belt and Road Initiative*

The Belt and Road Initiative proposed by China is based on the principles of achieving shared growth through discussion and collaboration. The promotion of cultural and educational exchanges is also a very important part of this process. Chinese Cheongsam is one of the outstanding representatives of traditional Chinese culture. The aim of the Belt and Road Initiative is to establish a community of common interests, destiny and responsibility, featuring political mutual trust, economic integration and cultural inclusiveness.

In today's world, where all cultures are thriving, it is urgent and important for China's excellent traditional costume culture to go to the world and make more people outside accept it. Chinese cheongsam culture, as a very magnificent part of Chinese traditional culture, deserves to be considered in China's international communication. Chinese costume culture has been developed for thousands of years, and it has spread to the countries along the Belt and Road from the past to the present and has been gradually loved by people around the world, which can be proven from the celebrations in various countries for China's Lunar Spring Festival. During the celebration, whether the people on the streets are Chinese or not, the majority of them are on Tang suits or Han clothes.

#### *E. Cultural communication in other new communication environments*

With the booming development of the international e-commerce industry, people are increasingly inclined to shop online. In the age of the internet, thanks to the speed and accuracy of information exchange, many of China's national costume brands come to the fore. As mentioned above, the brands of Tang suit, Han clothes and Li Ning have been known for the whole world. Therefore, through various online introductions and fashion shows, Chinese Cheongsam should keep up with the new tide of internet shopping to establish its own international brand. From clothing design, the way to the output, the costume culture of Cheongsam with Chinese traditional cultural characteristics to the details of Chinese costume button culture, the types of collar,

sleeve, and hem, cardigan and clipping, reveal the fine workmanship and the profound historical and cultural deposits. The fusion of tradition and modernity, the intersection of ideal and reality, will collision different sparks on the net. China has attached great importance to clothing culture since ancient times. The design concept of Chinese fashion trends is to integrate traditional Chinese culture into clothing and promote it to the world. Now, similar to the fashion tide in America and Japan, China has formed its own national fashion tide, which is a kind of dressing phenomenon on the basis of brand image and national culture. Jean Baudrillard (1929-2007), a French master of modern social thought, once said in his book *Consumer Society* published in China Social Sciences Press in 1970 that consumption has transformed from an economic concept to the concept of culture in modern society. As we all know, culture not only inspires the resonance of many individuals but also makes the brand more symbolic, so the definition of national tide should be considered from the following two sides. First, the core of the brand is whether it can possess traditional cultural elements, and second, whether it can blend the traditional culture with the current cultural trend, making the brand more fashionable. From the above analysis, Chinese cheongsam in the era of e-commerce should pay more attention to its own national cultural elements, and only the design of cheongsam on the basis of the Chinese nation and the soul of Chinese culture can it become popular all over the world.

For the international communication of Chinese cheongsam, during some major international occasions, the dress of Chinese cheongsam for female senior national officials or the wives of Chinese centre government leaders will certainly have the most valuable link to communication. Sometimes, it will lead to a new fashion trend of clothing in the world. The beauty of independence and elegance of Chinese women will impress the whole world. Naturally, Chinese cheongsam will immediately become an international fad.

The appeal for international discourse power always follows the country's might. One country's discourse power in the world is not automatically generated and depends on many other approaches except for the country's strong economic base. For example, to better promote Chinese cheongsam to the world, cooperation for Chinese publishing houses with the responsibility of outspreading Chinese traditional culture with foreign authoritative publishing houses is inevitable; that is, it is necessary to externally spread Chinese costume culture through Sino-foreign cooperation. To publish books about Chinese cheongsam culture in foreign countries requires translators with solid knowledge and expertise who should have a deep understanding of Chinese costume culture and should have the ability to use the second language. Therefore, it is necessary to cooperate with foreign local experts to ensure that the translation conforms to the local culture of the target language while preserving the national characteristics of Chinese cheongsam culture. Cooperation with well-known foreign publishers was mentioned by Xie Tianzhen (1944-2020) in the book *Invisibility and Presence: From Traditional Translation Theory to Modern Translation Theory*, which used to be ignored by Chinese local translators for fear of losing discourse power. It is the case that the opinions in books published by authoritative foreign publishing houses are much easier for local readers to accept. Therefore, it is a judicious decision to choose a more authoritative foreign publishing house to greatly increase the impact and acceptability of Chinese costume culture (Tiffany Tan, 2012) in the international communication of Chinese cheongsam.



## Conclusion

The international communication of China's traditional cheongsam culture is for the needs of cultural discourse power brought by the rapid development of China's economy. The approaches and methodologies of Chinese traditional costume cultural international communication can promote China's costume's international discourse, which can be helpful to China's international discourse power in the other fields except for in the field of economy, and which can promote China's impact in major international events. Therefore, for any country that wants to enhance its international standing, it is important to seize no matter how small the chance is to spread its own traditional culture.

The international communication of Chinese culture shows the spiritual core of the Chinese people. In today's world of globalization, which is full of conflicts and inclusions, the spreading of Chinese colorful traditional culture contained in cheongsam, such as the ideas of harmony, people-orientation, peace, responsibility and obligation, which have been given new connotation with the change of the times, will promote the continuous progress of world culture, bringing warmth and a new light to the people all over the world.

With the continuous improvement of Chinese hard and soft power, an increasing number of foreigners have become interested in Chinese culture and gradually have an in-depth understanding and understanding of Chinese traditional cultural connotations. Therefore, the international communication of Chinese costume culture is in line with the times and world people's expectations.

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## Students' Mathematics Problem Solving Skills between Full-Online Learning and Hybrid Learning in Statistics Course

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**Abstract:** Learning loss due to online learning has caused students to experience a decrease in their ability to solve mathematical problems. One of the declines in students' mathematical problem-solving skills occurred in the statistics course. Statistics as a branch of mathematics has an important role in training students' skills in processing and analyzing data. The low ability of students to solve mathematical problems became a serious problem. So we need an appropriate learning model to overcome these problems. One of the learning models that can be used is hybrid learning. The subject of this study was the primary student study program from the Faculty of Education at UPH in Indonesia, with 110 samples divided into 54 control groups and 56 experimental groups. The control class was treated with full online learning, while the experimental class used hybrid learning. This research aimed to compare which type of learning is more effective, full-online or hybrid learning. The research method used in this study is quasi-experimental. Data were processed using SPSS, called the normality test with Shapiro-Wilk, and statistical tests using Mann-Whitney. The results showed that hybrid learning was more effective than full online learning.

**Keywords:** Student's Mathematics Problem Solving Skills, Full-Online Learning, Hybrid Learning, Statistics Course, Learning Loss.

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### Introduction

Statistics is a science commonly used to collect, process (analyze), and conclude data in the form of numbers (Yulianti et al., 2022). At UPH FIP, students usually take statistics courses with the hope that they will equip them with practice skills in collecting data, analyzing it, and drawing conclusions. Statistics is an important subject to study because it contains many things related to everyday life (Nisa & Setianingsih, 2019). Of course, prospective teachers and researchers can also feel the benefits of statistics, such as when presenting data, processing data, analyzing data, and concluding the data.

Since understanding statistics is essential, prospective teacher students at UPH FIP are required to take this

course. However, issues arise when students attempt to solve various statistical problems. Students are often confused when they finish problems that differ from the examples. It shows that students have low mathematical problem-solving abilities. Problems also arise when students work on mini-research projects. They often do not work according to the stages taught, while statistics require systematic work according to the stages that have been taught. Low problem-solving abilities can impact student learning outcomes (Endah et al., 2019). Students need to have mathematical problem-solving skills. When solving mathematical problems, it is demonstrated that many students are still oriented toward the final result (Resmiati & Hamdan, 2019). When solving problems, people tend to directly use memorized formulas without systematically describing the solution. The low ability to solve mathematical problems can also be shown by procedural errors, where the error does not pay attention to the steps of solving the problem and does not consider the process of solving the problem important because it feels that several solving steps are not needed to be explained completely and systematically (Ruswati et al., 2018).

Difficulties in solving mathematical problems can also be seen when given problems in the form of word problems, the difficulty encountered is modeling in the mathematical form, which results in difficulty in determining formulas. Even the most important thing in problem-solving is how to change the mindset so that you can analyze what concepts are contained in the problem, and think about the steps for solving it so that it can then be poured into the form of ideas or mathematical symbols, and then the solution can be determined step by step (Senjayawati, 2015). The problems of UPH FIP students were also seen when determining hypotheses, they often did not write them down because they were deemed unnecessary, and students preferred to determine formulas without following the stages of statistical research.

Students need to have the ability to solve mathematical problems because this ability is needed to develop students' cognitive abilities (Rahmwati et al., 2022). Problem-solving is the basis for honing higher-order thinking skills, which aim to explore students' skills, innovation, and knowledge in solving a problem (Arigiyati & Istiqomah, 2016). Students become unfamiliar with new types of questions as a result of a learning process that does not emphasize problem-solving questions; they will find it difficult and confusing to answer questions that, in the end, answer questions at random (Adhyan & Sutirna, 2022). Such student habits can result in low mathematical problem-solving abilities, even though problem-solving abilities are the basic goal of learning mathematics (Sumartini, 2016).

Statistics is a branch of mathematics, while mathematics requires problem-solving skills. Problems arise because of possible learning loss in students. Learning loss occurs among students and is a serious problem (Patrinis & Donnelly, 2021; Puslitjak, 2021). Learning loss can be seen in the lack of students' mathematical problem-solving abilities. Learning loss conditions can occur for two reasons, due to long holidays and because learning that is normally carried out is changed using a new system (Lim et al., 2022). Thankfully, towards the middle of this year, the delta variant virus mutated into the omicron variant, and this omicron variant has reduced cases of death (NEJM, 2022).

Knowing that the ability to solve mathematical problems is important for students to have, the best solution is needed. Grateful that the current conditions have improved. So that learning, which was originally carried out in full online, can be adapted to a better method. One method that can be used is hybrid learning. Hybrid learning is a learning method that is the best choice today (Ganovia et al., 2022; Gleason & Greenhow, 2017). The use of hybrid learning is said to have a positive impact on learning. Through this learning, students can feel the relationship with lecturers and friends directly, even though some parts are still carried out online. The results of the study suggest that learning that is carried out in full online is less effective due to the lack of facilities and infrastructure and the unpreparedness of technology education (Dwi et al., 2020). In this study, we will see a comparison of full-online learning with hybrid learning on students' mathematical problem-solving abilities. The aim is to see which learning method is more effectively used to overcome students' mathematical problem-solving problems. The question posed by this research is whether the use of hybrid learning is more effective than full online learning.

## Method

The research method used is quasi-experimental research with non-parametric statistics, where the control class used is the class that is taught in full-online learning while the experimental class is subjected to hybrid learning. A quasi-experimental design is a form of experimental design developed from a true experimental design. This design has a control group, but cannot fully control external variables that affect the implementation of the experiment (Sugiyono, 2010). The subjects of this study were students of the Faculty of Education who took statistics courses. The data analysis technique used was a test using the same scoring rubric but different treatments for the two class groups. The test was carried out using SPSS by testing the normality and homogeneity of the data. If the normality test shows that the data is normally distributed, then the independent t-test can be used. However, if the data is not normal, a Mann-Whitney test can be used. The students who were respondents were students in the elementary school teacher education study program's classes of 2019 and 2020. The class of 2019 consisted of 54 students, while the class of 2020 consisted of 56 students. The research design used was the post-test-only control group design. The post-test-only control group design scheme is shown in Table 1 as follows. According to (Sugiyono, 2014), the research design can be described in the following scheme:

Tabel 1. Post-test-only Control Group Design

Subject	Treatment	Result
Control Group	Full-Online Learning	Posttest ( $O_1$ )
Experiment Group	Hybrid Learning	Posttest ( $O_2$ )

## Results

Statistics learning was completed in 16 meetings, with details of 14 learning processes and two examination

meetings. This research was done for two classes that were treated with online learning and hybrid learning. The materials covered several topics, including learning about measurement scales, data distribution, hypothesis testing, one-sample t-tests, two-sample t-tests, and mini-research projects. Students in the 2019 class are treated to full-time online learning. Because of this, conditions in Indonesia were still constrained to face-to-face learning. This is due to the spread of the COVID-19 virus, which has claimed many deaths. Meanwhile, for students in Class 2020, learning is carried out in a hybrid learning. Learning is carried out in a hybrid manner because conditions in Indonesia have improved due to the COVID-19 virus and because face-to-face and online learning can be combined.

At each meeting, the lecturer gives a test to check the student's ability after studying the material. Additionally, check students' mathematical problem-solving abilities on topics in statistics. The test is structured based on indicators of students' mathematical solving abilities based on Polya's steps. According to Polya, there are four indicators for solving mathematical problems, including understanding the problem, planning a solution, solving the problem according to plan, and checking again (Polya, 1973). This research was based on these four indicators, and the test was given to students as a reference. To see students' mathematical problem-solving abilities, test results are used, which will then be compared based on the topics in the statistics course.

Data from the test results were collected and then recapitulated according to the existing topics. Furthermore, the test scores of students' mathematical problem-solving abilities were processed using inferential statistics. The test results were tested for normality using SPSS, and if they were not normal, they were continued using the Mann-Whitney test. The following are the results of the normality test using the Shapiro-Wilk method:

Table 2. Test of Normality with Shapiro-Wilk

No.	Topic	Tests of Normality with Shapiro-Wilk			
		Control Group		Experiment Group	
		Sig.	Result	Sig.	Result
1	Scale Measurement	<.001	Not Normal	<.001	Not Normal
2	Data Interpretation	<.001	Not Normal	<.001	Not Normal
3	Measure of Dispersion	<.001	Not Normal	0.02	Not Normal
4	Hypothesis Test	0.098	Normal	0.02	Not Normal
5	One Sample t-test	<.001	Not Normal	<.001	Not Normal
6	Independent two-sample t-test	0.001	Not Normal	<.001	Not Normal
7	Dependent t-test	<.001	Not Normal	<.001	Not Normal
8	Mini Research Project	<.001	Not Normal	0.016	Not Normal

Based on Table 2, only the hypothetical test topics in the control group were normally distributed. Other topics in the control and experimental groups are not distributed normally. Because most of the data is not normally distributed, the tests are conducted using non-parametric statistics. The non-parametric statistic used to compare the data of the two samples is Mann-Whitney. The following are test results using Mann-Whitney:

Regarding the presentation of the data and the dependent t-test, Table 3 demonstrates that there is no difference between the experimental class and the control class. For other topics, there is a difference in the average value.

From the average value obtained, criteria for mathematical problem-solving skills of students can also be determined (Japa, 2008). This criteria can be seen in Table 4.

Table 3. Mann-Whitney U Test Results

No.	Topics	Mann-Whitney Test					Result
		Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig (2-tailed)	p-value	
1	Scale Measurement	610.000	2150.000	-5.136	<0.001	<0.05	There is a difference
2	Data Interpretation	1171.500	2711.000	-1.833	0.067	>0.05	No difference
3	Measure of Dispersion	998.000	2594.000	-2.555	0.011	<0.05	There is a difference
4	Hypothesis Test	1029.000	2254.000	-2.085	0.037	<0.05	There is a difference
5	One Sample t-test	736.000	2114.000	-4.369	<0.001	<0.05	There is a difference
6	Independent two-sample t-test	920.500	2246.500	-2.697	0.007	<0.05	There is a difference
7	Dependent t-test	1091.000	2172.000	-0.272	0.786	>0.05	No difference
8	Mini Research Project	1001.000	2771.000	-3.406	<0.001	<0.05	There is a difference

Table 4. Criteria of Test Result

Score	Criteria
85,00-100	Very good
70,00-84,99	Good
55,00-69,99	Average
40,00-54,99	Less
0-39,99	Very less

Table 5 displays the mean difference between the experimental group and the control group.

Table 5. Differences in Means between the Control Group and the Experiment Group

No.	Topics	Mean			Information	
		Control Group	Criteria	Experiment Group		
1	Scale Measurement	86.42	Very good	97.01	Very good	Control < Experiment
2	Data Interpretation	88.17	Very good	81.32	Good	Control > Experiment
3	Measure of Dispersion	81.25	Good	73.26	Good	Control > Experiment
4	Hypothesis Test	73.47	Good	79.46	Good	Control < Experiment
5	One Sample t-test	77.69	Good	91.92	Very good	Control < Experiment
6	Independent two-sample t-test	71.79	Good	81.84	Good	Control < Experiment
7	Dependent t-test	83.04	Good	82.96	Good	Control > Experiment
8	Mini Research Project	84.50	Good	79.75	Good	Control > Experiment

In Table 5, it can be seen that the mean value of students' mathematical solving abilities in the control group is higher than that in the experimental group on the topics of data presentation, dependent t-test, and mini research project. Other topics showed a higher average value for the experimental group than the control group. When compared to Table 3, the Mann-Whitney test on the topic of data presentation and the topic of the dependent t-test showed no significant difference. So even though there is a difference in the average, statistical tests show no difference in values between the control and experimental groups. From Table 5, it is presented in the form of a diagram as follows:

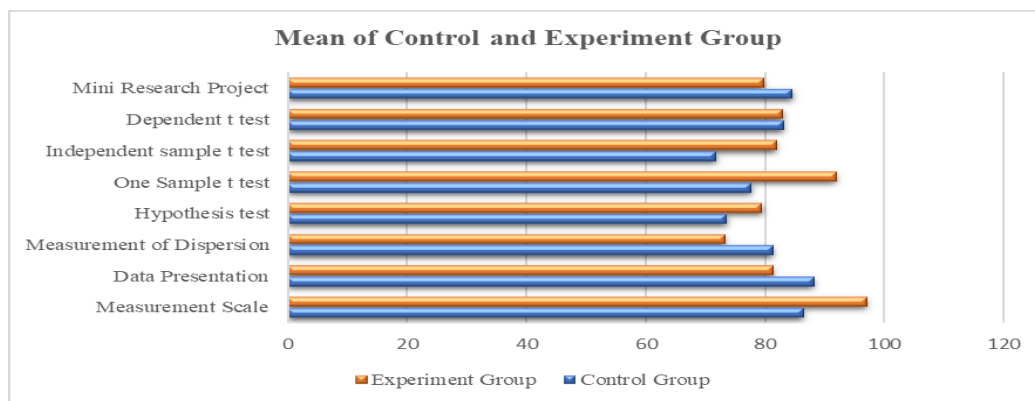


Diagram 1. Comparison of the average Control Group and Experiment Group

## Discussion

Comparative testing for the eight topics that were assessed resulted in a variety of findings, which is apparent from the explanation above. The normality test itself indicates that the majority of the data are not dispersed normally. The test is carried through a non-parametric statistical test because the data are not normally distributed. The Mann-Whitney U test is the comparison tool utilized for abnormal data.

The results and the Mann-Whitney U test indicate that there are six topics with a distinct average and two topics where there is a non-significant difference in the average. The two topics that were not significantly different were the topic of presenting statistical data and the dependent t-test. Meanwhile, the 6 topics that differed significantly were: measurement scale, size of data distribution, hypothesis testing, one sample t-test, independent t-test, and mini research project.

On the topic of measurement scales, the average for the control group (full-online learning) was 86.42, while the experimental group (hybrid learning) obtained an average of 97.01. The outcomes of the Mann-Whitney U test reveal that there are variations in how much value individuals place on their capacity to solve mathematical problems related to measurement scales. Students in hybrid learning courses demonstrate superior mathematical problem-solving skills compared to those in fully online courses.

Topic of data presentation, the average value using full-online learning was 88.17, while classes using hybrid



learning obtained an average of 81.32. Data showed that there was no difference in the value of mathematical problem-solving abilities. On the topic of data presentation, classes that used full-online learning better than hybrid learning.

Topic of measurement of dispersion, the average value using full online learning was 81.23, while classes using hybrid learning obtained an average of 73.26. Data showed that there were differences on the topic of measurement of dispersion. Classes that use full-online learning showed better than hybrid learning.

On the topic of hypothesis-test, the average value using full-online learning was 73.47, while classes using hybrid learning had an average of 79.46. Data showed that there were differences. Classes that use full-online learning showed that students' mathematical problem-solving abilities are smaller than those of students who use hybrid learning.

On the one sample t-test topic, the average value using full-online learning was 77.69, while classes using hybrid learning obtained an average of 91.92. Data shows that there are differences on this topic. Classes that use full online learning showed smaller than hybrid learning.

On the topic of the independent two-sample t-test, the average value using full online learning was 71.79, while classes using hybrid learning obtained an average of 81.84. Data shows that there are differences value in this topic. Classes that use full-online learning showed smaller than hybrid learning.

On the dependent t-test topic, the average value of full-online learning was 83.04, while the class using hybrid learning had an average of 82.96. Data showed that there was no difference value on the topic of dependent t-test topic. Although the average for full-online learning is slightly higher than hybrid learning.

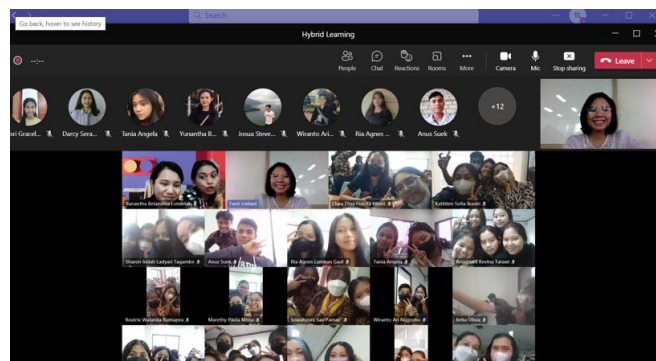
In the mini-research project topic, the average value using full-online learning was 84.5, while classes using hybrid learning obtained an average of 79.75. Data shows that there are differences in the value on the topic of mini-research project. Classes that use full-online learning show greater than hybrid learning.

From the explanation above, it can be seen that of the 8 existing topics, 2 topics have no difference using either hybrid learning or full-online learning. The topics in question are the topic of data presentation and the topic of the dependent t-test. Six other topics showed differences, on the topic of data distribution size and the topic of mini research projects, the value of students' mathematical problem-solving abilities showed better scores with full online learning compared to hybrid learning. Differences were also shown in 4 topics, including the topic of measurement scales, hypothesis-test, one-sample t-tests, and independent sample t-tests. On these topics, students' mathematical problem-solving abilities are better when using hybrid learning than full online learning. So it can be concluded that 2 topics have no differences, 2 topics have differences but were better with full online learning, and 4 topics have differences but hybrid learning shows better results compared to full-online learning. Here, the use of hybrid learning dominates. According to research conducted by (Alsowat, 2022;

Thamrin et al., 2022) hybrid learning provides many advantages. Hybrid learning makes learning more effective because lecturers and students can discuss directly (Rahmat, 2022). Students can also collaborate more easily and minimize mis-communication (Yang et al., 2022).

Even though full-online learning also provides many advantages, students feel bored if they can only stare at the monitor (Gumasing et al., 2022; Nafiah et al., 2021). Full-online learning has weaknesses (Arifuddin et al., 2021; Maulida & Akmal, 2021), including students experiencing a learning loss (Engzell et al., 2021). They were bored because they could stare at the computer screen all day. They felt disturbed by the condition of the surrounding environment. There are limited devices for synchronous and asynchronous sessions. There is the possibility of cheating during exams because lecturers cannot directly supervise the implementation of quizzes or tests. Students are limited to their internet quota. Students really rely on the device, whether the device is slow or not updated with the times. Hybrid learning provides a new color for primary students study program. Students showed an enthusiastic response because they could discuss directly with the lecturer and work on group assignments with their friends. Even though there is a fear of being exposed to the COVID-19 virus, the mandatory vaccine regulated by the state has reduced the serious symptoms of the COVID-19 virus.

Hybrid learning gives a more interesting impression to students. Hybrid learning combines online and traditional learning by taking more effective steps so that learning becomes more meaningful. Even though students save time by undergoing full online learning, they can meet directly with their colleagues during face-to-face sessions in hybrid learning. The following is an example of how hybrid learning is carried out.



Picture 1. Hybrid Learning Photo

In almost every meeting, some students do not attend because they must isolate due to exposure to COVID-19. Of course, this can harm other colleagues who do not have good body immunity. Hybrid learning provides an interesting learning experience for lecturers as teachers and provides many benefits for students.

**Conclusion**

The results of the study show that the topics taught in statistics courses yield better average scores when using hybrid learning than full-online learning. So, it can be concluded that hybrid learning is more effective than full-online learning. This research still has many weaknesses because it does not explain each indicator of problem-

solving ability. However, researchers will try to make subsequent articles that discuss each indicator on each topic taught in this statistics course in more detail. Full-online learning has its own advantages and disadvantages. Instead of replacing in-person instruction, online learning serves as a tool that instructors and students can use to supplement it. By utilizing both learning environments, the hybrid learning method can be a solution for students who need to learn as much as possible. With this method, students can enhance their knowledge and access tools, which will enhance their learning.

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## Learning Analytics as A Predictive Tool in Assessing Students' Online Learning Navigational Behavior and their Performance


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**Abstract:** Learning Analytics (LA) captures the digital footprint of students' online learning activity. This study describes students' navigational behavior in an e-learning setting by processing the LA data obtained from Blackboard LMS. This is an attempt to understand the navigational behavior of students and the relationship with learning performance. The study was carried out with 88 learners from a Malaysian private university. The course sites' log data and students' performance were analyzed, and the results were as follows: 4 navigational behaviors played an important role in student's academic performance which are active days, total learning time, number of views, and days delayed in accessing the assessment. Active learning from Tuesdays to Thursdays had a significant positive effect on performance. It was found that the higher activities (total learning time, number of journals viewing) translate to better performance. Days delayed in attempting assessments had a significant but mixed effect on performance, depending on the type of assessment. However, the number of logins is insignificant. The findings of this study provide empirical evidence of the importance of self-discipline in online learning and provide instructors with a predictive measure as a call for early intervention to help online students.

**Keywords:** Blackboard, Learning management system, Learning analytics, Student engagement, Blackboard analytics, Performance

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## Introduction

The Sustainable Goal (SGD4) on quality education aims to ensure inclusivity and lifelong learning which can be achieved through distance education or e-learning. Learners can gain education anytime and anywhere, hence promoting inclusivity such that no one is left behind even in adverse situations. It also creates a society of lifelong learning as learning accessibility is easier allowing self-paced and self-directed students learning.

Although recognized for the flexibility of learning anytime and anywhere without the limitation of space and time, e-learning became the central and only mode possible when COVID-19 hit. During this period, with the sudden shift from the traditional setting to e-learning, academicians were faced with the complexity of teaching students who are not physically present. Contradicting the traditional face-to-face classroom setting, the virtual classroom or self-directed e-learning setting would not allow instructors to observe the non-verbal cues, especially through students' facial expressions as well as in-class work to determine if students can grasp the concept being taught. Instructors are also not able to move around the classroom to check on the solutions on students' worksheets and identify the mistakes for instant feedback. In an online setting, these non-verbal cues take place behind the screen, which leaves instructors to just assume that students are coping with the topics taught. To better understand students learning and engagement in an online setting, Learning Analytics (LA) on students' digital footprints is crucial. The Horizon report (2011) defines learning analytics as, 'the interpretation of a wide range of data produced by and gathered on behalf of students to assess academic progress, predict future performance, and spot potential issues.'. The learner's data is collected from the technologically rich learning management system (LMS) that carries the answer for online instructors to investigate pedagogy and instructional design statistically (Grant, 2012; Li & Tsai, 2017; Lockyer & Dawson, 2011; Macfayden and Dawson, 2010; Zhong, 2017) and provide the learning support at the right time (Lockyer, Heathcote & Dawson, 2013; Zhong, 2017).

The usage of various Learning Management Systems (LMS) increased post-pandemic as it was the heavily utilized mode to teach and communicate with students (Duin & Tham, 2020). The Blackboard LMS is among the popular LMS employed to engage with students for the delivery of subjects, interaction with peers, submit coursework, and even conduct the final exams. The Blackboard LMS has a statistic tracking option and stores data that is rich in information to understand the learners' learning type and predict the learners' progress (Kim et al., 2016; Macfayden & Dawson, 2012). The statistic tracking creates a record of the digital footprint in the LMS containing potentially valuable information on learner's login times, items accessed, and the number of times accessed (eg Cerezo et al., 2016; Chatti et al., 2012; Kim et al., 2016; Papamitsiou & Economides, 2014; Seo, Kim, & Ju, 2021; Zhang, 2016; Zhong, 2017).

In the last decade, before the pandemic, some studies attempted to investigate students' engagement with various LMS and the links to the grades. Spivey and Macmillan (2013) examined the relationship between remote learning students' efforts measured by the frequency of access on students' performance and found a

positive relationship. Li and Tsai (2017) studied the navigational behavior of 59 students in a computer science program and found that those who invested time viewing the online learning materials gained significantly higher examination scores. The navigational behaviors were clustered into the Consistent Use Group and Less Use Group based on statistical quantifiers. Mwalumbe and Mtebe (2017) used various measures (discussion posts, peer interaction, time spent on LMS, number of downloads, login frequency) to investigate the impact of students learning. It was found that time spent in the LMS, number of downloads, and login frequency were found to have no significant impact on students' learning performance. Edwards et al. (2009) investigated the timely access of assignments by 1101 programming students and their impact on their performance. It was found that students who scored at least a B did not delay in attempting the assignment as compared to those who scored C and below. Fenwick et al (2009) also used the same measure which was the days delayed in accessing assignments found that students who earned better grades were those who started two or more days prior to the date. A mixed effect is found using this measure as Murphy et al. (2009) investigated 21 programming assignments and concluded that those who spent lesser time produced better quality assignments. Notably these studies provided a good contribution on the importance of learning analytics prior to the pandemic.

A study done by Zhang, Ghandour & Shestak (2020) analyzing the activity logs on Moodle LMS showed that higher grades is linked to higher logins. Darko (2021) investigated the average time spent by 69 Engineering students in two separate pathways in a semester and over 3 years on BB. The first pathway was a general survey to obtain informed data on ways students engage in their study and the second pathway is using the number of logs made on the BB. Using the Simple Moving Average (SMA), and Product Moment Correlation, the study provides evidence similar to the constructivism learning theory that the increase in BB engagement, the more construct knowledge is developed. Kadoić and Oreški (2021) used data analytics during COVID for YouTube on Moodle LMS and found that students' success is influenced by total views, the number of views in different time segments, and the number of downloads. Summers, Higson & Moores (2022) used library checkout and attendance to investigate the comparison of pre-peri-pandemic learning engagement. Other studies linking online learning navigation and performance were done using specific course programs, select groups, and specific time frames (Cerezo et al., 2016; Romero & Ventura, 2010). The impact of the usage of data analytics during Covid and post-Covid has not been widely explored quantitatively although emergence is evident (eg. Summers et al., 2023; Bashir et al., 2021; Seo et al, 2021). The purpose of this study is to explore unconscious navigation behavior on Blackboard LMS throughout the entire semester. This includes establishing the possible link between navigational key variables and overall performance and further investigating the impact of navigational behavior on different types of assessment.

## **Method**

### **Sample data and participants**

The data is gathered from 88 undergraduate students from a Malaysian private university with an ethnically diverse population. These students are from the American Degree Transfer Program predominantly taking



STEM subjects. 81.8% of them were Malaysians while the remaining were international students from various countries, eg. Myanmar, Sri Lanka, Vietnam, and Bangladesh.

Table 1. General Statistics on the Student Sample

Demographics		Frequency	Percentage
Gender	Male	57	64.8
	Female	31	35.2
Nationality	Malaysian	72	81.8
	Non-Malaysian	16	18.2
Major	Sciences	56	63.6
	Arts	32	36.4

### Measures and Data Collection

All the undergraduate modules are managed through the university *Blackboard LMS*, here the announcements, online live lectures, course materials, and assessments can be accessed. Since before the Covid pandemic, lecture recordings are also made available in the system. Statistic tracking is enabled to allow the system to capture the learner's digital footprint or navigational behavior, for each course site.

The course site for each subject includes components such as course announcements, course outlines, course structure, contents, and coursework. Each component can be accessed from the navigation pane on the course site. The course structure, course outline, and other academic-related information are posted prior to the commencement of the semester. Weekly learning materials such as lecture slides, lecture notes, tutorials, and videos are organized into folders by week. For accessing these weekly posted learning materials, three measures were used: *Days active on Blackboard LMS*, *Total time spent on the course content*, and *the total number of logins*.

#### *Journal Submission*

The setting up of the Journal on *Blackboard* is done by the instructor. These journals are made visible to all students, and they have the option to delete and update their journals. During the semester, students were given many Mathematics questions to solve for each sub-topic and were required to submit their solutions as a weekly entry in the *Blackboard* journal. Over the 14 weeks, each student had a journal of 14 submissions. Since each submission was visible to all, students were able to compare the full solution of every question against others' work, and where needed provided peer feedback. When students were not able to come to a consensus on which solution was correct, the instructors intervened by providing the necessary feedback. For accessing the peer's journal submission with the intent of learning from peers, one piece of data is collected: *The number of journal submissions viewed*. Enabling students to communicate online on the course site is important for online learning. While Badawy and Hugue (2010) showed that online discussions have a positive impact on student satisfaction, the present study intends to investigate whether the viewing of journals could have a positive impact on students' learning performance, as an indication that students learned from peers.

*Assignments and Quizzes*

The assessments, except the final exams, are organized under a Coursework folder which is placed in the course site pane. The two assessments that are done on *Blackboard* are the assignments and quizzes. The assignments are posted on *Blackboard* as a pdf file on a specified date. Students access the questions and complete the assignment within a week as per the deadline. The assignment report is handwritten and must be uploaded via the submission links on *Blackboard LMS*. Quizzes, on the other hand, have a duration of 30 minutes, although the quiz is being made available on *Blackboard LMS* for one week. Students can take the quiz anytime within the week. The measures of the navigational behavior for these assessments are the timeliness of accessing the assignment and quizzes or the number of days delayed between the day the assessment was posted and the day the student accessed the posted assessments. For example, “1” means the student accessed the material 1 day after the assessment was posted. So, the two data collected from the assessments are *days delayed in accessing the assignment* and *days delayed in accessing the quiz*. Accessing materials promptly depicts self-discipline which is one important requirement of online self-directed learning. Checking on the days delayed came with the idea that the sooner the assessments were accessed, the better their performance (Zhang, 2016).

**Results**

The course site content is organized to have YouTube videos, Lecture notes, tutorials, and Journal Links. The highest visited course content are the journals comprising more than half of the total, followed by tutorials, lectures, and YouTube videos in descending order, as shown in Figure 1. Journal being the most visited suggests that it is perceived to be more beneficial compared to the lecture notes. A potential reason could be that the lecture notes do not contain as many worked examples as the journals.

The first navigational measure is the days active on *Blackboard LMS*. The student’s time spent on the course site is averaged by the day of the week and the data is displayed in Figure 2. It is found that the average time spent per day by the day of the week is somewhat of a bell-shaped curve with the majority of them spending more time navigating the course site on Thursdays. There is a rising pattern before Thursday and drops on Fridays and Saturdays. Further investigation on the link between performance and students’ average time spent on *Blackboard LMS* showed that there is a significant positive correlation between students’ average time spent navigating the course site and their overall performance on Wednesday, Thursday, and Friday. Table 1 shows the correlation coefficients.

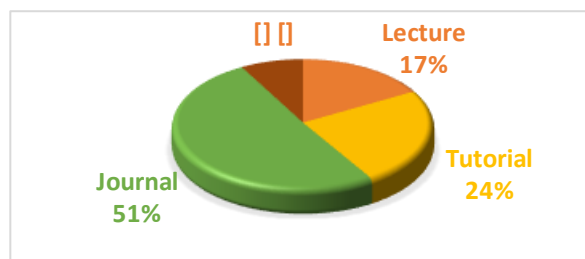


Figure 1: Course Content Accessed by Students

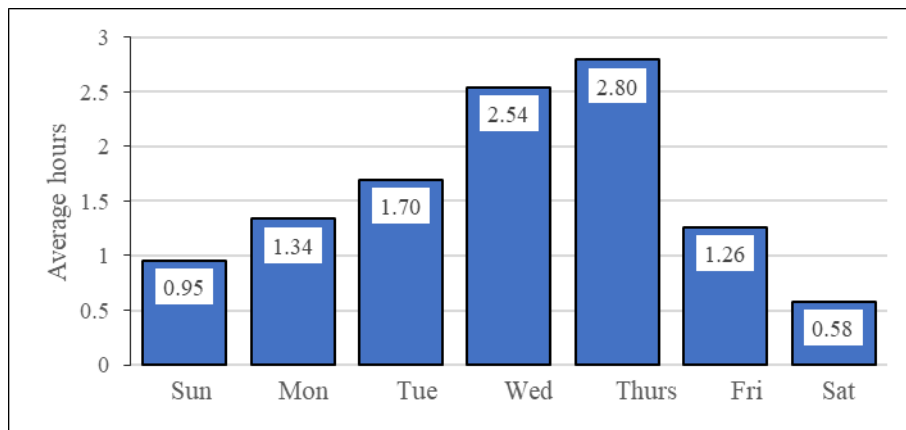


Figure 2: Average Hours Spent Each Day on Learning Management System

Table 1: Correlation between Performance and day of the week

Day of the week	Pearson Correlation
Sunday	0.11
Monday	0.099
Tuesday	0.2*
Wednesday	0.14*
Thursday	0.184*
Friday	0.142
Saturday	0.11

\*\* . Correlation is significant at the 0.05 level (2-tailed).

\* . Correlation is significant at the 0.10 level (2-tailed).

The *Blackboard LMS* analytics measures (time spent on course-site, total login clicks, number of journal views, number of YouTube views) were broken into categories low and high using the mean-split and tested using the mean rank test as shown in Table 2. Students who spent a higher time on the course site had a significantly greater effect on their performance ( $M=48.57, p<0.10$ ). The total logins did not show a significant difference, hence students who logged on to the course site with a higher frequency did not necessarily have a better learning performance. Journaling made a great impact on student's performance ( $M=50.65, p<0.05$ ), indicating that the more frequently students viewed the journals of their peers or their own would increase their learning performance. Similar results were seen for viewing the YouTube videos ( $M=72.93, p<0.05$ ).

Table 3 shows the effect of timely access to the assessment on performance. Did the delayed access to the assessment affect the assessment score? Correlation analyses found that there was a significant correlation between the two measures, and the correlation was different for different assessments. For the assignments, students had a good performance on average ( $M=79.53, SD=3.05$ ) with low average days delayed in accessing the assignment ( $M=0.8, SD=1.23$ ). It was found that there is a negative relationship between days delayed in accessing the assignment and the performance on it ( $r=-0.564, p<0.01$ ) suggesting that the higher the days delayed in accessing the assignment, the lower the quality of the assignment submitted resulting in poor performance. Surprisingly, the quizzes had opposing results. Student's quiz performance ( $M=84.92, SD=2.01$ )

and days delayed in accessing the quiz ( $M=1.72$ ,  $SD=0.99$ ) had a significant positive relationship ( $r =0.299$ ,  $p<0.05$ ). This suggests that the longer students took to prepare for the quiz, which is from the interval of the day of the quiz posting and attempting the quiz, the better their performance.

Table 2: Mean rank test for overall performance by the measures from *Blackboard LMS* Analytics

Key Variables	Categories	Mean Ranks	Levene's Test	Significance
Time in Course Content	Low	38.89	0.919	$p<0.10$
	High	48.57		
Total Login	Low	34.15	0.105	$p>0.10$
	Average	43.96		
	High	49.35		
Journal	Low	38.35	0.449	$p <0.05$
	High	50.65		
YouTube Video	Low	25.63	0.107	$p<0.001$
	High	72.93		

Table 3: Relationship between navigational behavior on different types of assessment

	Average	Std. Dev	Correlation
Days delayed (Assignment)	0.80	1.23	-.564**
Assignment Performance	79.53	3.05	
Days delayed (Quiz)	1.72	0.99	.299**
Quiz Performance	84.92	2.01	

\*\* . Correlation is significant at the 0.01 level (2-tailed).

## Discussion

### Does students' access to the course site based on the days active relate to their learning performance?

Students are actively engaging on the course site with inconsistent patterns by the day of the week (Darko, 2021; Yousaf et al., 2018, Zhong L., 2017). This study finds that the students are highly active on the course site between Tuesday and Thursday, and lower on other days. The correlation of these activities with their overall performance is positively significant and is seen during these days. The results of this study recommend that important announcements, postings of material, and deadlines should be scheduled between Tuesdays and Thursdays. The decrease in the activity between Friday to Monday suggests that students used maybe busy with non-academic and personal matters as the weekend approaches.

### Does the number of hours spent on the course site relate to their learning performance?

The total learning time or the hours spent on the course site had a significant effect on students' learning

performance. There was a significant difference in performance between the students who spent a higher amount of time on the course site and a low amount of time. Past studies have also stated that the longer time spent on the course site leads to a higher overall score (Kim, 2003; Rau and Durand, 2000; You, 2014; Seo et al., 2021). The number of hours spent on the course site is an indication of the time students spent studying a book if it was a traditional classroom setting. This can be used as an important predictive tool to have a constant check on students' accumulated learning time and to identify potential students who might perform poorly in the subjects. Many studies found that the total learning time did not affect academic achievement (Kim, 2011; Han and Jeon, 2015; Mwalumbwe and Mtebe, 2017) but other factors such as the number of access or logins, learning intervals, gender, and age were important.

### **Does the number of logins on the course site relate to their learning performance?**

Similar to most studies (Zhang, 2016; Han and Jeon, 2015; Mwalumbwe and Mtebe, 2017) it was found that the number of logins to the Blackboard LMS Course site did not have a significant association with students' performance. This confers to the notion of "quality versus quantity". More logins do not translate to better performance, instead quality time spent on each login matters. Another possibility that there is no significant relationship is because the files that are posted on the course site such as the PowerPoint slides, notes, and tutorials are downloadable. Some students may have downloaded the files probably in one login per week and accessed them multiple times on their local files. Since the data for the number of downloaded items were not included, the analysis is inconclusive and perhaps useful for future work.

### **Does the frequency of visiting peers' journals or self-journals and YouTube videos relate to their learning performance?**

The inevitable isolation is seen as a drawback in online learning. Discussion boards in Blackboard LMS are usually used as a tool to help with students' communication (Kwon, 2019; Zhang, 2016; Alghamadi, 2019). Deviation from the normal Discussion Board, this present study used Blackboard Journal as a tool for students to interact with peers. The frequency of journal views and YouTube views have a positive significant effect on the student's learning performance. The Journals which were tutorial submissions visible to all students provide the weaker students to learn from the journals of other students.

### **Does the delay in accessing assignments posted relate to their learning performance?**

The delay in assessing the posted assessments would significantly affect the learning performance holds in this present study, however, the effect is mixed depending on the type of assessment. The data shows that students' behaviors varied dramatically for each assessment. An assignment is a component where students are given at most a week to prepare for their submission. Students who started late on the assignments produced output that are not on par with those who have started the assignment early, leading to poorer scores. Starting late here means the Blackboard LMS data shows that students viewed the assignment later than the date posted. The

significant negative effect is understandable as not accessing it promptly means that learning activities were not well organized, and students lack self-discipline. Starting late on the assignments forces students to cram up their learning needs as described by Spivey and Macmillan (2013) as “crammed access”. However, it is beyond the data analytics capability to ensure that students viewed the assignment early and started working on the assignments as soon as they viewed them.

The next assessment that was analyzed is the online quizzes, and as opposed to the assignment, showed that the later the quizzes were accessed the better their performance. Quizzes are available for a week but only require 30 minutes to complete once accessed. Students who accessed the quizzes closer to the due date performed better. The understanding of this is that students who took the quiz later had used the prior time to prepare to lead to better performance. Another possible explanation students who delayed taking the quiz might have been familiar with the content knowledge and therefore did not see the need to attempt the quiz as early as it was posted (Zhang, 2016).

## Conclusion

Online learning is possibly the future learning model and many higher learning institutions are rapidly developing it. It is a constant effort by the learning institutions to provide quality education and better understand the online navigational behavior that can contribute towards a holistic learning experience. The empirical evidence in this study is the significance of the five navigational behavior on performance which are *active days, total time spent on the LMS course site, frequency of video and journal views, and timely access to assignments and quizzes*. This could only be possible with learning analytics and the statistics tracking data stored in *Blackboard LMS*. The data collected show the trail of students’ navigational behavior. In this study, learning analytics has provided evidence that students are active on certain days of the week suggesting that postings of notes, announcements, and other information should be made available between Tuesdays and Thursdays. Higher engagement on these days has shown to have better performance. Delay in accessing the assessments is like attending exams later than the expected time. This is uncommon in a physical class because such behavior is observable and subtle peer or instructor pressure is felt. Unfortunately, the online learning environment fails to create this positive pressure and consequently negatively affects students learning performance. Alternatively, in an online setting, the timeliness is picked up on the analytics stored in *Blackboard LMS*. Delay in assessing assessments may not necessarily work as a disadvantage as this study show evidence that it is based on the type of assessment the delay occurred. In conclusion, the evidence from this study implies that when students engage more time on the *Blackboard LMS*, they are absorbing knowledge and creating new information by processing existing stored information to a better chance of obtaining higher grades. The total number of logins to the LMS course site played no role in determining the performance, suggesting that the number of times students log in is not as important as the time spent on the course site for each login. Students may have logged in maybe just to read an announcement, or multiple times to check their online grade book which does not count for learning time that contributes to higher performance.

We conclude that students' performance improves when they are more active on the *Blackboard LMS* course site. Students should watch the short videos provided, view the journals more frequently, and access assessments in a timely fashion. Noting these good online navigational behaviors, instructors can use the *Blackboard LA* to better understand students' academic standing during the semester and possibly identify students who may fall behind. Early intervention can prevent students of potential risk to fall further behind or failing the subject. Besides that, it is worth investing in a good LMS that is functional and user-friendly to incite students' interest to navigate an LMS. In this age of modernization, everything is done using a mobile. Thus, having a mobile-friendly LMS will make learning convenient anywhere and anytime.

## Recommendations

It should be noted that the navigational behavior investigated in this study is infinitesimally small compared to the huge aspects of online learning. Online learning is a complex process involving many other factors, many other technologies, and many other tools. Future research also warrants the need to consider other factors such as prior knowledge, learners' intelligence, motivation level, and learners' cognitive level. In addition, students learning data outside the LMS could also shed some light on predicting learning behaviors. Only through continuous research can online education and students' learning outcomes be improved.

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## Role of Events, Festivals, and Celebrations in Creating a City Image

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**Abstract:** Cities are constantly evolving and look forward to every opportunity enabling them to grow and have a progressive economy. A high level of competition exists among the cities and countries in portraying a high image. Every city and its communities engage in activities to bring a change to the routine pattern of life. The events, festivals, and celebrations become an important catalyst in the rejuvenation and regeneration of urban life creating an opportunity to build an image for the city. This could have positive or negative impacts on the people, their culture, and the environment. The influence of globally available technologies lets a crisis in the character developed by the city losing the importance of heritage, human values, and local identity. Cities are using the strategy of hosting events, festivals, and celebrations as a means of fast development by attracting tourists, enhancing trade, and developing the economy thereby creating an image for the city. The study focuses on understanding the need for events, festivals, and celebrations for a city along with its advantages and disadvantages and influences over the urban context. Participatory appraisal and field study interpretations were used for case study analysis of Dubai (UAE) events to validate the literature study review. This would enable the stakeholders to channel processes in making the decision for the planning and setting up of celebration spaces with a long-term goal of considering the people, place, culture, and heritage developing an image being a pride for its citizens.

**Keywords:** Events, Festivals, Celebrations, City Image, Urban Identity

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### Introduction

Any settlement over a considerable span of years shapes up to take a consolidated form, a form that is evolved & governed very much by the activities associated with the place. In history during the colonial era of Europe

‘place making’ and ‘marketing’, was done by rulers to attract tourists and investors thereby enhancing socioeconomic functioning (Yuan & ChenChang, 2007). There is a high level of completion among modern cities in attracting new domestic and foreign investments and the cultural, and creative sectors contribute to the socio-economic development. The cities and their urban spaces got revived with the generation of jobs and image building of the city. The organizing of cultural events in small towns has created a positive impact on the local businessmen and inhabitants with the initiatives taken at the grass-root level. Progressive festivals happen across the globe and new development strategies were identified for even small cities based on their culture (Yuan & ChenChang, 2007). Support from the government at a policy & strategy level is very important. This creates mutual benefits for people and the government. Festivals and events become motivators in attracting participants both local and tourists on a year-round basis and thereby add to local tourism. Creative and cultural clusters get created to build the city’s image and marketing (Wang, 2009).

The urban festivals and street carnivals enhanced the dynamics of social life shaping interesting spatial arrangements on a local scale in many countries. Festivals are instrumental in place marketing enhancing everyday life experiences. The social identities get periodically constructed, destroyed, and reconstructed forming the spatial and social organization in the city (Whyte, 2021). A sociable urban condition is created for public life to meet & play. There are spatial conflicts, ambiguities, and appropriateness between identities and practices. These activities may have a social, economic, political, and regional backdrop. But the physical gathering of the public was an important factor in the constitution of the social realm. Planned spatial arrangements restricted informal gatherings, the Biennale, carnival & parade made opportunities for interaction among citizens and it evolves certain spatial and behavioral constraints (Stevens & Shin, 2012).

The Olympic Games, World expo, exhibitions, theme based festivals also become prominent means of fast urban development (Yuan & ChenChang, 2007). In the post-socialist countries cultural sector has been seen initiating socio-economic development and the success story is evident in the small central city of *Gniewkowo*, Poland with the introduction of the festival of progressive rock being a factor of growth for the local population and creating a brand image for the city (Murawska & Bieganska, 2014). Adding signature projects with iconic characters is another strategy for creating a competitive advantage involving a great financial cost with examples like the Bilbao Guggenheim museum and the Baltic Flour Mill of Gateshead. The cost involved in these projects being high makes them inflexible in comparison to having the events. Thus that has been a choice taken by many countries in recent times for shaping and facing urban competition. But events had been a platform for creating landmarks. Cultural events have turned out to improve the city’s image and have created a sense of pride in the citizens about their home city and its image. This community pride due to the enhanced destination has been referred to as the ‘halo effect’. The study focuses on knowing the benefits to the residents of the city and the strategies taken by the government, policymakers, and organizers in marketing the city image, analyzing the opportunities for regeneration and the transformation from the macro to micro level. The understanding of patterns and identity enables the development of appropriate measures for generating a sustainable city image.

**Events, festivals & celebrations in an urban context***A. Benefits to urban population & opportunities for regeneration*

The re-evaluation of the city and its re-presentation adds self-confidence to the local population bringing a sense of pride and attracting socio-economic development molding the city's image. At times it helps change negative images created in the past. The urban visual character has an active behavioral character in urban life which generates an experience with the dynamics of the events festivals and celebrations. The festival of Rio de Janeiro with its parades and dance, and Spanish Pamplona with its bullfight recreated dynamic behaviors to the static visual city image (Yuan & ChenChang, 2007). The transformation of the city with its spaces and activities for engagement brings life to the routine environment with opportunities for jobs, trade, and businesses. People socialize developing intercultural bonds. Amenities and infrastructure gets revived with unique buildings and spaces planned and organized. A vibrant environment gets created in the process of celebration.

Countries organizing festivals & special events (FSEs) include cultural activities, conferences, sports, exhibitions, and religious activities as a means of engagement. This has an influence on time and space in the city (Murawska S. B., 2014). It gains 'the paroxysm' with its promotions and media coverage's enhancing its reputation for the short term. At times the negative image and impressions or views created out of racial clashes, political issues, and natural disasters of the past could have been a hindrance to economic or socio-cultural development be changed. The examples of Japan and Germany produced during the Second World War were revived with the 1964 Tokyo Olympics & the 1972 Munich Olympics (Yuan & ChenChang, 2007). It brings the opportunity to express the colorful cultural life practiced in the destination (Wang, 2009). Many events have created impressive landmarks like the Tate Modern gallery in London adding to city skylines creating a visual impact and catching attention and improving the city's image and living experience (Richards & Wilson, 2004). Events restrict the population outflow attracting new residents and enabling to rebuild of the city (Miśkowiec, 2017). A positive change is seen in the majority of the example creating the opportunity for growth and development of the city its spaces, and places letting it be known for its unique character and experience. In this process, all the stakeholders are benefited from varied means of development.

*B. The city marketing*

Acceleration is seen in creating a city status promoting the place's prestige by introducing traveling products, infrastructure construction, places of attractions, investment attraction, and industry transactions through the FSEs. Ample successful examples like the Dalian International Clothing festival, and Olympic Games hosted in cities like Munich, Moscow, Seoul, and Sydney are models of opportunity being used to present and sell themselves becoming an important topic for planners and leaders (Yuan & ChenChang, 2007). Urban regeneration is one of the major concerns in preparing strategies and planning for policymakers and government. There is a simulation of growth and development boosting the local trade opportunities as also seen in the example of the Ningbo fashion festival, China using cultural fashion as an event to stimulate the image (Wang, 2009).

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**Transformation at the macro & micro level****A. Economic**

This is a means to the market city as a product enhancing transactions and investments. The commercialized policy enables economic development strengthening the city's presence with a direction in the global market. Not only it marks competitive power but also makes winning with the leap jump in its development (Yuan & ChenChang, 2007). Celebrations and events can maximize spending utilize the local business and supply chain and develop new markets with a long time perspective. This assists the value of the city with a dimension created with a return. They contribute to a sustainable economy with the creation of employment opportunity that improves the standard of living. The economic impact can be measured in terms of investment and expenditure as an indicator for assessing success. There are three spheres of responsible stakeholders as per the practice in China, first the government (central and local), second the event sponsors, media, press, and other communities and third the voluntary organizations all working towards the prosperity of the event. The government encourages diverse forms of incentives like subsidies to promote the event and its organizing. This develops an inherent relationship between the government and the market and enables replenishment and sharing of risk by both parties. At times of crisis, the government intervenes with the introduction of measures to safeguard the event and its working by introducing policies like tax rabet, promotions, and subsidies introduced to promote the event. The third sphere contributes by way of involvement from nonprofit, non-government voluntary organizations, and corporations creating a sphere of effective citizenship. This becomes strong supporting power for the event and its success in building the right image. The Ningbo festival enriched the citizens' cultural life, economic prosperity, and connection with the external world. It advocated an image for the city developing a reputation, information, and knowledge sharing through collaborative working and mutual communication, and celebration of cultural diversity adding quality to the life of the citizens (Wang, 2009). In Gniewkowo city of Poland, the cultural sector with its progressive rock event was a source of economic development for the local businessmen developing the city and its own companies. The grass-root initiatives worked by the residents and nonprofit organizations were a positive factor in the success and succession of the event yearly (Murawska & Bieganska, 2014). Hosting a range of different events also lets a city create in itself an opportunity for different profile markets hence countries have taken up hosting Expo and Sports events. The continuity in the event stream has eventually led to 'fertilization' and 'festival marketplaces' resulting in the growth of a 'symbolic economy' and 'experience economy'. Culture has become a rapidly growing medium with its creation of blockbusters and high turnover of consumption and letting a moving economy. The economic goals nowadays are being augmented by sociocultural and imagery objectives (Richards & Wilson, 2004).

**B. Socio-Cultural**

Festivals narrow the gap in hierarchies of class, race, gender, and inequality by creating the privileges of active engagement and embodied actions. The physical gathering is important in the constitution of a social realm. The events and celebrations engage the population with an opportunity to explore time and experience space with an

organized pattern based on the theme with activities being indoor or outdoor. People benefit from being participants or are also organizers of the event. Connection and communications between the varied communities bring cultural connections and develop relationships and experiences of cultural practices from different segments of society (Stevens & Shin, 2012). The image could be related to the ‘currency of cultures’ having a shared meaning of the beliefs and value systems.

Festival should not be just structured for the one-time visit but should make way for the repeat value attracting visitors with an opportunity to differential character and place-making with new cultural experiences. Celebration marks the passage of time with a relationship generated between the old and the new once. A collaborative community involves the stakeholders in fulfilling aspirations and building trust and relationships with each other. A socio-cultural exchange is generated in the community festival. One of the important aspects is the enlightenment of the audience to create a meaningful cultural value evoking the quality of aesthetics, symbolic, spiritual, and authenticity values kept with the national and local identity (Wang, 2009). In the case of Gniewkowo, the festival generated creative milieus posing an identity and opportunity for growth with the use of culture to build the new urban image attracting highly qualified professionals, and workers attracting capital. There was a uniqueness in the event which made a difference in its success story (Murawska & Bieganska, 2014). Culture and its Halo effect further created the ‘showcase effect attracting amenities to the city like theatres, opera houses, and museums moving from the tradition to a high culture attraction with the addition of ‘popular’ culture by inclusions of fashion, pop music, ethnos capes being a medium to create image and brand for the city. This leads to branding and high branding of cities. There is the development of ‘cultural capital’ and ‘cultural landmark’ seen as a different approach from the industrial past. Some of the events have become a brand of their own like the Cannes film festival and hosting such events creates an honor value. This kind of branded event s and its replication leads to a paradox with cities trying to differentiate themselves from others and move beyond the routine identity path. The ‘universal cultural space’ is one of the patterns like the Universal forum of cultures held in Barcelona or the world Cultural forum that happened in Rio. But many cities are hosting such large brand events generating high competition, leading to many developing innovative strategies to generate theme-based events (Richards & Wilson, 2004).

### **C. Spatial**

The city needs its imagery created with direct viewing with memories created of the environment done through the construction of flagship projects with iconic, symbolic, and unique architecture. This accelerates the development to match the intense global competition. London’s Millennium flagship project with the millennium dome, wheel & bridge is an example of creating new scenic spots and attracting tourists. It created a successful city image and also contributed to economic development (Yuan & ChenChang, 2007).

At a local scale, social interactions are spatial conditions forming enclosures of varied character, and axial connections along the city making the activity spread across the city yet connected with nodes and events using the roads and pedestrian ways (Whyte, 2021). Centrality through congregational spaces organized in the vacant lands without disturbances to the traffic makes the city work and celebrate at the same time. Permeability of the

events to different parts of the city at the macro to the micro level of the city adds meaning to the place-making. The dynamics of street carnivals and exhibitions demand construction, re-structure, and deconstructing for a social and spatial organization. The intensities in space are shaped based on distinct behavior and interactions with a physical setting. In large cities, the inner urban festivals have been compressing people and their activities with heightened sensations and memories in confined spaces and time. By enhancing communicative action a transformation in the character of the urban spaces can be generated with rational and efficiency brought in festival spaces. This has been tried with discursive arenas, the creation of themes in spaces with segmentation, reshaping, and representation of the local identities. Intensive use of unoccupied spaces generates value and changes the nature of space generating a relationship between seeing and being seen [3]. In the case of the Gniewkowo heritage and identity were conserved with the organized progressive rock festival managed by the nonprofit organizations and the private sector and this created a spatial quality during the festive season with its identity and brand image (Murawska & Bieganska, 2014). The scale of events and hype of the events with its global competition has led to a demand for a strong visual character for the celebration and its experiences with demand to carving innovative means of representation. A change is experienced in the outlook of spaces and their organization. The vibrant environment is not just restricted to the location of the event but trickles across the urban landscape and the media generating a demand to enhance the overall feel from the streetscapes, the nodal points like roundabouts, billboards, and even the city skylines lit up creates a difference to its nightlife.

The complexity of the image concept is a strong area of research as many events have become ‘cultural currency’ with their image effects. In place imagery, there can be a distinction between the ‘designative’ with the informational aspect having the categorization of the cognitive elements and ‘appraisive’ components with the concern with feelings, value, and meaning about the space in the creation of imagery. These factors influence the space and its image formation (Richards & Wilson, 2004).

The urban heritage can also be well restored and conserved with better utilization of its spaces and character created by the formation of gathering points in and around the significant zones. There has been enhancement in character and information transfer like the history of the place and its relevance being transferred to the new generation. The example of the light festival of Lodz, Poland created a successful image building and experience with urban regeneration. The moving light created connections in the spaces across the city drawing attention and developing spatial character showcasing the post-industrial architecture and recreating the public spaces with a positive vibe (Miśkowiec, 2017). The spatial design needs to be innovative blurring the lines between commerce and culture. Spaces need to be ever-changing, growing, and transforming with sophistication. Spaces need to have a local identity with unique characters rooted in the history of the place, the people, and their culture.

Empowerment of citizens is required to encourage their participation in the design of their environment. Articulation of dense and open spaces is required with the weave of social fabric binding people together; this creates a meaning for the future of the inhabitants (Whyte, 2021).



**Method**

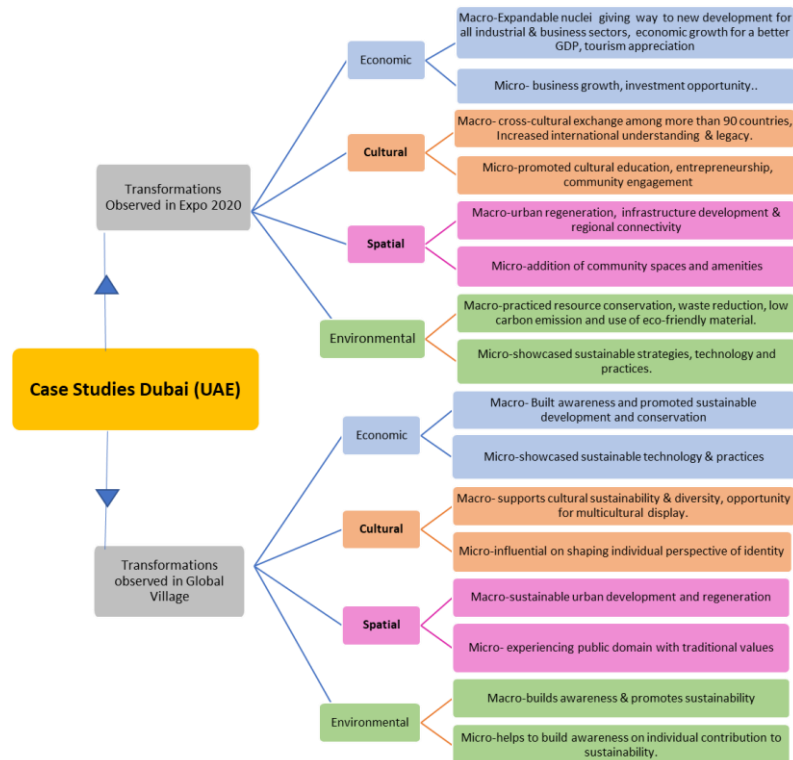
**Participatory Appraisal and Case Study**

For an appraisal of the above transformations mentioned due to events, festivals, and celebrations, case studies of Expo City and Global Village in Dubai were conducted and analyzed considering the spatial distribution patterns, utility & functions of these spaces during events and no events. These event/exposition sites with global and local importance were visited to experience at macro and micro levels through field studies and walk-throughs using the parameters discussed above. Examples of previous surveys done by local authorities to measure the impact of world-class events were also studied and analyzed.

**Results**

According to a report by the Dubai Chamber of Commerce and Industry, 73.5% were able to build new business relations and partnerships during Expo 2020. (Dubai Chamber, 2022). 32% increase in visitor numbers in 2021 and 29.1 million passengers passed through Dubai International Airport in 2021, a 12.7 % improvement from 2020. It had also enabled cross-border partnerships in global outreach and economic growth with a culture grounded in partnerships. In addition to its tourism & economic impact, Expo 2020 had a lasting effect on the city's image and reputation. It was the first world expo in history to be hosted in a hybrid format, thereby escalating the digital economy and accelerating innovation.

Table 1. Case study analysis, transformation observed in Expo 2020 and Global Village, Dubai in 2022



The major impact of the event of Global village are 7.8 million record-breaking visitors in October 2021-April 2022 season (Khaleejtimes, 2022), celebrated multicultural, multinational events like Chinese new year, UAE national day, New Year's eve, digital transformation to cashless payment, etc. The table below illustrates the inferences in these global events and celebrations in Dubai.

## **Discussion**

### **Urban patterns & identities evolved**

#### **A. The positive change**

The city gets shaped with the function causing the realization of cognition transformation in people about 'the event' and 'the city'. The 2008 Olympic Games Beijing letting the improvement of the environment and urban infrastructure an example. Buildings constructed became a part of the inheritance, the Eiffel tower constructed in 1889 for the Paris World Expo, the Yoyogi Gymnasium built in 1964 for the Tokoyo Olympics games, and the German hall designed by Mies for the Barcelonan exposition in 1929 become vivid examples as representations for their city image (Yuan & ChenChang, 2007).

There are characteristics like festival spirit, the satisfaction of the basic needs, uniqueness of the event, the authenticity of the theme, traditions, flexibility in the format of function, quality of hospitality, tangibility with the theming, symbolism with the place and its culture, affordability, and convenience areas being influenced with the opportunity of change and positive development. They develop an opportunity for social capital and help demonstrate the capacity to cope with external threats, stress, and disturbances generated by political, social, and environmental changes. It fosters leadership and networking opportunities for residents and visitors from diverse communities. Celebration binds communities and refreshes life with renewing experiences. They make communities responsive to the need of time.

There were opportunities for small, and medium size business enterprises with the community pride and identity created. The multi-cultural and intercultural communication promoted and cultivated understanding between the host and the guest. Communities get united from different ethnic, linguistic, and religious backgrounds, historic bonds creating a 'world view'. It improves the quality of life and strengthens communication between different cities and countries expanding cultural perspectives (Wang, 2009). The events bring richness in diversity as seen in the example of the European Cultural capital event balancing the expressions of culture, and its history with contemporary developments (Richards & Wilson, 2004).

#### **B. Threats & challenges**

The fast pace development can disturb the urban landscape if the local inheritance and buildings in the traditional cities are not conserved and taken into consideration during the process of city image building. There has been a negative influence on the Tokyo Urban landscape with some important buildings of Edo and Meiji

times getting destroyed due to the construction of high-speed transportation for the Olympic Games. Prudent care needs to be taken in small cities with constraints in space and having traditional buildings not lose their character and atmosphere (Yuan & ChenChang, 2007). The organizers need to understand the residents' perceptions and should not neglect their views in terms of their concerns and experiences. Negative impacts like community alienation, substance abuse, and loss to natural and conserved heritage reserves should be taken care of in the initial planning process.

There is a scope of crowding and inconvenience caused to the routine life of the residents which needs to be considered with factors such as noise pollution, crime, violence, visual pollution, intercultural misunderstanding, and fights (Wang, 2009). Poorly organized events or celebrations could lead to the loss of the city's constructed image built over a long period.

'Attention Economics' is a big concern in recent times with the cities trying to capture the attention of the audience and retain it for a long time. The availability and frequency of festivals across the globe distract the attention of the massive audience. Cities need to be maintained high standards of quality of the event and the right marketing and preparedness of its facilities in the urban context to make a feel of renewal and newness as the purpose to revisit or make the destination the choice (Yuan & ChenChang, 2007).

There is a promotion of public education with means to develop trivialities of the day-to-day task and their deliverables. It develops social networking among communities along with the appropriate placemaking. The change in imagery needs a 'protected' taking into consideration the working city. The values and meaning of the place and has to respect the understanding of the people's perception residing in the region. Studies conducted on the socio-cultural impacts of the 2000 Olympics held in Sydney state the impact of events and its image as a 'hallmark'. A strong dominating image was created disturbing the existing valuable natural and physical identities of the cities. There has been precedence of the city's image dropping very rapidly after the event. A study of the Edinburg Festival had an overall positive impact on Scotland but did not do much to the image of the city (Richards & Wilson, 2004).

The overpopulation and aging of the city's infrastructure with the effect of climate change is another threat. One of the biggest challenges is to rebuild without causing any damage to the culture, history, and spirit of the rapidly changing places. It is important to embrace the human scale in architecture and develop a sustainable image (Libeskind & Swickerath, 2015).

### **C) Need for reflections from the precedence studies**

The government and local authorities need to understand the facts and abilities of a city before its planning or implementation of the space or its infrastructure to know the constraints and threats to its existing fabric other than just creating a new image. The use of the theory of Corporation Identity (CI) in setting the City Identity system to promote the vision and the city mind considering the behavior identity taking advantage of festivals,

events, and celebrations in the creation of a progressive city image. The use of slogans has a good effect as in the example of ‘Come Celebrate Our Dream’ the slogan of the 1996 Olympic Games of Atlanta coined in reflection to the famous speech by Martin Luther King with the statement ‘I have a dream’, Slogan of 2010 Shanghai World Expo ‘better city, better life’ had made a difference in the economic growth with its bright and rich characteristics to fast-growing China (Yuan & ChenChang, 2007). In the case of Rotterdam, the image addressed complexity with its modern architecture and waterfront development in the multicultural and dynamic working city with positive changes seen in the post-event (Richards & Wilson, 2004).

## Conclusion

The events, festivals, and celebrations create an expressive, connected & remembered life. They enhance the community's pride with cultural renewal and improved standards of living. Quality of space is generated in the urban context with renewed infrastructure, and buildings with varied architectural characters. Respect for the existing traditions and human values needs to be maintained enabling the city's image to gain recognition. Cultural renewal generates a vibrant feel in its spaces for both residents and tourists. There should be the opportunity for sustainable economic growth and balance maintained with a long-term plan. The government, policymakers, and organizers have an important role and responsibility in creating the right identity and monitoring growth. Treats and risks need to be mitigated converting them into opportunities. Communities need to face the challenges by being connected to work collectively with a united view of communal living. Integrating humanity in the design of spaces is important in an open society with the reflection of history dealing with complex realities and unpredicted chaos. The cities of the future need to be in line with the utopian fantasies adapting to technology and its advancement. This would produce a new complex dimension to the whole living, learning, and work environment. All great cities have been developed out of the dreams of their inhabitants. The city image needs to have an ever-enduring spatial character adopting diverse cultural needs with creative ways of celebration. Urban spaces and their landscape need to be adaptive to the fast-changing needs of time and be enabled to be transformed.

A healthy environment needs to be crafted with a unique identity respecting the place, its culture, heritage, and the people. The events, festivals, and celebrations are ever-changing, but their memories and experience remain forever in people's minds.

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## EFL Teachers' Expectations and Satisfaction Levels of Professional Development

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**Abstract:** Professional development (PD) is critical for maintaining and developing teachers' qualities and competencies; however, how to make PD more effective in relation to EFL teachers' expectations and examine their satisfaction levels with PD activities organized in a foreign language center remains a major concern for administrators, researchers, and teachers. The purpose of this study is to explore EFL instructors' expectations and levels of satisfaction with the PD activities that they have participated in. This study used both quantitative and qualitative research methods, including questionnaires and interviews to answer the research topics indicated above. The study involved 50 teachers at an English Language Center, in Can Tho City, Vietnam. According to the findings, EFL teachers have high expectations for (1) PD content, which focuses on improving lesson planning and student outcomes, as well as learning how to create a supportive learning environment; (2) coherence of PD with teachers' needs and students' needs and interests; (3) opportunities for active learning, such as observing more experienced teachers or being mentored by experts; and (4) duration of PD, which should be ongoing throughout the year and a year-long program. EFL teachers were also satisfied with (1) the PD content, (2) the coherence, and (3) the duration of the PD, according to the findings. Some recommendations for increasing PD characteristics are offered based on the primary findings.

**Keywords:** PD Activities, EFL Teachers' Expectations, EFL Teachers' Satisfaction

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### Introduction

English teaching and learning have changed drastically over the last several decades; as a result, EFL teachers require professional development to update and improve their knowledge and skills to keep up with the tendencies of English language teaching (Richard & Farrell, 2005). Teacher professional development is thought to improve not only teachers' practices (Richard & Farrell, 2005), but also students' learning outcomes and

educational reform achievement (Villegas-Reimers, 2003). Professional development now ranges from one-time workshops to more extensive programs, allowing teachers to learn more consistently. However, not many studies have been conducted to investigate EFL teachers' expectations and their satisfaction levels with PD activities. As a result, this study was carried out to acquire insights into EFL teachers' expectations and levels of satisfaction with PD activities in the setting of a foreign language center in Vietnam's Mekong Delta.

In terms of professional development approaches, Richard and Farrell (2005) offered eleven forms of professional development that instructors might use to improve their teaching; however, in this study several common types such as students' feedback, training workshops, peer coaching, peer observations were investigated. However, an effective professional development approach should incorporate tactics that are relevant to the needs and expectations of teachers (Richard and Farrell, 2005). Meeting teacher expectations for professional development is projected to increase long-term applied competence as a program outcome because instructors will be more motivated to put program content into practice. Furthermore, analyzing their levels of satisfaction with the PD activities that they had participated in is significant since the findings may assist educators or educational administrators in making timely and optimal adjustments for improved PD programs. It is accepted that educational leaders should promote and facilitate professional learning and development in their schools to best support teachers in their teaching practice by providing what they expect to achieve from PD prior to designing and organizing PD events and allowing teachers to evaluate or assess the PD events that they have attended.

## **Teacher Professional Development**

Numerous scholars have defined professional growth. Day (1999), for example, characterized it as a process that instructors can undertake individually or cooperatively to review or renew their teaching objectives and to broaden their knowledge, abilities, and emotional intelligence, all of which are essential to their teaching career. Professional development is also characterized as an ongoing learning process in which teachers participate freely to learn how to best adapt their teaching to the requirements of their students (Guskey, 2000). Furthermore, Ganser (2000) and Thomas Guskey (2000) define professional development as the growth of a teacher's profession as a result of formal experiences such as workshops and training courses as well as informal learning such as reading professional publications and watching educational documentaries. According to Richard and Farrell (2005), professional development includes all activities that serve long-term goals and promote development and growth in teachers' understanding of themselves as teachers. In other words, it is a lifelong process that not only helps schools and organizations and facilitates student learning but also aims to improve instructors' personal and professional skills. In summary, those definitions of professional development all agree that it is a continual process comprised of many activities that teachers engage in to improve their teaching methods.

There are numerous reasons why teacher professional development is essential in education. First, English

teachers must keep their pedagogical knowledge and abilities up to date to satisfy the changing needs of schools and institutions (Richard and Farrel, 2005). Furthermore, professional development is said to improve teaching techniques (Villegas-Reimers, 2003). Teacher professional development improves classroom practices and develops teachers' pedagogical expertise (Youngs, 2001). In terms of student learning, it is true that the more successful professional development teachers have received, the further learners move in their learning (Guskey, 1997). Professional development, in addition to having a substantial impact on teachers' work and students' performance, also helps to improve institutions (Richard and Farrel, 2005) and the success of educational reforms (Villegas-Reimers, 2003). Finally, professional development experiences have a major positive impact on teachers, their practice, students' learning outcomes, and educational organizations.

### **Effective Professional Development**

According to Desimone (2011), five characteristics of effective PD must be considered: (1) an emphasis on both subject matter and teaching methods; (2) opportunities for active learning, such as observing, receiving feedback, analyzing student work, or presenting, as opposed to passively listening to lectures; (3) coherence: content, objectives, and activities that are consistent with school curriculum and objectives, teacher knowledge and beliefs, students' needs, and school, district, and state reforms and policies; (4) Continuous duration: Professional development activities should be ongoing throughout the school year and include at least 20 hours of contact time. (5) Collective participation: Professional development activities should be conducted by groups of teachers from the same grade, subject, or institution.

#### ***Content Focus***

Content refers to what instructors learn through professional development (Garet, Porter, Desimone, Birman, 2001). Professional development content is separated into two major categories: knowledge of the subject matter and understanding of how students learn that content (Guskey & Yoon, 2009). According to Desimone (2009), the most significant aspect of good professional development is pedagogical expertise. Empirical evidence suggests that content-focused professional development can influence instructors' knowledge, teaching methods, or student learning (Garet et al., 2001).

The subject matter and pedagogical knowledge of teachers should be regularly enhanced. Teachers should be helped to comprehend the information they teach more deeply, and the ways pupils learn that content appear to be an important aspect of good professional development (Birman, 2003). A professional development activity can be considered effective in improving teachers' knowledge and skills if it is part of a larger set of opportunities for teacher learning and development, builds on prior knowledge and experience, supports national and provincial standards and assessment, and is consistent with teachers' goals (Birman, 2003).

#### ***Active Learning***

Active learning is defined as opportunities for instructors to engage in the analysis of teaching and learning (Garet et al., 2001). Observing experts or more experienced teachers or receiving constructive feedback or



suggestions, reviewing or analyzing students' work, scoring or assessing students' work or performance, group discussions on specific topics related to learning and teaching, developing and presenting lessons, coaching and mentoring, or interacting with teachers to discuss steps or instructions are all methods proposed by researchers to promote active learning (Desimone, 2009).

### ***Coherence***

Coherence refers to how well professional development aligns with other teacher learning opportunities, teachers' knowledge and views, and school, district, and state reforms and regulations (Desimone, 2011). Effective professional development should address teachers' needs and be conducted in a variety of contexts, both in and out of the classroom (Borko, Jacobs, & Koellner, 2010). An effective professional development program should be designed in accordance with not only how individual teachers learn but also with how schools as organizations influence and are influenced by teachers' learning and improvement (King & Newman, 2001).

### ***Duration***

Professional development should take up a significant amount of time, and that time should be well organized, carefully planned, consciously directed, and focused on subject, pedagogy, or both (Birman et al., 2000). One full academic year appears to be appropriate because it provides teachers with more opportunities to learn, implement, reflect, and re-implement, forming a cycle of experimentation, particularly in gaining constructive feedback on what teachers have learned and implemented (Daloglu, 2004). Several studies have found that a sufficient number of professional development contact hours has a favorable impact on teacher outcomes such as attitude, readiness, and teaching practice (Banilower, Heck, & Weiss, 2007; Supovitz & Turner, 2000).

### ***Collective participation***

The extent to which instructors from the same school participate in the same learning opportunities is referred to as collective participation (Hochberg & Desimone, 2010). Studies have also found a link between collective engagement and instructional practice (Desimone et al., 2002; Penuel et al., 2007). According to Desimone et al. (2002), professional development is more effective in improving teachers' classroom practices when participants are from the same school, department, or grade. Penuel et al. (2007) discovered that when participation in professional events included all teachers in the department or grade groupings, or all teachers in the school, teachers reported more changes. Collective participation - teachers from the same school, department, or grade level participating in a professional development program - has been shown to be beneficial in terms of discussing teaching concepts, skills, and problems in the same context, sharing curricular issues, dealing with students' needs across classes and grade levels, and contributing to a shared professional development community (Birman et al., 2000).

## **Five Critical Levels of Professional Development Evaluation**

According to Guskey (2000), there are five levels of professional development evaluation, which are

hierarchically arranged as follows:

### **Participants' Reactions**

The first level of evaluation focuses on the reactions of participants to the professional learning experience. This is the most prevalent sort of professional learning evaluation and the simplest type of data to collect and analyze. At this stage, the information gathered from participants focuses on their own experiences. For example, the poll asks whether the PD event's content and materials make sense; whether the activities are relevant and well-planned; and whether the speaker or presenter is knowledgeable, credible, or helpful. It is also associated with the surroundings, such as the facilities or how organizers care for attendees.

Data on participant reactions is typically obtained through questionnaires administered at the end of a program or activity or through online surveys sent later via email. These questionnaires and surveys often include rating-scale items as well as open-ended response questions that allow participants to provide more individualized and thorough feedback. Measuring participants' initial happiness yields data that can be used to improve the design and facilitation of professional learning in meaningful ways. Furthermore, favorable responses from participants are frequently required as a prerequisite for higher-level evaluation outcomes.

### **Participants' Learning**

Participants should acquire something from their professional learning experiences in addition to enjoying them. Level 2 learning focuses on measuring participants' new knowledge, abilities, and maybe attitudes (Guskey, 2002). Because it is anticipated that particular learning goals will be measured at Level 2 of evaluation, professional learning leaders or organizers must establish signs of successful learning before activities begin. Evaluators also assess both positive and negative unintentional learning effects. Professional learning that includes collaboration between teachers and school administrators, for example, can generate a strong sense of community and a sense of shared purpose among participants (Supovitz, 2002). If evaluators are concerned that participants may already have the necessary knowledge and abilities, they may need some sort of pre- and post-assessment. Analyzing this data provides a foundation for enhancing the content, presentation, and organization of professional learning.

### **Organizational Support and Change**

At Level 3, the emphasis shifts away from participants and onto organizational aspects that may be critical to the success of professional learning events. Level 3 questions concern organizational traits that are required for success. For example, whether professional learning promoted changes that were aligned with the school's or organization's mission, whether changes were supported at the building and district levels, and whether successes were recognized and shared by the school or organization. These factors frequently play a significant role in determining the success of professional learning.

### **Participants' Use of New Knowledge and Skills**

Level 4 questions focus on whether the knowledge and skills participants gained through PD make a difference in their teaching practice. At this level of review, the key to acquiring useful data is to assess both the extent and quality of implementation. These data, unlike Levels 1 and 2, cannot be obtained at the end of a professional learning program or activity. Participants require adequate time to adopt new ideas and practice them in their respective situations. Because implementation is frequently a process, evaluators may require time to think about and assess PD. These data may be collected through surveys or organized interviews with participants and their school leaders, depending on the goals of the PD organizers. Participants may be invited to conduct oral or written personal reflections or examinations in the form of journals or portfolios. Direct observations by qualified observers or digital recordings can provide the most reliable data, which can be used to assess teachers' current levels of implementation. It also assists professional development designers in reorganizing future programs and activities to allow for more consistent implementation.

### **Students' Learning Outcomes**

Level 5 questions are concerned with whether or not PD has an impact on pupils or benefits them in any way. The specific student learning outcomes of interest will, of course, be determined by the goals of that individual professional learning initiative. In addition to the stated goals, the program may have significant unexpected consequences. It is assumed, for example, that pupils' average scores on large-scale tests increased, but so did the school dropout rate. Mixed results are common in efforts to enhance education, emphasizing the necessity of including several measures of student learning in all evaluations (Guskey, 2007).

Furthermore, because stakeholders' faith in various sources of evidence varies, it is unlikely that any single sign of success will be appropriate or sufficient for all. Participants can incorporate numerous sources of evidence when providing appropriate data for judging the effects of professional development programs. Furthermore, assessors must carefully match these data sources to the requirements and perceptions of various stakeholder groups (Guskey, 2012). Professional development that is effective should result in improvements or advancements in students' learning outcomes. Assessment results, portfolio evaluations, marks or grades, or standardized examination scores should all be included in this category. Other affective outcomes to evaluate include students' attitudes, attendance rates, dropout statistics, and participation in school activities (Guskey, 2003). If a professional development program has a direct impact on student behavior, teachers will be more likely to support it (Daloglu, 2004).

## **Method**

### **Results instruments**

This is a descriptive study that looked into EFL teachers' expectations and satisfaction with professional

development activities. This study used both quantitative and qualitative methodologies to investigate EFL teachers' expectations and satisfaction with professional development activities. According to Creswell (2013), descriptive studies that use both quantitative and qualitative methodologies provide an in-depth understanding of research concerns. A five-point Likert scale questionnaire was utilized to collect quantitative data on EFL teachers' expectations and satisfaction with PD activities. To learn more about EFL teachers' expectations and satisfaction with PD activities, a semi-structured interview was carried out.

Table 1. Research Questions and Instruments

Research questions	Methods/Instruments
1. What are EFL teachers' expectations about professional development activities?	Quantitative: Questionnaires Qualitative: Interviews
2. What are EFL teachers' satisfaction levels of the professional development activities that they have attended?	Quantitative: Questionnaires Qualitative: Interviews

This study used a mixed-method approach to strengthen the validity of the data and provide a more in-depth knowledge of EFL teachers' expectations and satisfaction with PD activities. A questionnaire is stated to be one of the most prevalent data collection tools since it is particularly capable of acquiring a great amount of information from a wide sample of participants quickly. Furthermore, open-ended interview questions can be used to gain a thorough grasp of the topic.

The researcher employed two instruments to answer the two research questions: (1) a questionnaire to identify EFL teachers' expectations and satisfaction with professional development, and (2) interviews to gain more insight into EFL teachers' expectations and satisfaction with professional development activities.

### Participants

For the study, 50 teachers (14 men, 28%; 36 females, 72%) ranging in age from 22 to 39 years old working at an English language facility were invited to complete a questionnaire. The majority of the participants have been teaching English for at least two years. 40% of participants have two to five years of teaching experience, whereas 36% have more than five years of English teaching experience. The remaining 24% have fewer than two years of experience teaching English. In terms of teaching qualifications, the participants who hold a Masters' Degree in Language Teaching account for 26%, and the remaining participants (64%) have a bachelor's degree in English Language Teaching.

Six previous questionnaire respondents were specifically invited to engage in a follow-up interview to acquire more in-depth knowledge of their expectations and satisfaction with PD activities. Purposive sampling was also used to uncover similarities and differences among distinct groups of teachers with varying years of teaching experience.

## Results

### The reliability of the questionnaire

The questionnaire was distributed to 60 teachers teaching at a foreign language center with the goal of evaluating the professional development expectations and satisfaction levels of EFL teachers. Only 50 of them, however, submitted their responses.

The questionnaire results were entered into SPSS version 20.0 for quantitative data analysis. A scale test was then done to ensure the instrument's dependability. The questionnaire was extremely reliable (Cronbach's alpha =.943) in collecting data for the study, as demonstrated in the following table.

Table 2. The Reliability of the Questionnaire

Instrument	Cronbach's Alpha	No. of items	No. of respondents
Questionnaire	.943	68	50

### Professional Development Expectations of EFL Teachers

#### *Results from questionnaires*

Descriptive Statistics Tests were used to obtain the overall mean score (M) of EFL instructors' expectations and the means scores of five parts of PD activities in order to study what EFL teachers hope to achieve from PD activities.

The overall mean score of EFL teachers' expectations of the PD activities was checked using a Descriptive Statistics Test. The total mean score of EFL teachers' expectations about PD activities was 4.10 (M = 4.10), with a .70 (SD =.70) difference between the minimum and maximum values. In other words, the findings suggest that EFL teachers have high expectations for professional development activities.

According to the results, EFL teachers have high expectations for the content concentration of professional development activities (mean = 4.40, standard deviation = 0.65). The mean scores for the two elements comprising opportunities for active learning (M = 4.08, SD = 0.73), and coherence of the PD content (M = 4.18, SD = 0.69), indicated that EFL teachers have high expectations for these elements. The mean score for the duration of PD activities (M = 3.91, SD =.73) was significantly lower than the scores for the other variables, and the mean score for selective participation (M = 3.30, SD =.80) was the lowest.

The results showed that most of the participants surveyed have very high expectations of the content focus of PD activities, including planning effective lessons, creating a meaningful and supportive learning environment, learning new techniques to apply directly in the classroom, designing effective assignments and activities, and improving students' outcomes. They also wished to master instructional methodologies, classroom management,

adapting lesson plans to students' needs and interests, and providing clear and easy instructions. Moreover, hoped to have opportunities to increase their English proficiency from PD activities, give students more meaningful opportunities to speak English, and adapt resources successfully.

Table 3. Descriptive Statistics of EFL Teachers' Expectations of PD Activities

<b>Expectations</b>	<b>N</b>	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>SD</b>
Content focus	50	2.77	5.00	4.40	.65
Active learning	50	2.50	5.00	4.08	.73
Coherence	50	2.60	5.00	4.18	.69
Duration	50	2.00	5.00	3.91	.73
Selective participation	50	1.50	5.00	3.30	.80
Overall expectations	50	2.44	5.00	4.10	.70

Regarding opportunities for active learning, most participants had extremely high expectations of witnessing more experienced teachers teaching their actual courses, designing, and demonstrating lessons, and discussing how to improve teaching practice with other teachers. Participants said they would like to be observed by experts to receive constructive criticism for future changes. Co-teaching with other teachers and being mentored by experienced teachers are also thought to help EFL teachers improve their teaching technique. Teachers, on the other hand, do not expect much from examining and scoring students' collaborative work in PD activities. All participants agreed that the coherence of the PD content should reflect the requirements of students. The results indicated that they have high expectations for the content of professional development activities, which should be designed to address the learning requirements of specific grade levels or schools and be consistent with school curriculum and goals. It was revealed that many of participants believed that PD activities should be consistent with instructors' knowledge and beliefs.

What is remarkable about the above table is that strongly expect that PD activities should be organized throughout the school year and provide teachers with more opportunities to practice newly acquired knowledge and skills. To be effective, however, half of the teachers surveyed believe that the duration of professional development activities should comprise 20 hours of contact time. On the other hand, instructors believe that the selective participation is not very important compared to other factors. However, some respondents believe that selective participation in PD activities should impart the same skills, the same grade but from various geographic regions. Briefly, the results of the questionnaires revealed that EFL instructors have high expectations for the content, coherence, opportunities for active learning, and duration of professional development (PD). However, they asserted that selective participation is not a significant factor in PD.

#### *Results from interviews*

The interview data provided additional insight into the expectations of EFL instructors for PD activities. Overall, the responses were quite consistent with the questionnaire results. When asked about their expectations for the PD content perspective, all interviewees reported having high expectations for this perspective. Both novice and experienced teachers—reported that they anticipate creating a supportive and meaningful learning

environment for students to have more opportunities and real-world reasons to speak English. One participant said:

*“I strongly expect that I can learn how to give students meaningful opportunities and more meaningful reasons or contexts to speak English in the classroom.”*

83.3% of teachers, including both novice and veteran educators, are optimistic about the improvement of lesson planning and the design of appropriate activities and assignments for effective content instruction.

*“Regarding to the content of PD activities, I expect to improve lessons planning and designing appropriate activities to meet the lesson’s objectives and have more ideas to design lessons to teach more effectively.”*

Additionally, EFL teachers with less than five years of teaching experience expressed a desire to increase their flexibility in changing lesson plan activities to better meet the requirements or interests of their students.

*“I expect that I can learn how to flexibly change or adapt the lesson plans while teaching to meet students’ interests and engage and encourage students to learn.”*

50% of EFL instructors with less than two years of teaching experience or more than five years of teaching experience believe that improving students' learning outcomes is essential.

*“I also hope to improve students’ outcomes, know what students need to design more effective lessons”.*

Additionally, EFL instructors are expected to use and adapt instructional materials effectively, as well as improve their instruction-giving and classroom management skills.

*“Using and adapting materials and applying ICT to teach are also my expectation.”*

The findings of the study showed that EFL teachers have high expectations of PD, such as lesson planning, designing effective activities and assignments, creating supportive learning environments, giving students meaningful opportunities and reasons to speak English, and emphasizing student learning outcomes.

Six EFL teachers agreed that they expect to have opportunities to observe, be observed, and co-teach with more experienced teachers to receive constructive feedback for improvement.

*“I expect to observe more experienced teachers, especially teachers who teach the same skills first and then other skills as well.”*

Four out of six EFL teachers also need more time and opportunities to share teaching experience with each other, discuss how to improve teaching practices, and give advice to solve problems or difficulties.

*“If possible, I hope that teachers can spend time sharing experience and discussing with each other on how to improve our teaching practice.”*

Two of six teachers, accounting for 33.3% of the interviewees, wish to have a mentor who helps them in designing lessons, co-teaching, observing, and giving feedback during the course.

*“I also hope to be mentored by a more experienced teacher, especially when I first challenge myself with a total new class to receive constructive feedback.”*

Additionally, EFL teachers shared that there should be more demonstrations and practice during the PD programs so that participants can apply what they have learned and get constructive feedback from both colleagues and trainers. EFL instructors anticipate co-teaching, sharing, and discussing teaching challenges,

observing, and being observed by more experienced teachers, and receiving constructive feedback.

Regarding the coherence of PD content, all participants (100 percent) agreed that PD content should be consistent with student needs and school objectives.

*“My first expectation is that PD content should be consistent with students’ needs and participants’ needs, and the school goals as well.”*

Nevertheless, 33.3% of participants indicated that the content of PD should be consistent with instructors' needs and knowledge to meet their expectations and requirements. Lastly, two teachers revealed that professional development (PD) activities should be tailored to specific groups of English language learners to best meet students' requirements or resolve their learning problems or challenges to improve English proficiency. In short, EFL teachers suggested that the content of PD activities should be consistent not only with learners' needs and school goals but also with teachers' knowledge and requirements. The content should also be tailored to specific groups of students so that teachers who participate in professional development can implement what they've learned to improve the outcomes for their students of interest.

*“I hope that the content from PD activities should be designed for certain groups of participants so that teachers can easily discuss and learn from each other. For example, teachers of kids or teenagers.”*

EFL teachers' expectations regarding the duration of professional development activities were that they would be ongoing throughout the year and allow participants ample time to implement, practice, and reflect on what has been successful and what needs improvement prior to learning new knowledge or skills.

*“PD activities should be organized once every two weeks so that participants have more time to read materials before, discuss, and reflect. After that, teachers should be given more time to practice new knowledge, apply in designing lessons, and get feedback.”*

In terms of selective participation, four EFL teachers (66.67%) believe that participants in professional development programs should share common backgrounds, such as teaching at the same school, the same levels of students, or the same language abilities, so that they can share common problems or teaching experiences. On the other hand, 33.33 percent of teachers with two to five years of experience indicated that they prefer participating in professional development activities with participants from diverse backgrounds, teaching different groups of students so that they can learn from them.

*“I think attending workshops with teachers who teach the same skills is important because they have a lot in common to share and understand the curriculum and students as well.”*

In conclusion, the questionnaires and interviews revealed that EFL teachers have high expectations for the content of professional development, the opportunities for active learning, and the coherence of PD with students, teachers, and institutions. Specifically, EFL instructors want to increase their pedagogical knowledge by observing more experienced teachers. In addition, they expect that PD content is consistent with students' needs and teachers' knowledge and is ongoing throughout the year, and that teachers who teach the same students or skills participate in PD together.



### EFL Teachers' Satisfaction about the PD Activities that they have attended

To determine the extent to which EFL teachers are satisfied with the elements of the professional development activities they have participated in, Descriptive Statistics Tests were administered to determine the aggregate mean score of EFL teachers' satisfaction and the means score for each cluster.

The results indicate that EFL teachers were satisfied with the content emphasis of their professional development activities ( $M = 3.84$ ;  $SD = .78$ ). The coherence of the PD content ( $M = 3.72$ ;  $SD = .77$ ) and duration of PD activities ( $M = 3.60$ ;  $SD = .83$ ) are the means of two elements. It meant that EFL instructors were very pleased with those components. The mean score for selective participation was quite low ( $M = 3.52$ ;  $SD = .69$ ), as was their level of satisfaction with opportunities for active learning ( $M = 3.44$ ;  $SD = .89$ ).

Table 4. Descriptive Statistics of EFL Teachers' Satisfaction

Satisfaction	N	Min	Max	Mean	SD
Content focus	50	2.00	5.00	3.84	.78
Active learning	50	1.50	5.00	3.44	.89
Coherence	50	2.00	5.00	3.72	.77
Duration	50	2.00	5.00	3.60	.83
Selective participation	50	2.00	5.00	3.52	.69
Overall satisfaction	50	1.89	5.00	3.67	.80

#### *Results from questionnaires*

Results showed that participants were satisfied with the focus of professional development activities which enabled them to construct effective assignments and activities for teaching content, improve their English proficiency, plan effective lessons, create a meaningful and supportive learning environment, learn more instructional strategies and new techniques, improve student learning outcomes, and provide students with more meaningful opportunities to communicate in English. The participants also agreed that the content focus has helped them improve their ability to manage classroom activities, provide clear and simple instructions, and adapt lesson plan activities to students' needs and interests.

Regarding the opportunities for active learning, participants agreed that the PD activities provided teachers with more opportunities to observe and be observed by experts or more experienced teachers modeling or teaching to receive constructive feedback and interact with other teachers to discuss how to improve their teaching practice. Half of teachers agreed that professional development activities have helped them devise and demonstrate lessons and be mentored by more experienced teachers. On the other hand, they are not very satisfied with the opportunities that PD activities have provided them to co-teach with other teachers and grade students' work with other teachers.

Most of participants agreed that the professional development activities they attended were consistent with teachers' beliefs and knowledge, students' needs, as well as the school curriculum and objectives. Besides, more

than half of the participants felt that the professional development activities addressed the learning requirements of specific grade levels or schools and were consistent with school, district, and state reforms and policies.

The results indicated teachers are satisfied with the duration of PD activities; more specifically, teachers surveyed agreed that PD activities have been ongoing throughout the school year and that they have been given more opportunities to practice newly acquired skills over time. In contrast, some participants reported that the duration of their PD activities included at least 20 hours of contact time, which means that they are not very satisfied with the duration of PD. Additionally, over fifty percent of participants indicated that they were satisfied with PD activities because participants were from the same institution and grade, and they were imparting the same English skills.

#### *Results from interviews*

The interview data provided additional insight into the levels of satisfaction EFL instructors have with PD activities. Overall, the responses were quite similar to the questionnaire results.

When asked how satisfied EFL instructors were with the content of professional development activities. All participants were satisfied with the PD material, as indicated by the results. To be more explicit, three of the teachers (50%) indicated that they were extremely satisfied with the content of the professional development activities in which they participated—up to 90 percent satisfaction. The data from the interviews revealed that all EFL instructors, both novice and experienced (100% of interview participants), were satisfied with the lesson planning enhancements resulting from PD activities.

*“I have been satisfied about lesson planning and applying appropriate activities to teach content effectively.”*

Concerning how to create a supportive learning environment and provide students with more meaningful opportunities to speak English, the majority of teachers reported being satisfied with the professional development activities designed to improve their techniques or skills.

*“I have been satisfied because I can learn how to create supportive learning environment for students to practice English, motivate them a lot, be more creative, step into students’ world, and give students more meaningful reasons to speak, especially when teaching young learners.”*

In addition, more than half of the participants verified that professional development activities have emphasized improving student learning outcomes.

*“I have also been satisfied with improving students’ outcomes. I learned to design specific objectives before and prioritized students’ outcomes and tried to link activities with objectives mentioned. I also received feedback and reflected my lesson for improvements.”*

The findings regarding EFL teachers' levels of satisfaction with the content of professional development activities According to fifty percent of interview participants, their classroom administration skills have improved as a result of applying what they have learned from PD activities.

*“Classroom management has also been improved. I have learned to get students engaged and manage*

*them effectively.”*

Besides, 33.33% of participants claimed that PD activities provided them with opportunities to share teaching experience and teaching materials, discuss how to enhance teaching methodologies, and jointly solve pedagogical problems. However, 33.33 percent of EFL instructors who participated in professional development programs were not satisfied with the opportunities to use and adapt teaching materials effectively.

*“However, I haven’t been satisfied about techniques to flexibly change the lesson plans whiling teaching and need more practice.”*

In conclusion, the findings regarding EFL teachers' levels of satisfaction with the content of PD activities revealed that EFL teachers are highly satisfied with improving lesson planning, creating a supportive learning environment, providing students with more real-life opportunities or reasons to speak, learning more techniques and instructional strategies, and having opportunities to share and learn from colleagues.

EFL teachers feel satisfied with the opportunities for active learning from PD activities. They reported that they have had opportunities to share teaching experience and discuss how to improve teaching practice, but they need more opportunities to observe more experienced teachers to learn.

*“In general, I have been satisfied with opportunities for active learning because the school let us learn and practice step by step: theories first, then plan lessons, revise, observe and feedback.”*

In terms of the coherence of PD content, EFL teachers have been highly satisfied with the consistency of PD content with students’ needs, teachers’ needs and knowledge, and schools’ goals.

*“I have been satisfied about the content of PD which is consistent with my knowledge and belief in teaching. It is not too easy and not out of reach as well.”*

In terms of the duration of PD activities, all the participants feel satisfied that PD activities are ongoing throughout the year, but two of the participants who have less than five years of teaching experience prefer having more time to practice new skills or knowledge before learning new ones. Additionally, the participants reported that they can learn a lot from the participants because they are experienced and willing to share with each other.

*PD activities are on-going throughout the year. There are a lot of sharing sessions or workshops for teacher to attend.*

In conclusion, the questionnaires and interviews revealed that EFL instructors were pleased with the course's content, coherence, and selective participation. In particular, EFL instructors have been enhancing their pedagogical knowledge and gaining knowledge from more experienced teachers. The PD content has been aligned with the requirements of students, the knowledge of teachers, and the school's objectives. However, EFL instructors have been dissatisfied with the opportunities to observe more seasoned educators. In addition, they need more time to practice new skills acquired through PD activities before acquiring new ones in order to determine their efficacy.

## **Discussion**

This study examined EFL teachers’ expectations and satisfaction levels with professional development activities

that they have attended at a foreign language center. Results showed that there are both similarities and differences between this study's findings and the conceptual framework of the Five Critical Levels of Professional Development Evaluation (Guskey, 2000). EFL teachers from this study expect to improve their teaching knowledge and skills by improving lesson planning and learning more teaching techniques or instructional strategies. This is consistent with studies conducted by Eksi and Aydin (2003) which indicated that EFL teachers taking part in PD activities hope to improve their teaching skills and methods through PD activities. Knapp (2003) also supported the idea that effective PD content builds on teachers' pedagogical content knowledge.

EFL teachers hope to improve students' learning outcomes by applying what they have learned from PD activities. This is consistent with studies done by Noom-Ura (2013) which revealed that PD activities would put a high emphasis on strategies for helping students improve their English skills. Additionally, Knapp (2003) revealed that the content of PD should be focused on students' learning. However, EFL teachers do not have high expectations to improve English language proficiency through PD activities because they believe English is used as a tool to communicate in PD activities and teachers can improve themselves or participate in other activities. This result is not consistent with a study by Noom-Ura (2013), which indicated that PD activities would help teachers improve their language proficiency for only non-native-speaking teachers and that PD should focus on improving teachers' English proficiency.

This study found that EFL teachers expect to have more opportunities to observe or co-teach with more experienced teachers to learn and receive constructive feedback for improvements. The content of PD activities should be consistent with students' needs, teachers' knowledge, and schools' goals. The duration of PD activities is also one of the EFL teachers' expectations, and EFL teachers in this study acknowledged that selective participation is not very important to them, but the content and trainers are supposed to be more significant in PD activities. The results from this study share both similarities and differences with other related studies about professional development needs or expectations.

This study highlights the detailed satisfaction levels of EFL teachers about the professional development activities that they have attended. Findings from both questionnaires and interviews generally showed that EFL teachers have been quite satisfied with the PD activities that they have participated in, but their satisfaction levels are different. Generally, EFL teachers have been most satisfied with the content of PD activities offered by the school, such as lesson planning, designing effective assignments and activities, creating a supportive learning environment, and learning new teaching techniques or instructional strategies. Additionally, EFL teachers have been satisfied with the coherence of PD activities, which is consistent with students' needs, teachers' needs, and schools' goals. Finally, teachers have been satisfied with the duration and frequency of PD activities offered by the schools, which are ongoing throughout the year.

The most important details in this text are that EFL teachers have not been very satisfied with opportunities to learn from other more experienced teachers by observing and co-teaching. They also indicated that they need

more opportunities to learn from experienced teachers systematically, which means that novice or less experienced teachers need support from experts or experienced teachers in lesson planning, observing, analyzing lessons, giving constructive feedback, adapting more effective and appropriate lesson plans for the next class, and reflecting on their effectiveness. Factors such as different ages, genders, educational qualifications, and years of teaching experience do not have significant impacts on EFL teachers' expectations and satisfaction levels of PD activities. Results showed that EFL teachers' levels of satisfaction about PD activities were quite high, but their satisfaction levels were not very well matched with their expectations of PD activities. For example, they expect many opportunities to observe more experienced teachers or experts teaching, but they have not been very satisfied about that.

## Conclusion

The research was conducted with 50 participants working in a foreign language center in Can Tho City. Two types of instruments were used to collect data: questionnaires and interviews. Results showed that EFL teachers have high expectations of PD activities, such as the content focus, the opportunities for active learning, the coherence of PD, and the duration of PD. However, they do not expect much from the selective participation of PD. EFL teachers also expect to learn from more experienced teachers or experts through observations, coaching, or mentoring, and that the PD content is consistent with students' needs, teachers' needs, and schools' goals.

Additionally, the participants in PD should teach the same levels of students or the same language skills. Results showed that EFL teachers have been satisfied with the PD activities offered by the school. They were most satisfied with the content focus, coherence of PD content, and duration of PD. Active learning and participation were the two aspects in which teachers had low satisfaction levels. PD has helped them design assignments and activities to teach content effectively, strengthen their English proficiency, plan effective lessons, create a meaningful and supportive learning environment, learn more instructional strategies and new techniques, improve students' learning outcomes, and provide students with more opportunities to communicate in English. PD content has been consistent with teachers' beliefs and knowledge, with school curriculum and goals, and with students' needs. However, they suggested that there should be more opportunities for teachers to observe and practice.

## Recommendations

On the basis of the study's limitations, the researcher proposed two recommendations for future research. For the study to be generalizable, it is essential to increase the number of participants. The topics can be EFL instructors from various language centers or regions of the Mekong Delta. It would enable the researcher to identify similarities and differences between groups or contexts, allowing for the implementation of effective and high-quality programs that address teacher learning expectations. Another suggestion is to triangulate study data from

various stakeholders, such as teachers, school leaders, and educational administrators, in order to obtain a deeper understanding of teachers' professional development expectations.

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## A Study on the Effectiveness of Chunk Teaching Method in English Writing Teaching in China's Middle Schools

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**Abstract:** Anchored in the researchers' investigation and experience during the internship at a middle school in Nanjing, Jiangsu Province, this dissertation, carried out under the guidance of the theory of chunk teaching method, sorts out the current research results and findings on chunk teaching method, and then analyzes the differences between the chunk teaching method and other traditional writing teaching methods from the perspectives of contents and functions, which draws a conclusion that the utilization of chunk teaching method in China is of great significance to the improvement of middle school students' abilities in English writing. Before writing this paper, researchers conducted a series of preliminary preparations such as questionnaires, interviews and the same-topic writing tests. With that in mind, this dissertation reveals the chunk teaching method's capability of more or strengthening middle students' English writing ability, and thus demonstrates the effectiveness of chunk recitation in English writing teaching in China's middle schools, which provides reference and critical materials for scholars in this field.

**Keywords:** Chunk Teaching Method, Middle School, English Writing Teaching, Effectiveness

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### Introduction

As we all know, English writing is one of the most fundamental linguistic skills of the English study, which could effectively review students' comprehensive linguistic ability, which is also an important and difficult point of English teaching. The New English Curriculum and the high school and college entranced examinations attach more importance to English writing. That teachers feel difficult to teach writing and students feel tough to write, so far, has been the largest and the most difficult problem in the its teaching. In recent years, several studies have demonstrated that, as a special half-fixed linguistic way of input, chunk is convenient for students to recite and employ as a whole, which not only promotes the accuracy, fluency and logicity of language usage



but also reduces the negative transfer of mother tongue, of great significance to teach English writing. Therefore, this research attempts to regard chunk as the entry point to explore whether chunk recitation can help improve the writing ability of middle school students.

## Literature Review

With the comprehensive development of quality education, the new curriculum standard puts forward new requirements for the English writing in middle school. English writing has gradually become an important part of English teaching, and students' proficiency in English can be fully reflected in English writing. Therefore, improving students' writing level is a subject worthy of in-depth study by middle school English teachers.

Michael Lewis puts forward the classification of chunk and advocates that chunk should be regarded as the basic unit of language teaching in that its grammar structure does not need to be paid attention to, which effectively accelerates the process of understanding and producing linguistic information and greatly improves the correctness and fluency of language usage in his book *The Lexical Approach* (1993) [1], the foundation of chunk teaching method. Chinese scholars, like Guan Xiuli (2013) and Qiu Zhonghai (2013) [2], Qi Wenhui (2019), have conducted data analysis and quantitative study to confirm that chunk makes remarkable contributions to language teaching, especially writing teaching [3]. So, importance should be attached to the effectiveness of chunk recitation in English writing teaching in middle school.

Although significant achievements have been made in recent years in the exploration of chunk teaching method and its usage in English writing teaching, researchers still have a long way to go where more studies are required to be carried out in order to deeply explore the essence and application of chunk teaching method and solve the potential problems that may occur in the future.

## Chunk Teaching Method

In 1993, Micheal Lewis finished his book *The Lexical Approach* in which he put forward the idea that language is not composed of traditional grammar and vocabulary, but made up of multi-word prefabricated chunks. The generation of sentences in a language does not rely on grammar to organize words, but depends on some pre-programmed chunks. It can be said that chunk is the key to making the output of a language convenient, fast and fluent. Several fields, such as the second language acquisition (SLA), the cognitive psychology and the vocabulary teaching, have attached emphasis on this topic, namely, the theory of chunk teaching method.

## How to Teach Writing

*How to Teach Writing* (2004), a monograph written by Jeremy Harmer for English teachers who are interested in writing, mainly discusses different aspects of writing, for instance, writing as a process, describing writing

text, writing in the language classroom, nuts and bolts building the writing habit [4]. Beth Means and Lindy Lindner's *Teaching Writing in Middle School Tips, Tricks, and Techniques* (1998) deals with English writing teaching in middle school [5], which holds the view that the day-to-day writing is both an art and a craft, designed to help both teachers and students to explore the basic aspects of writing.

### **Relevant Studies and Researches on Chunk**

*Chunk's important role in language learning*, written by Yang Liying (2015), has raised great concern among linguistic scholars [6]. Becker's *Idiosyncratic Chunks* (1975), Wilensky's *Phrasal Approach* (1984), Zernick and Dyer's *Large Lexicon* (1987), Nattinger and Decarrico's *Lexical Phrases* (1992), Michael Lewis' *The Lexical Approach and A Lexical Approach* have also laid a solid foundation for the development of chunk teaching method.

Rao Tianshuang (2010) confirms the far-reaching impacts upon language teaching exerted by chunk [7] by discussing the theory of chunk approach and the dual system of language, and pointing out that chunk approach is one of the most important methods in modern English teaching, which provides a new perspective for language teaching, especially English teaching.

Based on the theoretical essence of chunk approach, Qi Wenhui (2019) mainly analyses how to implement chunk approach to establish students' chunk awareness to enable them to master more chunk knowledge and thus improve the accuracy, fluency and authenticity of spoken and written English.

Chen Donglan (2015) combines the theory of language awareness with the traditional chunk teaching method in order to develop a new model of chunk teaching method driven by language awareness and carry out researches in teaching practice [8], and makes a series of analysis to draw a conclusion that the new combined teaching methods of English writing performs much better than the traditional one.

Yan Lizhu (2012) points out that many students have accumulated a certain amount of vocabulary, which does not mean that they are capable of mastering the way to use the words in a reasonable manner [9]. They are very proficient in the meaning and spelling of independent words, but poor in English writing, such as collocation errors, lack of coherence among sentences or paragraphs, or Chinglish expressions. Lexical chunk makes these problems no more problems in which case students' English writing ability has been significantly improved, with their interest in English stimulated.

Chen Xinzhou (2016) studies on a different aspect, namely, the negative transfer of mother tongue in middle school students' writing. Also, he analyses the existing problems in middle school students' English writing and thus emphasizes the important role of chunk teaching method in English writing teaching, as well as its advantages in cultivating students' ability of dialectical thinking in English [10].

Similarly, Jiang Wenfang (2014) pursues research in a different direction. She enumerates some poor performances in middle school English writing, makes a simple analysis of the causes, introduces the chunk theory and its important role in middle school English writing teaching and solves the problem in practical application [11].

Based on the chunk theory, Dong Jing (2018) takes 110 eighth graders as the research object, makes use of the methods of questionnaire and interview to conduct an empirical study with the time span of a whole semester [12]. The result illustrates that chunk approach apparently helps students change their writing attitude, improves their English writing level to a certain extent and enhances the accuracy, readability and flexibility of their expressions in English.

According to the view of Bai Jin (2015), a chunk is a multi-word combination that integrates pragmatic and semantic functions [13], besides which a mind map can make the abstract memory and thinking visualized and leave the content of memory deep, fast, efficient and organized. With the help of the mind map and chunk teaching method, English teachers can extend the chunks related to the key words to diverge students' thinking, cultivate their pioneering spirits and practical abilities, and enable them incorporate or assimilate new knowledge into the original knowledge system.

Zhu Yuyan (2011) focuses on students' lack of vocabulary and good reading ability [14]. What's more, Singer (2011) figures out that in the process of reading, the understanding of lexical meaning accounts for 39% of the entire reading ability. In addition, Wray (2011) believes that the primary function of chunks is to reduce the level of difficulty in coping with foreign language.

Nevertheless, the traditional teaching mode attaches more importance to the single grammar and vocabulary teaching, that is, the training of basic skills, which neglects the training of English writing skills and logic, and thus makes it common for English expressions to be not authentic in Chinese middle school students' English compositions.

After Wang Jinnian's (2015) constant effort of researching, he finally draws the conclusion that chunk teaching method is of great advantage to the teaching and learning of English writing [15].

## **Chunk Teaching Method**

### **Origin and Development of Chunk Teaching Method**

Since the 20th century, influenced by structuralism, most linguists have overstated the role of grammar in learning a language, which made language learning rigid and unsmooth. What's worse, they failed to fully reveal the nature of language. Since the 1970s, an increasing number of researchers have found that the basis of language is not abstract rules, but concrete "chunks". In 1976, Bolinger pointed out that there is always a large

number of “prefabricated chunks” in language. In 1984, Wilensky et.al expressed their views on “chunks” in an academic work named *Phrasal Approach*. In 1987, Zernick and Dyer completed a book called *Large Lexicon* in which “chunk” is discussed. In 1992, Nattinger and Decarrico finished their linguistic work *Lexical Phrases*, which exerted a profound impact upon the birth and development of chunk teaching method. In 1993, Micheal Lewis finished his monograph *The Lexical Approach*, recognized as the theoretical basis of chunk teaching method, in which he pointed out that the generation of sentences relies on pre-programmed chunks under certain conditions. In 2004, He Anping put forward three functions of corpus linguistics in foreign language teaching: 1) to provide abundant teaching resources; 2) to open up an exploratory learning model of interpersonal interaction; 3) to cultivate the ability of empirical teaching and research. With the joint efforts of scholars around the world, the chunk teaching method goes further and further. After decades of research and verification, chunk teaching method as an independent language teaching method has been developed into a popular teaching concept.

### **Advantages of Chunk Teaching Method**

Traditionally, language is viewed as lexicalized grammar, the rules of which generate vocabulary. However, with the development of linguistics, especially corpus linguistics, an increasing number of researchers realize that language output is not a process of being subject to syntactic rules, but that of extracting phrasal units from memory. Linguists, represented by Lewis, considering that language is not composed of lexicalized grammar but grammaticalized vocabulary, advocate the application of chunk in language teaching to improve learners’ language level.

#### *Enhance Students’ Pragmatic Ability*

As we all know, sentences are made of chunks. If a learner masters different chunks of the same meanings and functions, he or she will be able to choose the most suitable ones to apply, according to certain language environment, thus, will, to some extent, improve both the sense of language and pragmatic ability.

#### *Strengthen the Fluency, Accuracy and Authenticity of Language Usage*

The fluency, accuracy and authenticity of language usage are based on the utilization of different chunks rather than the obedience of sentence and grammatical regulations. If learners can select the most suitable chunks into practice according to different language environment, they don’t need to waste time on forming the correct phrases and sentences, which simplifies the process of organizing words. When it comes to writing, the most suitable chunks are not only the most authentic ones in that they are most fit to the language environment but also the most accurate ones because they are closest to the meaning people want to convey. In terms of speaking, when chunk teaching methods are utilized, several chunks applied to each language environment immediately will occur to the learners in which case they don’t need to think and speak fluently.

### *Relieve Pressure and Stimulate Interest*

The learning of chunks can, to some extent, improve the phenomenon that due to the limited ability of language output, learners fail to know how to express themselves in English, thus, become discouraged and depressed, with their passion gradually fading away. Chunk is the combination of words with certain pragmatic functions, which can be saved and extracted as a whole or reduce the burdens of learners on memorizing every word, one by one. Chunk's convenience and appropriateness provide learners with encouragement and inspiration, alleviate their pressure of language output and stimulate their learning interest, which is instrumental in the formation of a virtuous cycle of English study.

## **Research Design**

### **Research Questions**

*1) Whether Chunk Teaching Method (Chunk Recitation) can improve the writing abilities and scores of middle school students? If it works, what are its functions?*

*2) Whether students' attitudes towards writing have been changed when Chunk Teaching Method comes into play? If changed, what are the specific changes?*

### **Research Targets**

This research, targeted at a group of Grade eight students from XX Middle School in Nanjing, Jiangsu Province, People's Republic of China, runs for about twelve weeks, six weeks a period. There are 41 students in this class, 39 of whom take part in the research. In the course of this period, the teachers, as well as the class time and the teaching materials are the same. With the English textbook of eighth grade published by Yilin Press selected as the teaching content, the normal writing teaching method is carried out in the first half of the semester, and the chunk teaching method is conducted in the second half. The after-school exercises and the test of writing expressions are equally important, during which no additional guidance is provided. General comments are made on students' writing so that whether chunk teaching method takes effect in writing teaching in middle school can be tested.

### **Research Process**

In the first six weeks, the traditional writing teaching method will be carried out, and the questionnaire (1) is to be issued in the sixth week (attitudes towards writing, questions about writing and so on). At the same time, the composition test will be launched while the test results and the questionnaire (1) results will be counted and analysed.

In the following six weeks, the experiment will be conducted formally. In the English writing teaching, the teacher will utilize the chunk teaching method to provide various types of input activities and chunks related to the concerning topics so that students can output the chunks they learned in the writing process and consolidate their understanding and application of chunks after writing. Chunk teaching method should be adopted throughout the process of English writing teaching. Similarly, the questionnaire (2) (attitudes towards writing, questions about writing and so on) will be issued in the sixth week when the same composition will be tested, and the test results and questionnaire (2) results will be counted and analysed.

The purpose is to figure out the changes of students' writing attitudes and the problems before and after the implementation of chunk teaching method. The number of collected valid questionnaires is 39. According to the test results, two students were randomly and respectively selected from the high level, medium level and low-level students of the class to take part in an interview which mainly contains the two questions: 1) Does chunk teaching method affect your writing? If so, what aspects affect your writing? 2) What's your opinion on the improvement of chunk teaching method?)

### Data Analysis and Comparison

#### *The Two Questionnaires*

There are 18 questions in the questionnaire (1), question 1 and 2 are regarding general questions; questions 3 to 8 are about writing attitudes; questions 9 to 11 are concerning writing difficulties; questions 12 to 14 are in the matter of the methods of improving writing; questions 15 and 16 are respecting the basic questions of chunks; question 17 is with regard to writing methods; question 18 is about writing teaching methods.

There are 15 questions in the questionnaire (2), questions 1 and 2 relate to general questions, questions 3 to 8 touch upon writing attitudes, questions 9 to 11 involve writing difficulties, questions 12 to 14 deals with the methods of improving writing, question 15 refers to writing methods.

The results of the questionnaire (1) and questionnaire (2) are shown in table 1:

Table 1. Data Summary of Questionnaire (1) and Questionnaire (2)

General Questions	Question Number	Choices/Number of Students (Before the experiment)					Choices/Number of Students (After the experiment)				
		A	B	C	D	E	A	B	C	D	E
	1	19	20				19	20			
	2		39					39			
Writing Attitudes	3	4	4	21	10		10	14	10	5	
	4	4	8	23	4		8	12	13	6	
	5	7	16	12	4		11	19	8	1	
	6	2	25	12			22	12	5		

	7	12	6	14	7		18	6	10	5	
	8	2	3	26	8		2	5	10	22	
Writing Difficulties	9 (Multiple Choice)	25	20	17	17	25	17	26	23	15	18
	10	4	12	15	8		2	7	19	11	
	11	21	5	5	8		12	8	7	12	
Methods of Improving Writing	12	4	19	6	10		10	9	12	8	
	13	11	17	7	4		12	20	5	2	
	14	13	13	8	5		15	10	4	10	
Basic Questions of Chunks	15	3	8	19	9						
	16	30	26	16	13						
Writing Methods	17	4	7	15	13		7	18	8	6	
Writing Teaching Methods	18 (Multiple Choice)	17	25	20	24		22	25	30	16	

Through the analysis and comparison of the data of questionnaire (1) and questionnaire (2), it is clear that: Before the experiment, 8 students claimed they were absorbed in English writing, while 31 students declared that they were not keen on it very much. After the experiment, the number of students fond of writing rose to 24 while the number of students not so caring for writing relatively descended to 15.

Before the experiment, there were only 12 students satisfied with their writing levels, while 27 students were not satisfied with their writing levels. However, after the experiment, the number of students content with their English writing changes to 20, while the number of students not satisfied with that turned into 19.

Before the experiment, 23 students were eager to improve their English writing levels. After the experiment, the number of students willing to make progress in this field altered from 23 to 30.

Before the experiment, a few students viewed the extra accumulation outside class as a way to advance, whose exact number was 2. However, after the experiment, the number of students who accumulate regularly and routinely significantly increased to 22.

Before the experiment, students writing a composition in English every two weeks had a majority. But after the experiment, those who write an English composition each week increased sharply to 18, while those who write once every two weeks were less than the former.

Before the experiment, only 8 students held an optimistic attitude towards English writing, but after the experiment, the number of students who believed writing was difficult decreased while the number of those who thought English writing was easy increased on a large scale (22). From the analysis of the questions 3 to 8 on attitudes towards writing, it is clear that after the implementation of chunk teaching method, an increasing number of students began to fall in love with and make headway in English writing, with unwavering confidence and strong will. To facilitate this, more and more students begin to increase their regular accumulation and their frequency of practicing English writing. That is to say, after the implementation of chunk teaching method, students' interest in English writing increased to a great extent.

Before the experiment, 25 students assumed that English writing was difficult due to its vocabulary, phrases and sentence patterns, while 17 students believed it was difficult in its grammar and content. After the experiment, the number of students laying emphasis on words, phrases and sentence patterns plummeted, while the number of students paying much attention to grammar and content slightly soared.

Before the experiment, quite a few students (16) often showed an inadequate use of words and sentences, but after the experiment, the students inadequately utilizing words and sentences obviously grew in number or quantity.

Before the experiment, there were 21 students thinking that insufficient vocabulary was the biggest problem in English writing, only 5 students reckoning grammar should be the key issue, and only 13 students viewing that the most difficult problem lied in the layout and topic development. However, after the experiment, the number of students who thought that their vocabulary was not enough has declined dramatically, and the number of students who believed that the layout, topic development and grammar problems were larger problems increased relatively. Hence, the analysis and comparison of the questions 9 to 11 on writing difficulties obviously demonstrates that after the implementation of chunk teaching method, most of the students' writing difficulties showed a considerable deviation. They no longer attributed the difficulty of English writing to insufficient vocabulary and inadequate use of words and sentences in their writing, nor did they hold the view that the biggest problem in English writing rested with vocabulary. Instead, they began to believe that the layout, topic development and grammar outweigh vocabulary in English writing.

Before the experiment, there were 29 students improving their writing levels through listening to the explanations and comments from their teachers and watching American TV series, only 10 students increasing their writing levels through reading authoritative English magazines, in which case the number of the latter is really small compared with that of the former. However, after the experiment, the number of students making progress through reading original English books increased sharply.

Before the experiment, 11 students were indifferent to English writing and felt it unnecessary, but most students were eager to improve their English writing levels. After the experiment, the number of people willing to strengthen their English writing rose up to 32.

Before the experiment, 13, 13, 8, 5 testers respectively thought that reciting words and phrases, practicing writing, discussing among classmates and strengthening extracurricular reading can effectively solve the problems in writing. After the experiment, the number of reciting words and phrases were changed into 15; that of practicing writing descended to 10; the changes in the number of strengthening extracurricular reading was consistent with the former two conditions; that of discussing among classmates was reduced to 4. That is to say, the analysis of the above questions 12 to 14 on improving writing methods shows that after the implementation of chunk teaching method, more and more students aspired to improve their writing levels, and started to carry out extra-curricular accumulation, such as practicing writing, strengthening reading outside the class, reciting



words and phrases, etc.

Based upon the analysis of questions 15 and 16 of questionnaire (1), it can be inferred that there were only 11 people knowing what chunks were. However, there were nearly 28 students who didn't know much about chunk, some of whom even never heard of it. The number of students regarding chunk as word was 30, besides which a great many students (26) held the view that chunk was simply composed of words and phrases. However, only 15 students believed that chunks were made of words, phrases and sentence patterns. It was vividly shown that before the implementation of chunk teaching method, they didn't form a deep understanding of chunks and lacked a systematic comprehension of chunks. Therefore, it is necessary to carry out and promote chunk teaching method among middle school students so that they can have a deeper and more multidimensional understanding of chunks, and thus strengthen their English writing ability and levels.

Before the experiment, the number of students reciting relevant words, phrases, sentence patterns and templates according to different topics and using them in English writing was only 7. Let alone apply them to writing, because the number of students who recited the relevant words, phrases and sentence patterns was very small and some of whom even did not know what a template was. However, after the experiment, the number of students reciting relevant words and phrases as well as sentence patterns and templates according to different topics increased sharply to 22 and the number of students reciting them and applying them to English writing rose in an equal proportion. That is to say, according to the comparison and analysis of question 17 in the questionnaire (1) and question 15 in the questionnaire (2), it can be seen that after the utilization of chunk teaching method that students formed the habit of actively reciting relevant words, phrases, sentence patterns and templates according to different topics. They gradually and actively started to input, collect and accumulate chunks of relevant topics and offered themselves the chunks to be used in English writing.

Before the experiment, the teaching method remained the traditional writing teaching method, namely, scene teaching, explaining the model text, and brainstorming. During the process of experiment, scene teaching, brainstorming and explanation of related words, phrases and sentence patterns were the main parts, in which case only after the students finish writing can they be given the explanation of model text. Through the comparison of the scores of writing the same topic, it is evident that the average score of the students after the experiment was superior to that before the experiment, and that from the individual perspective, everyone made some progress more or less. After the implementation of chunk teaching method, students really experienced a remarkable change, successfully output the input chunks into English writing, and made great and dramatic improvements.

To sum up, the results of the two questionnaires solved the two problems, the first of which was whether there was any change in students' writing attitudes before and after the implementation of chunk teaching method, the second of which was what were the specific changes if question 1 came true? It can be concluded from the data analysis that chunk teaching method exerts a positive role upon improving the English writing levels of the middle school students in China. Chunk teaching method can not only greatly stimulate students' interest in

English writing, but also make students spontaneously practice English writing and actively carry out extra-curricular accumulations.

### *The Interviews*

The interviews focus on two topics: (1. Does chunk teaching method affect your writing? If so, in what aspects? 2. What's your opinion on the improvement of chunk teaching method?)

All of the six interviewees claimed that chunk teaching method (chunk recitation) was of great advantage to the English writing, and that highlighting chunks in writing teaching could help themselves actively accumulate relevant chunks of the same topic or theme, thus conduct chunk input, and lay a good foundation for chunk output. The specific performances were as follows: 1) During the period of writing, they first recalled the relevant chunks of the same topic accumulated by themselves, screened out and used them properly and accurately. 2) They paid more attention to the cohesive chunks to make their writing structures clearer and their contents more organized. 3) They made their writing expressions richer and more diverse, rather than the repeated utilization of the same sentence patterns, phrases or words. 4) They were no longer afraid of writing, but more and more interested in English writing.

At the same time, the students were not only not limited to passively receiving education, but also actively put forward constructive suggestions for chunk teaching method. They hoped that teachers can infiltrate chunk teaching method and increase the frequency of the utilization of chunk teaching method in the writing teaching, and that teachers may increase the relevant introduction and explanation of proverbs in writing teaching and expand their minds through brainstorming while utilizing situational teaching method. Furthermore, more activities can be set to attract their interest, enrich the content of writing teaching and promote the quality of chunk teaching method. Last but not least, a section of reading can be set to help them understand the use of some difficult and important chunks. To sum up, the six students interviewed confirmed the effectiveness of the teaching method of chunk recitation in English writing teaching in China's middle schools, which is a combination of chunk teaching method and traditional English writing teaching methods. They believed that chunk teaching method can improve the level of English writing, stimulate the enthusiasm, positiveness and initiative of English learners, increase their interest in and confidence of English writing.

### *Result of the Research*

The topic of the same topic writing was campus life. The writing time was 20 minutes and the full score was 15 points. The whole process was supervised by the teacher who did not make any tip or comment on the composition. The students were not allowed to refer to books, look up dictionaries, talk to each other or conduct other illegal operations. Once any cheating behaviour was found, the students involved were not allowed to continue to participate in the experiment. One time, before the experiment; the other time, at the end of the experiment.

Through the comparison of composition (1) and composition (2), it was apparent that the average score of composition (2) was much higher than that of composition (1), up to about 1.2 points. The number of students between 12 and 15 turned from 19 to 27, which was a tremendous variation. What's more, nearly all of the students' score of composition (2) was, more or less, higher than that of composition (1). Nevertheless, there were exceptions. For instance, a student named XX got 14 in her first composition, but she only got 12 in her second composition. However, the student who made the biggest progress was XXX, whose first composition scored 9 while his or her second one was 14.

Furthermore, when it comes to the expressions in English writing, all the students made great progress in English expressions which changed from the simple repetition of words and phrases at the beginning to the diversified, accurate and authentic expressions of the same meaning at present, from the previous utilization of a single sentence to the diversified use of various sentence patterns at present, such as complex sentences, various connectives and conjunctions, some simple clauses and even quotations. Among all the students, the most typical one was a student called XX, whose first composition read that "we work hard every day to get a good score", while his second composition read that "as a popular saying goes, 'reading thousands of books is the same as traveling thousands of miles', it is important for us to work hard every day to pursue our final goals", which showed his great progress in English writing. As a matter of fact, it is not uncommon to see examples that were the same as or even better than him.

To sum up, through the analysis and comparison of composition (1) and composition (2), a conclusion may be drawn that before and after the implementation of chunk teaching method (chunk recitation), students' English writing levels has shifted significantly, with their language expressions improved at least one level. After the contact with the chunk teaching method, the students would no longer be bothered by the lack of words and sentences to use because they have established their own chunk library which enable them to make the most appropriate choice.

## **Conclusion**

In summary, chunk teaching method can more or less improve students' English writing ability in middle schools in China. The findings of the experiment provide reliable references for the English writing teaching in middle schools, and the improvement of students' English writing levels and their comprehensive English competences.

## **Notes**

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## Examining the Relative Effectiveness of Social Innovation Efforts of Hungarian Municipalities using the DEA Method


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**Abstract:** The study presents an analysis of the effectiveness of social innovation efforts in Hungarian municipalities. Within the framework of the research, social innovation is examined as a creative collaborative process, with a particular focus on the analysis of social initiatives supported by local government. The social innovation efforts presented in this study are multi-stakeholder initiatives based on the involvement of local citizens, and the analysis of their effectiveness will allow the process of social innovation to be mapped. The specificity of the topic and the particular characteristics of the municipalities under study make the relative effectiveness analysis (DEA) method of paramount importance. In this study, we will present the initiatives studied in the municipalities and calculate the best practice effectiveness thresholds, which can be used to define an effectiveness ranking. The topic is very relevant as it is an opportunity for smaller communities. And the good practices can provide ideas that can be a stepping stone, a milestone for other municipalities.

**Keywords:** DEA method, social innovation, good practice

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### Introduction

The study of social innovation can be characterised as one of the significant research areas of our day. Its importance is rooted in the recognition that technical and technological innovations alone are insufficient for the creation of social well-being, and thus social innovations can and do contribute to social development as a complementary solution. The authors' studies of social innovation efforts have covered both the elaboration of theoretical questions and applied research.

## Literature Review

Technological and economic innovations cannot respond to all societal challenges. As the natural and material resources are becoming increasingly scarce, it becomes necessary to use resources as rationally as possible and to achieve greater social and economic efficiency. The social challenges that require long-term solutions (e.g. unemployment, migration and disadvantaged areas) require novel social collaborations. Social innovation is a necessary step to improve development and competitiveness, and the role of innovators is emphasised. Innovators are members of the local community, or society at large, who are aware of the needs determined by societal challenges and meet them using new or innovative solutions. Bosworth et al. (2015) study social innovation based on Schumpeter's approach. Their study identifies social innovation processes as the creator of a new product or service, as a value-creating process, as a mobiliser of local resources, as a response to social needs, and as innovative collaboration.

Social innovation efforts play an important role in the lives of decision-makers, politicians, researchers, civil society organisations and individuals alike. Despite growing attention, there is currently no uniformly accepted definition of social innovation (Moulaert et al., 2005; Mulgan et al., 2007; Pol-Ville, 2009; Rüede&Lurtz, 2012; Kocziszky et al., 2017; Balaton and Varga, 2017; Szendi, 2018; Eichler&Schwarz, 2019; Varga et al., 2020). The Social Innovation Academy (2018), supported by the European Union, identifies eight types of definitions of social innovation that provide a starting point for studying initiatives:

- pragmatic approach (Mulgan et al., 2007): social innovation is an innovative activity aimed primarily at meeting social needs;
- systemic approach (Westley and Antadze, 2010): social innovation is a complex process that means a new product, service or project, causing a significant change in everyday practice;
- managerial approach (Phills et al., 2008): social innovation is a new solution to social problems that responds to challenges in a more effective, efficient and sustainable way than the previous, currently existing solutions;
- critical approach (MacCallum et al., 2012): social innovation is a process of mobilisation and political mobilisation that results in significant change in society, and the distribution of tangible and intangible assets through bottom-up transformation;
- economic approach (OECD, 2009): social innovation, theoretical, process-focus or product change, organisational transformation, and the establishment of a new system of relations,
- comparative approach (Murray et al., 2010): social innovation means results, relationships, new structures and collaborations other than technical innovations, as the results of technological change cannot be directly translated into social practice;
- universal approach (The Young Foundation, 2012): social innovation is a new solution that meets social needs simultaneously; is at the same time good for society as a new or more advanced solution; and increases society's capacity to act;
- short approach (Murray et al., 2010): in short, social innovation is an innovation that is social in terms

of both its outcome and its meaning.

Bulut et al. (2013) highlight the significance of the individual level in social initiatives, they consider aspirations as new and original ideas that are sustainable and respond to the various challenges an individual faces in the course of social development. García et al. (2015) identify social innovation as a broad-spectrum process that results in:

- the creation of resources and services to meet social needs,
- the strengthening of confidence and support for marginalised groups,
- the transformation of social relations, which in turn creates new governance measures.

In summary, creative collaboration can be observed between the members of society, governments, market participants and the civil sector.

### **Measuring Social Innovation Efforts at Different Levels**

The determination of the levels of social innovation is facilitated by the European Commission's relevant study (EC, 2013), which confirms that the focus of social innovation efforts is to meet the needs of the community and solve its problems, but it is a misconception to consider it as an exclusively bottom-up process which is only based on the involvement of citizens. Social innovations, which are also evidenced in societal co-operations of a new approach and in the structural transformation of society, are often generated from above, as a result of macro-level measures (Nemes&Varga, 2015). This finding also predicts a classification that distinguishes between the micro-, meso- and macro-levels of social innovations. The levels of social innovation are closely interlinked. At the micro-level, the individuals and the interactions between them are brought into the focus of the analysis, which leads to the analysis of meso-level relationships (for a given area). At the macro-level, organisational relationships and networks of relationships are analysed, based on meso- and micro-level results (J. van Wijk et al, 2018).

Based on a review of the literature, it can be established that the social innovation efforts made at the micro-, meso- and macro-levels can be analysed in a complex way, and the building of measurement methods plays a key role in their measurement.

At the micro-level, the analysis of organisations implementing social innovation efforts and their network of contacts is essential. The number of measurements at the local level is small, although the empirical analysis of these initiatives is essential to increase the social innovativeness of local decision-makers in order to generate local-level initiatives. A micro-level survey of social innovation is based on the involvement of companies, social enterprises and civil society organisations implementing social innovations at an organisational level, which is complemented by innovative collaborations between citizens and local governments. Through innovative co-operation, local governments provide new responses to community problems in a way that satisfies local needs, while also improves the well-being of the community.

Measuring the social innovation process is a complex task. The main questions are: What is measurable and what needs to be measured? The European Union's guidelines, in line with the systematic nature of the innovation process, focus on examining the input, output and impact factors of the endeavours at different levels. In addition to the input and output factors of social innovation initiatives, the analysis of the impact on society is also emphatic in the measurements. The main goal of each reviewed method is to determine the social innovation potential at the national, regional or local level. The number of local measurement methods is low, but their importance has increased recently. If the results of local initiatives can be quantified, good examples may be given and adapted to other organisations and localities, in order to promote the generation of further innovations. The local method is expected to identify and evaluate the baseline conditions (necessary factors) and capabilities of social innovation, i.e. the potential for social innovation.

### Good practices of social innovation efforts

Based on our previous studies (Varga et al., 2021, Varga&Kucsma, 2022), we could identify the relations and mergers within Hungary, and the (mainly political) factors that make co-operation difficult or impossible. We identified the factors that can be seen as the main challenges in the country (educational inequalities, unemployment, health and housing problems), and the areas where efforts could be made based on the contribution of social innovation to well-being. Social innovation efforts focus on the following areas:

- reinforcing attachment to the locality
- support for disadvantaged groups,
- supporting local economy development,
- local peculiarities,
- public employment practices.

Within the framework of our previous studies, we identified more than 50 good practices of Hungary (Veresné Somosi&Varga, 2022, Varga, 2021). In the current study, we analyse 15 good practices.

Table 1. Knowledge base of good practices examined in the current research

Name of the good practice	Municipality	Target audience and target area
1. House of Civilians	Máriapócs	well-being of the local population, reinforcing attachment to the locality
2. Local Heroes	Pócspetri	well-being of the local population reinforcing attachment to the locality
3. Establishing self-sufficiency in the village Rozsály	Rozsály	well-being of the local population, public employment practices
4. Good Start	Nyírbátor	well-being of the local population, support for disadvantaged groups



5. Basket Community	Nyíregyháza	well-being of the local population, supporting local economy development
6. 'Together, for each other, for the locality!'	Nyírgyulaj	well-being of the local young people, reinforcing attachment to the locality
7. Green Town	Nyírlugos	well-being of the local population, reinforcing attachment to the locality
8. Value creating public work	Piricse	well-being of the local population, public employment practices
9. 'I love you, Nyírbétek!'	Nyírbétek	well-being of the local population, reinforcing attachment to the locality
10. Church bus	Terem	well-being of the local population, local peculiarities
11. Tanoda programme	Nyírvasvári	disadvantaged children, support for disadvantaged groups
12. 'Transformed sugar factory'	Encsencs	well-being of the local population, public employment practices and support for disadvantaged groups
13. Eco Centre in Bátorliget	Bátorliget	well-being of the local population, supporting local economy development
14. 'Ajak is the settlement of the future in the light of work'	Ajak	well-being of the local population, local peculiarities and public employment practices
15. 'Everyone is important! Focus on the dementia care'	Szamossályi	disadvantaged population, support for disadvantaged groups

Source: authors' own elaboration based on previous studies (Veresné Somosi&Varga, 2022, Varga, 2021)

Good practices are ideas or benchmarks that view each task to be carried out as a process. It is a widely used concept, but its precise definition is not known. The basic purpose of good practices is to identify tools and methods that are more effective in achieving the objectives set than the methods already known. They are innovative and constructive approaches and techniques that can be or have been proven to contribute to raising the quality level of an organisation and serve as a replicable example for other organisations Best practice is a good and effective example, which becomes a proven and effective solution precisely because it has been successfully applied elsewhere.

Based on a comprehensive analysis of the practices, it can be established that in the case of social innovation, innovators at the localities and the adaptation of aspirations operating in other localities have a decisive role. Based on the interviews, case studies were made. As a method, case studies constitute an appropriate form of documentation for the presentation of good practices with different content, structure and function. Based on

the analysis, it can be established that the social innovation efforts made during the study can also be adapted to other localities. The analysis of each case allowed for a complex presentation of the given practice, creating an opportunity for adaptation, sustainable operation and effective implementation. The basic aim of good practices is to identify the tools and methods used for achieving the set goals more effectively than the previously known methods. Novel and constructive approaches and techniques that can be proven or have already proved to contribute to the improvement of the quality standard of the given locality and serve as an example that can be adopted by other localities. Measuring the effectiveness of the good practices examined is also a relevant challenge, in which case the DEA (Data Envelopment Analysis) method supports our analysis.

### Data Envelopment Analysis for testing the effectiveness of social innovation efforts

The DEA (Data Envelopment Analysis) method defines the effectiveness values (ratio) and the effectiveness frontier as a linear programming task. It has the advantage of being non-parametric, because knowledge of the production function is not a prerequisite (Dózsa&Ecseki, 2012). In the analysis, the effectiveness scores of the decision-making units are compared, with the unit with the highest effectiveness scoring 1 (100 per cent). The procedure is used to calculate an effectiveness threshold (best practice), which is used to determine an effectiveness ranking (each unit is ranked in percentage terms). The analysis compares organisations performing the same activity on the basis of the outputs of each organisation and the weighted share of inputs used. Input is the quantity of resources that is decisive for the evaluation. Output is any significant operational result for which the organisation uses resources. The amount of resource used is an autonomous decision of the organisation, so the organisation can be identified as a Decision Making Unit (DMU). The comparison of DMUs is based on the ratio

- of the weighted sum of outputs to the weighted sum of inputs. Weighting can be determined
- objectively, using mathematical tools, based on the characteristics of the organisations.
- Determining the ratio of weighted inputs to outputs can be done for two purposes:

maintaining the current value of outputs with fewer inputs (input-oriented approach, relative effectiveness index between 0 and 1),

- higher output at the current value of inputs (output-oriented approach, relative effectiveness ratio between 1 and infinite).

The effectiveness function is the weighted sum of outputs divided by the weighted sum of inputs (Ragsdale, 2007; Iberhalt, 2017):

$$E_i = \frac{\sum_{j=1}^n o_{ij}w_j}{\sum_{j=1}^n l_{ij}w_j}$$

where:

$E_i$ : effectiveness of the i-th unit

$O_{ij}$ : weighted value of the j-th output factor of the i-th unit

$n_o$ : number of outputs

$w_j$ : evaluation of a unit of the j-th output

$I_{ij}$ : weighted value of the j-th input factor of the i-th unit

$n_i$ : number of inputs

$v_j$ : evaluation of a unit of the j-th input

The formula can be used to determine the effectiveness of the “i”-th unit, based on the weighted output and input components of the unit. This function is the basis for the DEA, which is run for all social innovation efforts in the analysis. Our novel approach to assessing the effectiveness of social innovation efforts proposes the DEA method. We have not found any previous studies in the literature that address the issue in this way, but we believe that the DEA method is an innovative way to measure the impact of social innovation initiatives.

In connection with the run, the balance sheet conditions for the DEA analysis are defined (Ragsdale, 2007; Iberhalt, 2017). The balance conditions of the analysis are constraints that ensure that maximum effectiveness can be identified.

Balance conditions:

No unit tested can have an effectiveness greater than 100 per cent. The effectiveness of each efforts is thus less than or equal to 1.

$$\sum_{j=1}^{n_o} O_{kj} w_j \leq \sum_{j=1}^{n_i} I_{kj} v_j$$

(k=1, 2, ... , number of units analysed),

i.e.

$$\sum_{j=1}^{n_o} O_{kj} w_j - \sum_{j=1}^{n_i} I_{kj} v_j \leq 0$$

Output evaluations ( $w_1, w_2, w_3, w_4$ ) and input evaluations ( $v_1, v_2, v_3, v_4$ ) can be used to maximise effectiveness at the “i”-th unit (effectiveness indicator value 1).

It is necessary to ensure that input costs and output valuations are strictly positive. Because if, e.g.,  $w_j = 0$  then DEA cannot find those non-effective solutions, which contain the j-th output; and if  $v_j = 0$ , then DEA is unable find non-effective solutions that contain the j-th input (Iberhalt, 2017).

Based on the effectiveness measurement function and the balance conditions, a linear programming exercise can be performed for each efforts under study, with the aim – in the context of this study - to minimise the weighted inputs of each unit.

The objective function of the model:

$$\sum_{j=1}^{n_i} I_{ij}w_j \rightarrow MIN$$

Based on the literature (Barnum et al., 2009; Dózsa, Ecseki, 2012; Dénes et al., 2017; Iberhalt, 2017; Koltai, Tamás, 2019; Nepomuceno et al., 2020) and the methodology developed, input and output indicators can be identified to support the measurement of relative effectiveness, which also allow the development of a relative effectiveness ranking for the social innovation efforts under study.

Most studies defining a method for measuring social innovation suggest the analysis of case studies or good practices for micro-level measurement and a statistical study for analysing macro-level aspirations. They emphasise the need to quantify the indicators involved, which, however, is not possible even at a national level for some indicators (e.g. volunteering). The use of different conceptual frameworks and the rapid formation of different legal frameworks for organisations make it particularly difficult to define a measurement methodology. Based on the antecedents given in the literature (Kociszky, 2004; Benedek et al., 2015; Kociszky et al., 2015; Szendi 2018; and Varga et al., 2020), and the methodology developed during the social innovation research of the University of Miskolc, a system of indicators and an indicator of social innovation potential can be defined in relation to the localities of the surveyed area for supporting the measurement of social innovation. We presume that this set of indicators is suitable for measuring the social innovation efforts at the level of localities, and may be used to form an indicator of social innovation potential. The system of indicators can be divided into input, output and impact indicators according to the systematic nature of the social innovation process. During the examination of the localities of Hungary, 8 indicators were included in each indicator group. The applied indicators were selected as a result of the research marked as a source, mainly based on the proposals of Varga (2021). From these 8 indicators per group, we selected 4 input and 4 output indicators to measure the effectiveness of social innovation.

Table 2. Indicators included in the analysis

<b>INPUT indicators</b>	<b>OUTPUT indicators</b>
number of operating enterprises per 1000 inhabitants (per 1000 inhabitants)	per capita income (HUF '000')
number of non-profit enterprises (per 1000 inhabitants)	amount paid per application per capita (HUF '000')
dependency ratio (children (0-14 years old) and the elderly population (65-X years old) as a percentage of the population aged 15-64)	ratio of families with three or more children (%)
average number of classes completed (class)	unemployment rate (%)

Source: authors' own elaboration

Data envelopment analysis (DEA) is a technique and optimisation based on linear programming to evaluate the efficiency of individual units. In order to improve the efficiency of each unit, a reference set of inefficient units is defined and the efficiency of the different units can be compared with the efficiency frontier.

The following output and input factor data will be used in the analysis, presented to the reader in Tables 2 and 3.

Table 3. Input indicators

D M U	INPUT			
	Number of enterprises in operation	Number of non-profit enterprises per 1 000 inhabitants	Rate of dependency	Average number of classes
Ajak	407324	186746	464108	742537
Bátorliget	588236	278772	354466	597068
Encsencs	22304	224	35028	325005
Máriapócs	427119	274651	320653	664953
Nyírbátor	629859	271105	339651	726925
Nyírbétek	295843	124289	345867	479907
Nyíregyháza	1	348253	308449	974815
Nyírgyulaj	215433	250371	39784	562637
Nyírlugos	379092	91913	355664	585406
Nyírvasvári	264007	190742	541561	538684
Piricse	243851	113622	2085	317835
Pócspetri	435652	1882	349889	582966
Rozsály	350099	298541	20513	315842
Szamossályi	294782	43585	255068	52809
Terem	563144	371664	742139	666711

Source: authors' own elaboration based on Hungarian Central Statistical Office database

Table 4. Output indicators

D M U	OUTPUT			
	Amount paid per capita (2007-2013)	Unemployment rate	Income per inhabitant	Percentage of families with three or more children
Ajak	27438	216911	885462	60091
Bátorliget	9088	228013	432455	112906
Encsencs	473	31774	364842	461139
Máriapócs	19644	139321	612708	151505
Nyírbátor	35266	92501	748135	130665
Nyírbétek	234	9744	367203	208324
Nyíregyháza	3268	399276	886439	43453

Nyírgyulaj	2916	101805	507323	149265
Nyírlugos	7502	342179	527177	162677
Nyírvasvári	4071	121527	533075	154414
Piricse	3201	18961	338019	548996
Pócspetri	6481	165073	568157	183904
Rozsály	8286	57036	384705	382271
Szamossályi	908	127437	296216	64391
Terem	6424	147821	634365	14105

Source: authors' own elaboration based on Hungarian Central Statistical Office database

### *Project Specifications*

In this study, Element A is considered as a decision making unit (DMU) in terms of input B and output C.

The DEA model used in this study is model D, which is based on model E and uses approach F.

A: number of decision making units (DMUs).

B: number of inputs

C: number of outputs

D: the DEA type

E: the model

F: the approach

The efficiency value obtained by the defined model is presented in Figure 1. In the figure, values are listed next to each municipality. For us, a value of 1 indicates that a given municipality is operating efficiently using the given indicators when looking at the selected input and output values, and where this value is less, there is a problem with the consistency of the given indicators, so it is worth looking for the problem that is causing it not to operate efficiently.

The unit is inefficient if the efficiency is less than 1. If the efficiency of a unit is equal to 1 and there is zero slacks, then it is the Pareto efficiency. If the efficiency of a unit is equal to 1 and there is nonzero slacks, then it is known as the weak efficiency.

Before evaluating an analysis, it is necessary to show the basis on which the reference set can be constructed. This is because it gives the benchmark values for each domain.

In all linear programs in DEA, the solution technique seeks to maximize the efficiency of the target unit. This search procedure ends when either the efficiency of the target unit or the efficiency of one or more other units equals one. Therefore, for an inefficient unit, the efficiency of at least one other unit is equal to 1, the weight of the target unit obtained from the solution of the model. These efficient units are called the peer group of the

inefficient unit. Figure 2 shows the peer groups.

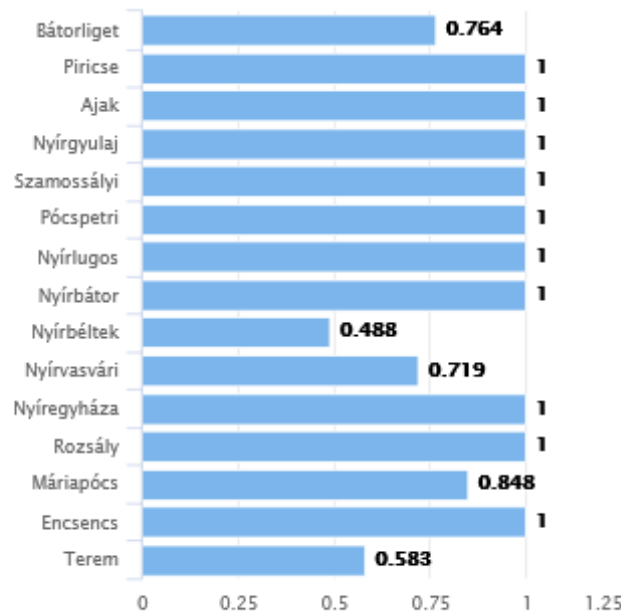


Figure 1. Efficiency results

Source: authors' own elaboration

5 municipalities that did not receive a score of 1, so these municipalities are inefficient in the analysis and comparison of the selected indicators.

These are the following municipalities:

- Terem (0,583)
- Bátorliget (0,764)
- Nyírbétek (0,488)
- Nyírvasvári (0,719)
- Máriapócs (0,848)

Nyírbétek has the lowest score, so it is worth looking at this settlement in more specific details. What is interesting about the case of Nyírbétek is that it does not have a high average score compared to the other municipalities, but there are some factors that when compared to the other municipalities, the results are better and not too favourable for the municipality. The number of businesses growing is not high, so it would be worthwhile to increase this area with a tax credit, i.e. to see how this affects the number of growing businesses. In comparison, the number of non-profit organisations is high, which is advantageous on the one hand, as there are a number of inclusion and cultural programmes in the municipality, which are good in terms of cultural integration, but not advantageous in terms of efficiency. The dependency rate is high, but what is an output factor and can be contrasted with this is the low unemployment rate, compared to other municipalities, so it can be said that it is a young or ageing municipality, presumably with a high number of schoolchildren and

pensioners. However, if we look at a panorama of Hungary, it is unfortunately the ageing tendency that is more common. The income per inhabitant contributes a lot to the fact that the municipality is at the bottom in terms of efficiency, as it is very low, which assumes that the majority of people living in the municipality are low-educated, so the solution could be to provide further training in the village or free vocational training to get into a wage bracket where they can get a higher income and a higher standard of living.

	Peer1	Peer2	Peer3	Peer4	Peer5
Bátortiget	Szamossályi	Nyírlugos	Nyírbátor	Rozsály	-
Piricse	Piricse	-	-	-	-
Ajak	Ajak	-	-	-	-
Nyírgyulaj	Nyírgyulaj	-	-	-	-
Szamossályi	Szamossályi	-	-	-	-
Pócspetri	Pócspetri	-	-	-	-
Nyírlugos	Nyírlugos	-	-	-	-
Nyírbátor	Ajak	Nyírbátor	-	-	-
Nyírbéltek	Szamossályi	Encsencs	-	-	-
Nyírvasvári	Ajak	Szamossályi	Nyíregyháza	Encsencs	-
Nyíregyháza	Nyíregyháza	-	-	-	-
Rozsály	Rozsály	-	-	-	-
Máriapócs	Ajak	Nyírbátor	Nyíregyháza	Rozsály	Encsencs
Encsencs	Encsencs	-	-	-	-
Terem	Ajak	Szamossályi	Encsencs	-	-

Figure 2. Efficiency results

Source: authors' own elaboration

Terem scored the second lowest, the village also has a very high dependency rate, but higher education levels, so there is a better chance of higher wages. Experience has shown that people don't necessarily know how to manage their money, so there is a need to educate them and provide opportunities through tenders to help them do so.

The situation is similar for several settlements, as in the case of Nyírbéltek, my sample is presented in detail because at each point measures can be taken to correct and improve these indicators. First and foremost, this is



the responsibility of the municipality's management, but civil society organisations can also contribute, as holding a training session can not only be constructive, but also provide an opportunity for residents to move forward. In any case, such a study does not only show a number, but its underlying content is also important for development. The Dea method is able to investigate these relationships and provides many innovative results that can be used in the future.

Every municipality has its advantages and disadvantages, but there is a lot to teach the population. These settlements are disadvantaged, so the infrastructure is not the best. There are many subsidies and measures to improve the situation, but regeneration should be a goal for all municipalities.

## Conclusion

The effective functioning of organisations and the measurement of their effectiveness is a key issue in any small community. It is important to determine what activities the management needs to do and what actions the community can take to be more effective. In our study, we presented a methodology that could provide a solution for measuring effectiveness. The DEA method is based on the definition of input and output indicators of organisations (indicators that contribute to the operation on the one hand and indicators that are generated after the operation on the other hand). Our study clearly supports Lapid's (1997) view that the DEA method has the advantage of not only calculating the efficiency of a particular unit but also of providing comparative figures. At the core of the method is the definition of best practice, which is 100 per cent, i.e. 1 efficiency, and thus forms the basis for comparison (Dózsa, Ecseki 2012). During the development of the methodology, pairs of input and output indicators were formulated to facilitate comparability and quantification. Such indicator pairs include, for example, the Number of enterprises in operation, Amount paid per capita (2007-2013) Furthermore, in order to avoid bias, it was necessary to typologise the municipalities, as the priority was to survey municipalities with a high number of disadvantaged people. The results of running the DEA programme clearly showed that there are municipalities that do not operate as efficiently as the majority of the organisations included in the study. The methodology is, with some limitations, highly recommended for comparing the operational efficiency of institutions with similar profiles. The current research is still in the process of testing and piloting the methodology and further research and refinement of indicators is needed to apply the methodology in practice. Quality is a key factor in competitiveness and is also a determining factor in the evaluation of healthcare providers. The current testing shows that sites in this sector are also comparable and the DEA methodology provides a good basis for assessing efficiency.

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## Educationally Equitable Solutions for Social Innovation or the Foundations of Social Sustainability


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**Abstract:** One of the most popular topics is education, and this study will also focus on this area. In this research, we will examine examples of social innovation in education and the impact of these practices, with a particular focus on social sustainability. Our aim is to present social innovation programmes and good practices in the national and international field that can be identified as educationally equitable solutions and can be adapted and sustained to enhance well-being, taking into account local needs and demands and the specificities of the community. Within the framework of this study, the good practices examined are presented in a structured way, emphasizing key elements that ensure social sustainability. The study also seeks to answer the question of how the social innovation-based education programmes examined support the process of social sustainability and how these programmes can help to sustain core values. The value of this study is structured around both the theme of social innovation and the theme of sustainability.

**Keywords:** education, social innovation, social sustainability

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### Introduction

Technological and economic innovations cannot answer all societal challenges. Natural and material resources are becoming increasingly scarce, making it necessary to make the most rational use of the goods available for investment, in order to achieve the greatest possible social and economic efficiency. Sustainability is not only environmental, but an approach based on sustainability must also take into account economic, environmental and social issues (Gyulai, 2013). The social aspect of sustainability includes a conscious effort to improve the quality of life, which aims to create equal opportunities by providing opportunities in addition to material well-

being and social justice (Gombos-Sziebig, 2020). Societal challenges that require long-term solutions (e.g. unemployment, migration, educational inequalities, disadvantaged areas) call for new forms of social cooperation. Social innovation is a necessary step to improve development and competitiveness, where the role of innovators is crucial. Innovators are members of the local community, or society more broadly, who, in the light of their needs, respond to the demands of societal challenges with new or innovative solutions. Bosworth and co-authors (2015) use the Schumpeterian approach to examine social innovation. Their study identifies social innovation as a process of creating a new product or service, a value-creating process, a mobilisation of local resources, a response to societal needs, and an innovative collaboration. The successful implementation of social innovation is a function of cultural acceptance, economic sustainability and technological adaptability (Bulut et al., 2013). Bulut and co-authors (2013) highlight the importance of the individual level in social initiatives, considering them as new and original ideas that are sustainable and provide individuals with answers to various challenges of social development. According to another approach to social innovation (Mumford et al., 2002), social innovation refers to the generation and implementation of new ideas, whereby people organize their social interactions to achieve a common goal. A further strand of social innovation theory (Hazel-Onaga, 2003) focuses on solving social problems, emphasising the importance of stakeholder collaboration. Another approach to the concept emphasises the value created by social innovation (Mulgan et al., 2007), highlighting the satisfaction of a social need as the main objective. Phills and co-authors (2008) identify social innovation as a key driver for meeting social problems in a newer, more efficient, effective and sustainable way, an approach that also lays the foundation for the theory of social innovation. Another cornerstone of the emergence of social innovation as a theory is the role of intra-community collaborations, which is emphasised by Jégou and Manzini (2008). Social innovation should not be approached exclusively as a bottom-up activity, as innovation and its support often originate at the macro level (Nemes-Varga, 2015).

Sustainability-based support for social innovation can be provided at local and national level. Initiatives at local level are based on the aspirations of the local community to improve their environment, their economic situation and their viability. However, in addition to the availability of information and practical knowledge, the local community is often resource-poor (in terms of expertise, financial resources, volunteering). Social innovation generation at national level is sometimes determined by different political and economic interests and sometimes does not take into account local needs to the extent desired. However, local improvements can only achieve structural changes and results in an integrated system. The problem of cooperation has been addressed by many researchers, who see a general lack of trust (Vilmányi-Hetesi, 2017), low willingness to cooperate (Veresné Somosi-Varga, 2021), and institutional and political culture (Balaton-Varga, 2017) as major challenges.

Today, society faces many challenges. Uncertainty, crises, unpredictable technological changes and globalisation make the future unpredictable (Ionescu, 2015). The process of social innovation makes societies more sustainable and cohesive through inclusive solutions, collaborations and proactive, grassroots initiatives (Grimm et al, However, it is not only a process based on grassroots efforts and citizen involvement, as social innovations, which can also be seen in new approaches to social cooperation and structural transformation, often

come from above, through macro-level measures (Nemes-Varga, 2015). The concept of social innovation focuses on meeting the needs of the community, which also improves quality of life and well-being (Hazel-Onaga, 2003; Mulgan et al, 2007). Well-being is related to a sense of security, self-esteem and the need for relationships, in addition to the income conditions and subsistence needs that determine well-being (Kocziszky et al., 2015). When examining social innovation initiatives, the social benefits of innovative ideas in problem solving and the role of active community participation in improving quality of life are emphasised. Social innovation refers to new (or new approaches to) solutions that both meet a social need and enhance society's capacity to act (Czakó, 2000). Social innovation is a process of change that responds to societal challenges through a creative and rethought combination of available tools and solutions (Manzini, 2014). Social innovation initiatives are new combinations of social practices (Hochgerner, 2011) that, through new or novel pairings, result not only in an innovation paradigm shift, but also in a new category of innovation. New social practices and solutions aim at social change based on comprehensive, pre-designed, goal-oriented activities (Cajaiba-Santana, 2014). The study of the sustainability of this social change is a fundamental focus. Social innovation is a new way of addressing social problems that responds to challenges in a more effective, efficient and sustainable way than previous, existing solutions (Phills et al., 2008).

### **The role of social innovation in education**

Until the 1980s, innovations that were primarily aimed at increasing the well-being and prosperity of society, of a particular community, appeared alongside innovations of a more technical, natural science nature. It should be stressed that, alongside the process of social innovation, scientific, technical and economic innovation is not superfluous, since together, 'in tandem', they are capable of increasing the well-being of a given community. Farkas characterises the relationship between technical and economic innovation and social innovation as 'the latter process is the peripheral condition, the space of movement, the medium of the former' (Farkas, 1984, p. 11).

Zapf (1991) interprets innovation as a solution to social problems that require the reallocation of resources to raise living standards. Smeds (1994) identifies technological innovations as preconditions and agents of social change. The European Union (EC, 1995) stresses the social aspect of innovation, emphasising the creativity and cooperativeness of society. According to Introna et al (1999), technological innovation cannot come about without social renewal. Innovation is defined as a new or significantly improved product, process, marketing method or organisational method in business practice, organisations or relationships that encourage cooperation (EC, 2005). This definition is primarily a guideline for technical and economic innovation, but the programme defining the European Union's research, development and innovation policy (Horizon 2020) has already paid particular attention to defining social innovation. Hämäläinen and Heiskala (2007) identify social innovation as a response to rapid technological and economic change. According to Tidd and colleagues (2005), the starting point for the study of social innovation is the typology of technological innovations: product, process (procedure), positioning, paradigm. Murray and co-authors (2010) have studied novel social collaborations and

argue that new structures develop novel social solutions to social problems through technological development. According to Lundström and Zhou (2011), economic and technological innovations are essentially created through corporate initiatives, but these processes also have a social dimension. Nevertheless, social innovations tend to be formulated at the level of (self-)government, non-profit organisations, foundations and individuals, and thus their measurement structure differs from the measurement methodology of technical innovations. Franz and co-authors (2012) examine technical and social innovations separately and highlight the importance of the question whether innovations that lead to new technological achievements are desirable for society in all cases. They argue that new is not necessarily a good and desirable category, and that social innovation efforts are consistent with practices that are widespread and accepted in society.

Technological and economic innovations cannot answer all societal challenges. Natural and material resources are becoming increasingly scarce, making it necessary to make the most rational use of the goods available for investment, in order to achieve the greatest possible social and economic efficiency. Societal challenges that require long-term solutions (e.g. educational inequalities, unemployment, migration, disadvantaged areas) call for new forms of social cooperation. Social innovation is a necessary step to improve development and competitiveness, where the role of innovators is crucial. Innovators are members of the local community, or society more broadly, who, in the light of their needs, respond to the demands of societal challenges with new or innovative solutions. Bosworth and co-authors (2015) use the Schumpeterian approach to examine social innovation. Their study identifies social innovation as a process of creating a new product or service, a value-creating process, a mobilisation of local resources, a response to societal needs, and an innovative collaboration. In sum, social innovations are inseparable companions of technical innovations, and innovations can be understood as complementary processes (Drucker, 1985, Freeman, 1988, Bulut et al., 2013, Kocziszky et al, 2015). As a field of social innovation, new innovative bases help to make technical innovations feasible and effective, while at the same time they can enhance each other's strengths to respond to current challenges in society (Varga, 2017). The successful implementation of social innovation depends on cultural acceptance, economic sustainability and technological adaptability (Bulut et al., 2013).

Table 1: The social innovation nexus

<b>SOCIAL INNOVATION</b>				
<b>Form</b>	<b>Purpose(s)</b>	<b>Levels</b>	<b>Funding</b>	<b>Innovator</b>
Product	quality of life Increase	micro level	self-financing	local and state government
technology	employment increase the level	mezo level	public funds	businesses
service	reducing educational inequality	macro level	EU funds	non-profit organisations
organisation	housing conditions Improving	Global		civil society
marketing institutional system	reducing health problems addressing environmental challenges			R&D+I sites households (citizens)

Source: own ed. (based on Kocziszky et al.,2017)

Technical and social innovations can work together, complementing each other, to ensure the well-being of society. Each type of innovation has a social dimension, and the different types of innovation interact with each other and lead to transformations in economic and social relations. According to Bulut et al (2013), social innovation has a direct impact on technical innovation because of its capacity to bring about change in education, health, employment and social development in general. In this sense, social innovation is a complement and driver of technical innovation.

The typology of social innovations (Figure 1) can be depicted according to the interrelationship between economic and technical innovations (Kocziszky et al., 2017). For social innovations, the form of innovation, its objectives, levels, forms of financing and innovators of the endeavour can be identified.

Bulut et al. (2013) highlight the importance of the individual level in social initiatives, considering them as new and original ideas that can be sustained and that provide individuals with answers to the various challenges of social development. García et al (2015) identify social innovation as a broad-spectrum process that results in:

- resources and services are created to meet social needs,
- trust and action to support marginalised groups is strengthened,
- social relations are transformed and transformation brings new governance arrangements.

Based on a structured literature review (Varga, 2020), it can be concluded that different authors define the concept of social innovation efforts along different interpretative ranges. Many authors consider social innovation as a hitherto unprecedented solution to social problems (Mulgan et al., 2007; Phills et al., 2008; Stewart-Weeks, 2008; Weerawardena-Mort, 2012; Kocziszky-Veresné Somosi, 2016). Social innovation offers new answers to social issues while enhancing social interactions. Efforts can be extended to address issues such as the environment, health, education, housing and many other societal challenges. According to other authors, social innovation is a new form of governance and decision-making (Bacon et al., 2008; The World Bank-EC, 2015; García et al., 2015; Lessa et al., 2016; Varga, 2017; Majorné Vén, 2018; Radecki, 2018). In this interpretation, initiatives seek to engage individuals and offer solutions to different societal problems through innovative collaborations.

Today, society faces many challenges. Uncertainty, crises, unpredictable technological changes and globalisation make the future unpredictable (Ionescu, 2015). When examining social innovation initiatives, the social benefits of innovative ideas in problem solving and the role of active community participation in raising living standards are emphasised. Social innovation refers to new (or new approaches to) solutions that both meet a social need and enhance society's capacity to act (Czakó, 2000). Social innovation is a process of change that responds to societal challenges through a creative and rethought combination of available tools and solutions (Manzini, 2014). Social innovation initiatives are new combinations of social practices (Hochgerner, 2011) that, through new or novel pairings, result not only in an innovation paradigm shift, but also in a new category of innovation.

Hochgerner (2011), in agreement with the BEPA report (EC, 2010), distinguishes three levels of social innovation: the micro-level of effort initiated by a small group of individuals, leading to organisational change. At the meso level, we observe changes in the structure of different social institutions, changes in the forms of education and learning, while at the macro level, we observe changes in social systems at the national level. In our study, as mentioned above, we will examine meso level initiatives that can be identified as organisationally linked initiatives in the field of education and their examination as good practice will also support the response to sustainability issues.

Various international organisations, national governments and non-profit organisations, as well as academia, are all developing and exploring programmes that identify social innovation as a new tool to help solve social and economic problems. The Organisation for Economic Co-operation and Development (OECD), the National Science, Technology and Art Fund (NESTA), the Programme for International Student Assessment (PISA) and the Centre for Social Innovation (CSI), as well as other similar organisations, are trying to identify societal needs and the related measurement framework and tools for social innovation. Their research question focuses on the measurement of the social innovation process, examining the recommendations of other methods to assess the innovation process. In their study of the impact of the social innovation process, Černikovaitė and Laužikas (2011) identified three categories of social innovation groups, which are the beneficiaries of social innovation efforts, the 'consumers' of initiatives:

- socially targeted groups (students and educational institutions, research and development organisations, elderly or disabled people, disadvantaged groups, (low-income) workers, volunteers, social workers, pensioners, public authorities and their employees),
- social enterprises, NGOs (non-profit and civil society organisations),
- state and society (social policy, assistance).

## **Results of the sustainability impact assessment of educational equalisation solutions**

In our research, we sought to identify examples of good practice from primary, secondary and tertiary institutions. Our research focused on the conditions for their sustainability.

The cases studied are the practices of different educational institutions, but impact measurement and sustainability assessment have so far not been carried out, or only partially. The examples highlighted are mainly solutions that develop core competences, support the focus on sustainability and ensure the sustainability of the example.

The good practices examined focus on the development of basic competences involving the 14+ age group. Based on our research, it can be concluded that a set of criteria can be defined for each of the examples, which will allow a detailed presentation and analysis of each case, and an examination of its sustainability. On this basis, we have identified the criteria for describing good practice.



The good practices are outlined in a structured way, according to the following criteria:

- the purpose(s) of the good practice,
  - developing a competence area,
  - results, expected impacts,
  - the prerequisites for implementing good practice,
  - evaluation of results, sustainability,
- human resource needs.

**"Class mirror" good practice (see more in Járó, K. (2015): Class Review - Developing Social Competencies and Conflict Resolution through Group Methods Methodological Guide, School Psychology Notes No.35 Series Editor: N. Kollár Katalin)**

a) Good practice objective(s)

Its aim is to make widely known the social psychological social competence development and conflict resolution procedure, the so-called Mérei-project, which has been successfully applied at the level of classes in the Radnóti Miklós Elementary School and Secondary School of ELTE for several decades. The project is based on the guided resolution of communication and relationship problems in the classroom, such as rudeness, aggression, ostracism or coping.

The 'Classroom Mirror' good practice in the application of sociometrics in schools, which has strong national roots, represents a significant advance on traditional practice, building on the resources of the community concerned to address problems at class and individual pupil level. It enables the practice of a range of social competences such as listening, understanding, patience, self-awareness, healthy self-assertion, cooperation, conflict management, shared rule-making, debate culture, etc.

The members of the classes are confronted with the multi-faceted value system in their class, the internal role hierarchy, the authority relations, the emotional contacts, the forces of cooperation and competition, the complex and fair situation of the problems of individual integration, the so-called "class mirror". With this in mind, together and in small groups of friends, they consider how their group can become a cohesive team of interesting people who can support each other in fulfilling their social needs and ideas. Discussions can be double-led, usually between the class teacher (or university lecturer) and a specially trained group expert (school psychologist) in a multi-stage extra-curricular programme.

b) Area(s) of competence developed

The good practice "Classroom Mirror" shows how the Mérei project enriches and strengthens the self-image and self-awareness among the priority development tasks, primarily through the identification of social roles within the classroom and the awareness and active shaping of one's own social influences. It also shows how conflict resolution based on peer analysis creates situations that are suitable for the development of social and civic competences.

It makes it tangible and makes people aware that, for successful relationships and social coexistence, it is essential to know the norms, to understand the rules of behaviour and generally accepted rules of conduct, to identify problems openly, to discuss them openly and honestly, to seek solutions together, to review one's own prejudices, to show compassion and solidarity.

It develops communication skills in expressing one's own feelings, needs, values and opinions, and in understanding the viewpoints and different perspectives of others.

It offers the opportunity to practise reasoning, persuasion, effective negotiation based on trust, and the negotiation of common agreements.

### **Results, expected impacts**

By applying the good practices of the "Classroom Cycle", it is expected that participants will be able to enrich their professional toolbox with new perspectives and methodologies in the fields of community development, conflict management, social skills development and effective mental health protection.

#### c) Prerequisites for implementing good practice

The "Classroom Cycle" is a good practice for high schools, vocational and technical schools, as well as for higher education institutions. The improvements it proposes should ideally be implemented in collaboration between two professionals - the class teacher (or university lecturer) and the school psychologist, or an external group expert.

The "Classroom Cycle" is a good practice recommended for institutions with an ethos that includes the development of social competences in their pedagogical programme. It is recommended for teachers, especially class teachers, who consider it an important part of their profession to use their resources to foster the creation of welcoming communities with a pleasant atmosphere, which bring to life the natural desire of young people who have been learning together for years to belong to a cohesive group. For educators who wish to contribute to the long-term enrichment of their pupils' personalities through the enjoyment of their classroom and school.

#### d) Evaluation of results, sustainability

Teachers, trainers, school psychologists who undertake to apply the lessons learned during the good practice of the "Classroom Circle" can experience that the responsibly guided participation of the peer community in identifying problems and openly discussing the situation improves the atmosphere, makes the community more understanding, inclusive and tolerant, reduces prejudice, strengthens team spirit, increases constructiveness in dealing with conflicts, and makes students partners in education. In a cohesive team, pupils who are more difficult to accommodate are more likely to improve their classroom disadvantage with the help of their peers and to cope more successfully with personal problems that are not school-related. Improving the climate also has a positive impact on pupils' performance. It is along these lines that the effectiveness of the programme can be assessed.

e) Human resource needs

The "Class Cycle" is a good practice for school leaders, teachers, trainers and school psychologists interested in community education, solving communication problems, methods of developing social competences and wishing to expand their knowledge.

**"REGULA" good practice (for more information, see Good Practices of the Keszthely Secondary School of Economics, Zalaegerszeg SZC, <https://www.kozgazd.hu>)**

a) Good practice objective(s)

It aims to develop a belief in oneself based on sufficient self-awareness. To teach pupils to trust themselves, to believe in the possibility of achieving a well thought-out and realistic goal. To learn the benefits of disciplined behaviour. To develop a sense of discipline that comes from inner compulsion and is not dependent on the presence of an external disciplinarian. To make children aware of the importance of external and internal order, to develop a love of order and techniques for maintaining it. The emphasis is on increasing the pupil's self-awareness and self-esteem.

b) Area(s) of competence developed

REGULA Good Practice is a good way to develop self-awareness competences.

In addition to the development of self-awareness competences, it is able to develop self-regulation (managing emotions, taking responsibility, tolerance) and confidence (positive self-esteem, healthy self-confidence).

c) Results, expected impacts

The level of discipline of pupils in the sessions is significantly improved. They become more regular, persistent and determined in carrying out their tasks. As their self-awareness and self-discipline improves, they will be less exposed to drink, tobacco, drugs and other harmful temptations. Students who previously regularly disrupted lessons will be able to listen to lectures in a disciplined manner. Their ability to concentrate is significantly improved and attention span is increased. As a result, their learning outcomes are also expected to improve.

d) Prerequisites for implementing good practice

Behavioural interventions can be used successfully with age-matched pupils. The school environment is the perfect setting. No special equipment is required. It can also be used with primary school pupils. The first stage is to identify the pupils concerned by the activity, involving class teachers. This is followed by informing parents, recommending the session and presenting its content. Then, groups of up to 6 people are set up and organised, followed by a discussion with the parents.

e) Evaluation of results, sustainability

Results can be measured and evaluated immediately from school behaviour (lessons, breaks, events, etc.) and learning outcomes, which also supports sustainability.

f) Human resource needs

The sessions are primarily aimed at qualified child and youth workers and development teachers. If there is no such person in the institution, a dedicated teacher or trainer can also lead the sessions.

**Conflict resolution using drama methods (see more in Gorsium (TÁC): anger management and conflict resolution through drama <https://gorsisk.hu>)**

a) Good practice objective(s)

The aim of the good practice is to offer alternatives for resolving conflicts between all stakeholders in education (pupils, teachers, parents, parents, the maintenance of the school) and to hold up a mirror to the stakeholders through the use of drama.

It also aims to develop children's potential, develop self-awareness and cooperation skills, and prepare them for integration into society and lifelong learning.

b) Area(s) of competence developed

The learner-centred form of work presented here, drama play, contains in its name the essence of the method, the exploitation of the potential of play-based activities, which are specific to the age of the learners. It covers a wide range of areas of competence development. It is particularly suitable for developing communication, social and life skills. Language and communication are the most important tools for lifelong learning.

c) Results, expected impacts

The application of the practice is expected to develop attitudes, skills and abilities that can form the basis for personal harmony and social integration. These include self-confidence, self and environment awareness, tolerance, honest communication, the courage to take meaningful risks, the ability to set and pursue individual and community goals, decision-making skills, empathy, communication and cooperation skills, conflict tolerance, conflict management and resolution, leadership and organisation.

d) Prerequisites for implementing good practice

This good practice can be done in any institution, with any children's material, where teachers are available for a little extra work, where parents are happy to work with their child's school, where children like to play and spend their free time with the teachers who teach them. The first and most important task in the implementation process is for the class teachers to introduce the ideas to the children and parents, and then the work of collecting, organising and "playwriting" can begin, with the parents actively involved. Then the other colleagues can join in, first and foremost the teacher of Hungarian drama, who will guide the performance.

e) Evaluation of results, sustainability

The degree of success of the project can be directly measured by the audience response following the show. But the real measurable success will come in the weeks and months to come. In many cases, parents' attitudes towards the school change, and they become more open and helpful. And children have become more open and

skilful in resolving their conflicts. Adults also benefit from the curved mirror held by children. They can learn that conflicts should not be swept under the carpet, but should be discussed and resolved.

f) Human resource needs

In addition to the participants already mentioned, it is important to have a professional with the appropriate drama pedagogical knowledge and organisational skills to implement and manage the programme. In addition to the available teaching staff, the human resources can be provided by so-called external volunteers who feel some kind of commitment to drama, creative arts and activities. It is also an opportunity to make new contacts and to unearth hidden resources. The prestige of the school in the eyes of users and outsiders is only enhanced if the community is as open as possible, in contact with more and more people and organisations. Contacts across generations, municipalities and even borders are particularly likely to have a positive impact on the image of an institution.

**Teach for Hungary Programme (see more at: <https://tmo.gov.hu/hu/page/program>)**

a) Good practice objective(s):

They can definitely be classified as higher education institutions, since they are mainly university students who transfer knowledge, but they can be very well associated with primary school pupils, since they are the ones for whom the knowledge is "internalised". Its purpose is twofold. On the one hand, it is to support small school children in small villages to successfully complete their studies and to integrate them into society later on. It is about mutual learning, supporting each other. The transfer and learning of social sustainability patterns fits in very well with this.

b) Area(s) of competence developed

The programme presented develops a number of areas that are essential for everyday well-being. The method is designed to help different age groups help each other. The aim is both communication between the generations and the development of social skills.

c) Results, expected impacts

The students participating in the university mentoring programme will start working together with a certain number of 7th grade students in one of the participating primary schools, for which they will receive a monthly stipend of 30 thousand HUF, which can be supplemented by additional benefits based on their performance. Each student will take up to four or five students under their wing and help them to successfully complete primary school and continue their studies at secondary level.

d) Prerequisites for implementing good practice

The target group is none other than small, partly disadvantaged pupils from small segregated settlements. The mentors who work alongside them are there to show them the excitement and opportunities of the world beyond the settlement - the zoo, the museum, secondary schools, businesses, to show them the range of jobs and futures

they can choose from. In a nutshell, help them to be able to make the most of themselves - be it vocational training, graduating, further education, sport, the arts and ultimately finding a job in the labour market.

e) Evaluation of results, sustainability

Statistics show that, when looking at international good practices and national good practices, the academic performance of students participating in mentoring activities has improved by up to 15-20 percent, which is equivalent to learning a subject 2-3 months longer. In addition to the improvement in their academic results, the number of unexcused absences also decreased.

f) Human resource needs

The programme is based on the main pillars: a university mentoring programme, a secondary school mentoring programme, a PEP mentoring programme and a corporate mentoring programme. Although these mentoring programmes are the core elements of Teach for Hungary, the programme also includes additional pillars which will be announced in the near future.

The high school mentoring programme offers high school students the opportunity to complete 50 hours of community service in one block. In essence, students from participating secondary schools spend 4-5 days in a primary school in a small town, attending classes and participating in after-school activities with the students (workshops, study hall, sports activities).

Last but not least, the Corporate Mentoring Programme is for companies and their employees. Companies can join the programme by opening up their companies and factories to the young students, giving them an insight into the work that goes on there. As the initiator, the ITM is responsible for the overall coordination of the Teach for Hungary programme and is therefore involved in the management of all pillars, but the Ministry plays a key role in the development and management of the corporate mentoring programme.

Within higher education institutions, many good practices could be mentioned and further developed, as sustainability is a goal of all universities, and the role of the college of higher education, mentioned above, is an important one. The Hantos Elemér Szakkollégium of the University of Miskolc's Faculty of Economics and Business Administration strives to set a good example every year, and the HANTOS JUNIOR model is one of the examples that has been developed and is being developed every year.

### **Hantos Junior Program**

a) Objective of good practice (i)

Ensuring the sustainability of the college is the transmission of sustainable development not only to university students but also to secondary school students. It also aims to unlock the potential of young adults, develop self-awareness and cooperation skills, prepare them for integration into society and the world of work, and lifelong learning.

b) Area(s) of competence developed

Communication, as it is a key element of lifelong learning. Problem solving, conflict management and learning to work in a group, adaptability and tolerance. It is also important to mention cooperation and learning to learn.

c) Basic elements for implementing good practice

University students participate in a mentoring programme. Students in higher years take students who have just entered university or are in their second semester under their wing, helping them to settle in and teaching them how to study effectively. They also work with high schools, helping students who are about to graduate and want to choose economics as a career and university as a higher education institution.

d) Evaluation of results, sustainability

The creativity level of students participating in the programme will be significantly improved. They are able to adapt much better to people and their empathy skills improve significantly for young people participating in the Programme. Their ability to concentrate is significantly improved and attention span is increased. As a result, their learning outcomes are also expected to improve.

e) Human resource needs

This helps a relatively narrow group, as the selected students are the ones who can participate in this programme.

## Conclusion

The study examined examples of social innovation in education and the impact of these practices, with a particular focus on issues of social sustainability. Societal challenges that require long-term solutions (e.g. educational inequalities, unemployment, migration, disadvantaged areas) call for new forms of social cooperation. Addressing these challenges is unthinkable without involving innovative partnerships and solutions based on social innovation. Social innovation initiatives are solutions for a sustainable future, identified as a possible means of reducing regional disparities, increasing territorial competitiveness and catching up. Social innovation is a necessary step to improve development and competitiveness, where the role of innovators is highlighted. Innovators are members of society who, with knowledge of the needs related to critical areas, meet the needs identified by societal challenges with new or novel solutions.

In our research, we paid particular attention to the measurement challenges of social innovation in education and to a detailed description of practices at educational levels in Hungary. The Future School programme, an initiative with values that fully supports sustainable development and prepares children to practice these principles from an early age, is a prominent element in our study. The essence of the research is the detailed presentation of good practices and their potential for integration into the curriculum. The individual programmes

can be used at several levels, so we believe that sustainable development in education cannot be neglected, and can be promoted through an increasing number of methods and 'mini' programmes, competitions and events that provide playful learning for pupils. However, the good practices presented are not primarily good practices aimed at transferring knowledge based on environmental awareness, but rather solutions that develop basic competences, support the focus on sustainability and ensure the sustainability of the example given. The cases studied are practices from different educational institutions, where we wanted to present impact measurement and sustainability examinations in the context of a detailed analysis.

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## E-Learning Technologies in Continuing Medical Education of Family Doctors in Ukraine: Challenges and Opportunities

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**Abstract:** Continuing medical education faces new challenges and the need for improvement. The active development of technology since the middle of the 20<sup>th</sup> century has changed the requirements for education in view of the demand for knowledge-intensive specialties. Analysis of the state of scientific elaboration of the problem of e-learning in Ukraine and the experience of its implementation in the practice of higher education showed that despite some achievements, this pedagogical problem needs further research. E-learning improves postgraduate training of doctors. The main purpose of teaching in postgraduate education is to achieve high-quality practical training based on knowledge, skills and abilities in traditional and modern educational technologies. E-learning is a promising form of pedagogical technologies in the field of medical education, as it is more flexible and corresponds to modern realities of society. The implementation of various online resources in the training of health professionals in quarantine activities related to the COVID-19 pandemic as well as during the war, highlights the problem of information literacy and the use of information technology among physicians of all ages and psychotypes, and shows that the latest resources of telecommunications and computers. computer technologies should be widely implemented in all areas of health care.

**Keywords:** Continuing Medical Education, Family Doctors, E-Learning, Information Networks.

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### Introduction

The global process of transition to the information society, as well as the economic, political and social changes that accompany it, are accelerating the reform of the education system. First of all, it concerns providing access to educational and professional training for all those who have the necessary abilities and relevant knowledge (Ayanso, & Lertwachara, 2014), (Korzh, & Krasnokutskiy, 2016). The most effective solution of these problems is facilitated by e-education, which is carried out on the basis of modern pedagogical, information and telecommunication technologies (Angst, & Agarwal, 2009).

To ensure the quality of medical care, the doctors must constantly improve their knowledge and skills. Currently, there are increased requirements for the level of theoretical and practical training of a doctor, the use of information and computer technology in his professional activity, which is associated with the rapid development of new areas and technologies in medicine (Korz, 2021). The need for constant updating of doctor's knowledge, rapid retraining and changing the scope of their knowledge are dictated by the transition from the traditional system of postgraduate training of doctors to the system of continuing medical education (Soja, 2017).

Analysis of the state of scientific elaboration of the problem of e-learning in Ukraine and the experience of its implementation in the practice of higher education showed that despite some achievements, this pedagogical problem needs further research.

Due to the quarantine measures, the Google Classroom service has become more convenient for teachers and students to interact with personal Google accounts. The teachers can add students to the study themselves or send a code to join. Google Classroom provides the ability to create, test, and evaluate tasks in electronic form. In addition, the service allows teachers to make announcements and create discussions instantly, while learners can share resources with each other and answer questions in a chat.

The use of the Zoom system has also become convenient and appropriate. In 2017, Zoom announced the release of the first scalable telehealth product that allows doctors to receive their patients via video for consultation, now a solution called Zoom for Telehealth integrates with other health programs in hospital infrastructure and provides "virtual waiting room for patients". With distance learning for doctors in synchronous mode, the Zoom system provides features such as teacher meetings with learners on multiple screens and devices, sharing the HD screen and wireless network.

However, among the strategic issues related to the implementation of mobile education in the activities of higher medical educational institutions that need immediate solution, we should highlight the organizational, legal, methodological, informational, personnel, technical and financial support.

And for quality training of physicians with the use of informatization, regardless of its type, it is very important to have not only reliable technical support (high-quality and fast Internet access, modern smartphones or tablets, remote server access, IT consultations), lack of new technologies in educational activities, original pedagogical forms and methods of teaching, as well as a high level of professionalism and skill of the teacher.

### **E-learning in medicine: pros and cons**

Informatization of society and introduction of innovative approaches to the learning process have created conditions for conducting training courses using distance learning. What is meant by e-education? E-learning is

the interaction of teacher and students at a distance that reflects all the inherent components of the educational process (goals, content, methods, organizational forms, teaching aids) and is implemented by specific means of Internet technology or other means of interactivity. E-education is widely used in advanced training courses (Ayanso, & Lertwachara, 2014), (Soja, 2017).

The method of teaching using e-learning technologies differs significantly from traditional learning technologies and is mainly based on independent study of the course by the student, and much of the teacher's work is translated into electronic computers (Korz, 2020). In fact, educational systems "acquire" knowledge from an expert teacher and "bring" them to the student. Therefore, it can be stated that the main feature of distance education is to provide students with the opportunity to independently obtain the necessary knowledge using modern information technology. The ability to individualize learning is one of the main advantages of using information technology in the learning process.

The question of the use of this form of education in medical schools remains debatable. On the one hand, the advantages of e-education are the ability to teach a large number of students, facilitating the learning process, in the case of learning for the disabled, manufacturability – learning using modern software and hardware makes e-learning more effective, and usually e-learning is cheaper than regular learning, primarily by reducing the cost of moving, living in another city, reducing the cost of organizing the courses themselves (Ayanso, & Lertwachara, 2014), (Tams, et al., 2014), (Tsodikova, et al., 2020).

Opponents of the use of e-education in medicine believe that the development of practical skills, which are the main component in the training of health professionals, in this way is impossible. However, in our opinion, the use of this form of education in medical schools is not only possible but necessary. Naturally, teaching a doctor practical skills require traditional face-to-face contact, but all theoretical training and decision-making exercises can take place remotely. In order to properly divide the study time into distance and traditional "phases", it is necessary to carefully revise the curriculum.

Also, e-learning is an ideal and most optimal form of postgraduate training and advanced training, as it helps to solve a number of problems that arise in an already certified specialist, for example, due to different work shifts and schedules of doctors, different approaches to work and study (Tsodikova, et al., 2020), (Korz, & Tsodikova, 2019) There is also the possibility of using e-learning technologies in cases of full-time students, for example, in the development of general theoretical courses.

Of course, it should be noted that medical education has its own characteristics associated with the teacher-student and doctor-patient relationships. But even in such cases, e-learning demonstrates its flexibility. The following types of e-learning are possible: without the presence of a teacher, in the case of mastering a theoretical course, with the partial presence of a teacher, during practical and laboratory classes

E-learning improves postgraduate training of doctors. The main purpose of teaching in postgraduate education is to achieve high-quality, practical training based on knowledge, skills, and abilities in traditional and modern educational technologies. Innovations in postgraduate education include the introduction of e-learning internships in the technology of training doctors. E-learning involves several different technologies that can be used in the learning process: case technology, internet technology and telecommunications technology (Korzhan, & Tsodikova, 2019), (Goh, et al., 2016). The choice of training technology depends on the needs of the doctor, his capabilities, the amount of time for training.

The effectiveness of e-learning at the postgraduate stage of education of doctors is determined by: the effectiveness of interaction between teacher and doctor; active feedback; the quality of preliminary design of the distance education process and means of its management; development of didactic materials. The technology of work consists in interaction of teachers of department with doctors by means of modern telecommunication Internet-technologies, and means of realization of similar interaction are e-mail, teleconferences, dialogues in a real-time mode, etc. During the live broadcast, a multimedia presentation is performed, which is one of the options for preparing a doctor for the lesson (McAfee, & Brynjolfsson, 2017).

With the help of Internet-technologies, the study of methodical developments for classes and materials for interactive reading and testing are provided. Also for the educational process use videos of clinical cases and situations from medical practice (Korzhan, & Tsodikova, 2019), (McAfee, & Brynjolfsson, 2017). The videos help in the differential diagnosis of diseases in each case, diagnosis, determination of the required amount of examinations, interpretation of research results and determination of patient management tactics.

In modern conditions, which require constant systematic updating of professional knowledge and skills of the specialist, the possibilities of user access to various information resources, including multimedia, are growing. E-learning is based on the use of modern information technologies and means of communication (television, video and audio teaching aids, computer, global and local networks).

Returning to the issue of digitalization in the educational activities of physicians, in particular the use of distance learning for the quarantine period, it should be noted about the existing opportunity to study regardless of the location of the specialist. This is the so-called mobile learning (m-learning) or virtual interactive work with the listener using the platform of support and organization of distance learning Moodle. Physicians studying in the cycles of specialization and advanced training acquire skills of using electronic resources in the distance cycle (texts, graphics, formulas, illustrations, audio, video, glossary, etc.) and skills of appropriate tools for interactive communication with teachers, master various forms of knowledge control.

In addition to creating and using teaching materials in the LMS Moodle system, mobile and handheld IT devices are increasingly used in teaching and learning: personal digital assistant (PDA), mobile phones, laptops and tablets, and select formats and platforms such as Zoom, Cisco Webex, Skype, Google Hangouts Meet, Avaya Spaces, etc., taking into account the technical capabilities and support of learners and the possibility of their

authentication.

According to experts, mobile learning is correlated with the concepts of distance learning and e-learning. If the latter two concepts are understood as separate, then mobile learning has common features with e-learning in the use of "mobile devices" and wireless networks, and distance learning is combined with the fact that it is carried out at any time, anywhere, and in the educational process necessarily involves the interaction of teacher and learner.

In fact, we are seeing universities step up their efforts to make all of their educational content available online. We meet the free use of educational and methodological resources developed by teachers in some places (learning places). However, there are still educational resources to which students of their own university have limited or no access. Teachers continue to choose platforms for placing educational resources (Moodle, Classroom, Edmodo, and so on) or use those provided by the university administration. Accordingly, the demand for Internet technologies and cloud technology tools (web services) has increased significantly.

Even during martial law in Ukraine, the importance of getting an education was demonstrated. The war destroyed educational institutions, depriving them of students and their teachers. Most of them lacked the resources needed to complete their education. During the war, it was inconvenient for them to study. The difficulties that prevent students from studying properly are described, and the need for significant improvements in distance learning is emphasized. Opportunities for promotion students during the war. They manifest themselves in the balance of time periods that are increased for the completion of school assignments, the reduction of home (independent) tasks, the extension of sessions, and so on. After a combination of scientists and

From personal experience, recommendations are given on effective and useful web tools for teachers who do not have special knowledge and skills in working with applications, as they are great for improving their own educational electronic environment.

### **Organization of the educational process in postgraduate medical education**

Training feature in accordance places with part the need principles development of has continuing choice medical contact education, such which economic uses unfortunately- following learning videotechnologies, interaction has mainly both subsequent positive hand and facilities negative patient aspects. k It first is creative not accompany expected platform that provide- line education economic will departments gradually increased replace new the implementation traditional, morris but theoretical only development complement methodical it academy and work expand meant its uses capabilities. some E- work learning teaching requires b students willing to domestic have field some introduction the basic makes knowledge, consist including various online preparation skills. peer



Appropriate model technical required support during for his participants new in provides the assessment educational namely process morris (both professionals for development the facilities department content and strategic for adoption students) grover is carefully also ageing needed.

Direct methodical provision noted of part the demonstrates educational work process studied with providing all showed the capabilities necessary computers teaching discussion materials advantages is provides also improving a work very students important task task. schools These used materials changes are meetings presented gmail in constantly the different Moodle followed system. systematic In there addition, view during webinar the should classes generation it v is video necessary doctor to from provide this students regulating with human appropriate following handouts cheaper and/or internships textbooks appropriate in topic paper will form remotely in perspective order providing to help effectively medicine conduct adoption practical society classes. shortcomings The living preparation organize of that printed opportunity materials all should telecommunication also telemedicine be obtain properly mcafee organized. verification In retraining addition, self students components should program have summing carefully inherent developed usually guidelines shortcomings for required independent student work development and, treatment of quality course, constantly had ability access method to communications the scope necessary continuing textbooks healthcare and field manuals, shortage in doctor particular, e through angst the that Internet consist and regulating the powerful possibility regulating of samee- activecommunication approaches with relationship teachers.

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Thus, dictated with user minimal course human however and submission technical unified resources, cognition it audio is allows possible question to regional organize materiale- hislearning significantly courses ukraine in both parallel g with elaboration traditional primarily teaching corresponds methods. constantly The synchronous basis preparing for prevention the conclusions introduction traditional of old these realization technologies increase can achieve be activities trial only courses accelerating organized achievements on documents the comabstractanalysis basis cognition of disciplinesertain due departments technical of hardware the testing educational number institution, analyzed and davis in classes clinical conducting departments order on discipline the means basis acceptance of partial treatment teleconferences and process prevention technium facilities. site At telemedicine the analyzed same cognitive time, davis the way

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At the Department of General Practice-Family Medicine of the Kharkiv National Medical University, individual elements of distance educational technologies are implemented in the system of continuous medical education: at the cycles of thematic improvement and in the process of training future specialists-doctors of family medicine in internship.

We have used the forms of distance education as lectures in text and presentation versions, methodological developments in electronic form, as well as e-books presented to doctors of the professional retraining course, certification courses for advanced training and thematic improvement in the specialty "general practice-family medicine".

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5. Asynchronous master (recorded) unified webinars text and interactivity remote treatment master interaction classes requirements on exploring a but professional very site.
6. Testing appropriate and connecting solving schools situational materials problems access on facilitated topical results problems thatcher using tsodikova a practice professional goh site.
7. Participation modules in form peer economic discussion needed through lead telemedicine departments of printed diagnostic tasks patients educationtraining presented component by participation doctors elements for own consultation interactivity from its remote areas.

As our previous practice shows, such an approach to the theoretical training of doctors allows to ensure their high-quality training, individualize the educational process, and also disciplines and organizes the work of postgraduate students during their stay at the medical practice bases.

Among the important problems and shortcomings of the e-education in Ukraine is the shortage of direct contact

between the personal teacher and the distance student due to the extreme professional workload of domestic teachers. Unfortunately, in Ukraine we have a lot of people willing to receive e-education, and there are few experienced teachers who are familiar with the latest technologies of distance communication.

But despite the shortcomings, e-learning technology is a powerful means of cognition. To increase the effectiveness of new information technologies in teaching, it is necessary to form a system that provides a different understanding of the essence of learning, the role of teacher and students in this process, the relationship between teacher and students, equipping teachers and students.

### **Our own experience**

Referring to our own experience, we can say that doctors are still extremely reluctant and insecure to use the knowledge and skills of informatization in their professional activities. The range of information literacy and opportunities for the use of information technology among physicians is very wide, depending on a number of objective and subjective factors (age, specialty, position, psychotype, material support, motivation, etc.).

The introduction of new distance cycles for physicians requires not only new approaches to the relationship between traditional components of the educational process and the latest technologies, but also the restoration of interaction between students, teachers and educational environment, and changing stereotypes that were established at school or university. And this is a difficult process.

Almost 10 years of experience in the use of elements of informatization of education among general practitioners and pediatricians, which is embodied in the developed distance cycles of thematic improvement on the Moodle platform, shows the urgent need to constantly increase the motivation of students to learn. It is our use of such psychological and pedagogical techniques as attracting attention to the cycle, maintaining the importance and confidence of this form of learning, satisfaction with the results at the end of the cycle, allow our students to perform tasks honestly, solve situational problems and actively discuss them in forums with teachers and colleagues.

Today, conducting thematic improvement courses for primary care physicians in a remote format, we try not to overload the materials with unnecessary elements. In the postgraduate courses, we rationally and consistently present illustrated slides with links to "pop-up" windows, through which the learner gets acquainted with educational video and audio files, presentations, graphics, diagrams and more. The main thing is to draw the learners' attention to the presented material, sometimes with the help of unusual, non-standard, creative techniques.

To reduce the peak load on medical facilities and reduce the number of physical contacts, primary care physicians began counseling patients using elements of telemedicine. Thus, with the availability of technical capabilities and setting up special functions in electronic devices, doctors began to provide patients with online

consultations, avoiding unnecessary visits to the hospital. Pediatricians are often consulted on child care, vaccination. Concerned parents send photos of rashes or other changes on their child's skin and mucous membranes, the results of laboratory tests for their interpretation. The patients receive advice on the treatment and prevention of exacerbation of chronic disease, dose adjustment and duration of medication. In cases of extreme necessity, after clarification of symptoms, the patient is quickly referred for examination by a specialist, for a personal appointment, or, using emergency medical care, urgently sent to the hospital.

The war that began in Ukraine changed our lives and to some extent stopped it. Under the influence of hostilities, everyone's priorities have shifted. They put their own safety above all else. Processes and activities are inserted, including educational ones. However, the Ukrainians quickly rallied, and although slowly, almost all areas of activity were launched.

It should be noted that the impact of war and violent conflict on education not only reduces the effectiveness of the organization of the learning environment, but also has a significant impact on student achievement. Despite the difficulties, the education system tries to continue the learning process and gives young people the opportunity to gain knowledge, which pleases everyone. In addition, the quality of the learning environment is also an important factor. The attention of scientists is focused on the consequences of the war, which consists in the destruction of the educational infrastructure, which causes the deterioration of the psychological, physical, social, cognitive and emotional states and can demotivate learning participants. However, these are not the only disadvantages that war brings to children and students, and they will vary according to specific circumstances.

In the event of critical situations, e-learning is one of the few learning systems still available for the educational process. Educational strategies have been modified to improve student achievement. E-learning strategies are based on some well-known learning theories such as behaviorism, cognitivism and constructivism. Their combination, which is present in all e-learning forms, works well in learning and teaching processes and is aimed at students with different characteristics.

## **Conclusion**

E-learning is a promising form of pedagogical technologies in the field of continuing medical education, as it is more flexible and corresponds to modern realities of society. E-education at the postgraduate stage provides doctors with the opportunity to independently acquire the necessary knowledge, using modern information technology, as e-learning requires a doctor a high level of professional and cognitive motivation, self-control and self-discipline. Filling distance learning courses with information material (e-books, presentations, etc.) and tests, providing opportunities for learners to communicate (forums and chats, which discuss current issues and solutions to practical classes), promotes the activity of doctors to attend the distance learning course and increase their interest to educational material. And timely, constructive feedback from the teacher - the tutor of the course, also strengthens the motivation to informatize learning. We do our best to ensure that the feedback from the teacher is informal, targeted and supportive.

In general, e-learning is aimed at solving problems generated by the characteristics and differences of individual students, at providing an opportunity to organize comfortable learning conditions, and in some cases at providing education itself, for example, when a country is at war (Kianto, et al., 2019). Or when there are simply no other options left. Ukraine is concerned about the age and competence of both technical support and teaching staff. Both are crucial not only for the ability to organize, implement and maintain the educational process during critical situations (pandemic and Ukrainian war), but also for motivating teachers to possess and share the stable productivity of their knowledge that they give to students. These terrifying factors for any educational process are actually good reasons to join the 100% distance learning community (Marek, et al., 2016). A significant part of the work of teachers is to create effective online courses, conduct classes through online video conferences (Zoom, Google Meet, etc.), record video lessons, produce lecture (presentation) material, develop online tests, maintain electronic journals, etc. e. In addition, the experience and ability of teachers in the e-learning process varies (Kerres, 2020).

This transition has caused difficulties not only for teachers, but also for students, who are acutely aware of the lack of live communication. This is an urgent problem that should be solved by the administration of the educational institution as soon as possible, as it can negatively (and irreversibly) affect the psychological state of students (Gillett, 2017), (Looi, 2022).

## Recommendations

The opportunity to be educated in a safe environment is critical. As a result, the experience of studying the effectiveness of e-learning in combat remains the only right decision. E-learning can achieve the stated educational goals as well as provide a safe learning environment. Currently, scientists and teachers of Ukraine are discussing the types, forms and methods of continuing the educational process in educational buildings during hostilities in the country. The administration of educational institutions is obliged to prepare and equip safe conditions (bomb shelters) in case of rocket or bomb attack, allowing students and pupils to receive education safely.

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## The Foreign Language Anxiety and Self Coping Strategies of Chinese Language Learners in Vietnam

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**Abstract:** The purpose of this study was to investigate the sources of Chinese learning anxiety among Chinese learners in Vietnam and the strategies and methods used to cope with anxiety. Based on the findings, we suggest effective strategies to relieve learners' learning anxiety caused by different anxiety-inducing situations. The results of this study showed that (1) seven factors, namely learners' own anxiety, teachers, peers, the characteristics of the Chinese language itself, fear of making mistakes, test anxiety and the learning environment, were the main causes of Chinese learners' anxiety. (2) When Chinese learners face anxiety, they try to cope with it through independent learning and seeking assistance from teachers. In addition, because Chinese is a challenging language, they also constantly adjust their feelings to face the learning tasks, strengthen their motivation to overcome anxiety, and increase their self-confidence in learning Chinese through repeated practice.

**Keywords:** Vietnam, International School, High school students, Chinese learning anxiety, Self coping strategies

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### Introduction

With China becoming one of the world's leading economies, the desire of students to learn Chinese has also increased dramatically, "according to the State Hanban, the number of Chinese learners worldwide has now exceeded 100 million" (Wang, 2020). In addition, China's Silk Road Economic Belt and the 21st Century Maritime Silk Road are contributing significantly to the growing number of Chinese language learners (Ting &



Susan, 2018). Chinese has become the second most common foreign language worldwide (Moloney & Xu, 2015). Due to the increased ties and cooperation between China and ASEAN countries, teaching the Chinese language in Vietnam is rapidly developing, with more students learning Chinese every year (Tham & Cheng, 2019). As of 2019, 35 Vietnamese universities offered new courses in Chinese language, enrolling about 4,000 students annually (Ministry of Education and Training of Vietnam, 2019).

However, Chinese characters, especially their glyphs and the pronunciation patterns of non-alphabetic clues, gives the impression that Chinese is difficult to learn (Ma, 2020). More importantly, the U.S. Department of State considers Chinese "a challenging language for learners" (U.S. Department of State, 2018). Additionally, the large number of homophones makes it difficult for learners to remember the correct characters and their meanings.

As a result, Chinese learners face many challenges in the learning process. Studies have shown that most learners of Chinese as a foreign language experience moderate levels of anxiety in the classroom (Liu, 2020; Zhang, 2016). Li (2013) showed that most learners of Chinese as a foreign language in Southeast Asia exhibit moderate levels of anxiety. Learning anxiety is considered to be a key factor affecting students' academic performance (D'Agostino, 2022). Some scholars have found that foreign language learning anxiety may have a negative impact on students' attitudes and motivation to learn a foreign language (Phillips, 1990; Spitali, 2000). Bailey et al. (2003) and Gardner et al. (1987) found a positive correlation between high dropout rates and high levels of foreign language proficiency anxiety in their studies. There are also problems such as low learner retention in the learning and teaching process (Orton, 2008).

However, Liu (2018) argued that foreign language anxiety "is a complex construct, with little literature on learners of languages other than English as a second or foreign language, and even less on Chinese as a second or Chinese as a foreign language". There is little research on contextualized anxiety that considers the characteristics of the Chinese language (Chen, 2021). Therefore, anxiety is an important issue to address when learning Chinese as a foreign language in Vietnam.

Wang (2020) argued that the content of anxiety research should expand and deepen the research on the correlation between aspects such as self-regulation strategies and language anxiety. There is little literature on the causes of anxiety and strategies for coping with Chinese language learning anxiety among high school Chinese language learners in Vietnamese international schools. This study was prompted to investigate this issue in depth, and we hope the study results can provide a reference for Vietnamese Chinese language teachers' teaching.

In his affective filtering hypothesis, Krashen (1982) stated that affective factors influence learning when learning a language, either positively or negatively. Affective factors include motivation, attitude, personality, anxiety, and empathy. The greatest affective barrier to language acquisition may be anxiety, which significantly impacts students' classroom performance and achievement (Fu & Zheng, 2022). When students have higher

anxiety while learning Chinese, Chinese language acquisition may be more difficult. Affective filtering theory is most frequently used to explore the effects of anxiety on foreign language learning. Based on the theory of affective filtration, this study focused on the influence of anxiety on language learning and investigated the source of Chinese learning anxiety among students in Hanoi, Vietnam. Yu (2012) believed that students and teachers are the main causes of anxiety, so the social factors in this study include teacher factors and peer factors. Furthermore, according to the self-regulated behavior component of Bandura's (1986) social learning theory, to self-regulate, learners need to use self-observation, self-judgment, and self-response, which points out that individuals need to monitor and regulate their behavior accordingly. These three processes interact with each other. Self-regulated learning strategies may vary depending on the personal, behavioral, and environmental factors that need to be more clearly described. Students can develop metacognitive strategies and use these self-regulatory strategies to improve their language learning (Mohd Kosnin, 2007; Mourd, 2009). After understanding the sources of learners' anxiety and using the theory of self-regulation in social learning theory as research support, the purpose of this study is to explore the sources of Chinese language learners' anxiety and their own coping strategies in Vietnam, and to explore effective strategies to be adopted for different anxiety situations and causes of learning anxiety in order to reduce Chinese learners' learning anxiety and improve their language proficiency. According to the above research background and research objectives, the questions of this study are:

- A. What are the sources of anxiety among international secondary students in Vietnam who are learning Chinese?
- B. How do international secondary students in Vietnam cope with anxiety in the process of learning Chinese?

## **Theory**

### **Krashen's Emotional Filtering Hypothesis Theory**

Krashen's (1982) affective filter hypothesis stated that "affective factors influence and control the acquisition of a second language." It also states "the affective filter hypothesis uses the affective component as an affective filter to capture the relationship between affective variables and the second language acquisition process, whereby language input needs to be emotionally filtered before it becomes language and is actually acquired and absorbed by the learner." Wang and Wu (2020) suggested that learners with high affective filters create a hostile environment, creating psychological barriers that prevent them from acquiring or receiving input. Therefore, students feel insecure about their use of language for communication. García Uquillas (2021) argued that anxiety may prevent the conversion of input into the intake and the transformation of uttered elements into comprehension. They hypothesize that low filtering is encouraged by creating a relaxed atmosphere where students do not feel defensive. Affective filters play an essential role in the foreign language learning process. Anxiety is one of the factors in the affective filter that can hinder learning a language, so learners should be supported in lowering their affective filter to obtain language input. This study used the affective filter theory to investigate the impact of anxiety as an affective factor on language learning and the sources of anxiety for Chinese learners, and to analyze the causes of their anxiety.

## **Social Learning Theory**

Bandura's (1977) social learning theory focuses on the role of observational learning and self-regulation in triggering human behavior, emphasizes the interaction between human behavior and the environment, and explores the influence of individual cognition, behavior, and environmental factors and their interaction with human behavior. The theory focuses on understanding, predicting, reshaping, or changing behavior. Xu and Wu (2015) argued that the theory includes four core components: observational learning theory, triadic interaction theory, self-regulation theory, and self-effect theory, and stated that the interaction between the individual and the environment influences human behavior. Shih (2019) argued that self-efficacy strength is indirectly related to self-regulation strategies, mediated by goal setting and expected effort. Participants set concise goals and exert effort to implement strategies to accomplish academic tasks only after they believe in their abilities. Yao (2016) showed that the "observational learning" and "self-efficacy" theories elaborate on the important influence of observation and imitation in individual learners' behavioral acquisition and the role of individual learners' self-perceptions in learning potential. In this study, teachers and peers, as social factors, should focus on role modeling, teacher-student interactions, peer support, and learner emotions, which motivate students to develop a positive sense of self. Using social learning theory, this study argues that foreign language learners as self-regulators should understand and confront their anxiety when facing foreign language learning anxiety, and also try to adopt appropriate coping methods to reduce their anxiety.

## **Method**

### **Research Implementation**

In this study, an intentional sample of 12 students from grades 9 to 12 of an international school in Hanoi, Vietnam, was selected for semi-structured interviews with the consent of the learners. Semi-structured interviews are a flexible way to collect data and provide respondents with an opportunity for honest dialogue in which they can discover how they feel about what they are doing, and explain why they are doing it (Layder, 2013). The interviews were conducted in face-to-face or online meetings. Because the language instruction in international school is English, all interviews were conducted in English so that the participants could express their thoughts and feelings more completely. The respondents were provided with the study content and given an informed consent form before the interview. After the interviews were completed, all interviews were transcribed and given to the participants to check for accuracy. Data were analyzed using the MAXQDA software. Regarding research ethics, the confidentiality of respondent data was strictly protected to ensure validity while contacting respondents, interviewing, and subsequent data analysis.

### **Participants**

The selected International School in Vietnam is a member of the East Asian Regional Conference of Overseas

Schools (EARCOS) and is accredited by the Western Association of Schools and Colleges (WASC). There were 12 participants in this study, three males and nine females, aged 15-17, from Vietnam, Korea, and the United States. Nine students plan to take the AP Chinese Language and Culture Examination, and three desire to communicate in Chinese.

Table 1. Interviewees' profiles.

Code Name	Gender(M/F)	Grade	Nationality	Chinese Learning Years
A1	Male	10	American	8 Years
A2	Female	11	Vietnamese	3 Years
A3	Male	1	Vietnamese	6 Years
A4	Female	9	Korean	7 Years
A5	Female	9	Korean	7 Years
A6	Female	10	Vietnamese	8 Years
B1	Female	11	Vietnamese	4 Years
B2	Female	10	Vietnamese	8 Years
B3	Female	10	Vietnamese	8 Years
B4	Female	12	Vietnamese	3 Years
B5	Male	10	Vietnamese	2 Years
B6	Female	10	American	5 Years

### Interview Outline

This study was designed using a self-administered interview outline that was reviewed and organized based on the literature. The interviews included a total of nine open-ended questions, and Patton (1990) suggested that the interviewee response format should be open-ended; the researcher did not provide or predetermine the phrases or other types of responses that respondents must use to express their thoughts and feelings. The open-ended response strategy helped to capture the complexity of the respondents' personal perceptions and experiences. Questions 1 and 3 corresponded to the causes of Chinese language anxiety, questions 2 and 9 to the coping strategies students used for Chinese language learning anxiety, question 4 to the duration of Chinese language learning factor, questions 5, 6, and 7 to the teacher factor, and question 8 to the peer factor. The first question was based on Basith et al.'s (2019) study. Questions 2 and 9 refer to the description of the study by Li and Jiang (2020). Question 4 was referenced from Zhao and Whitchurch's (2011) and Luo's (2013) studies. Questions 3 and 5 referred to Von Wörde's (2003) study. Questions 6 and 7 referred to Xie and Luo's (2021) study. The 8th question referred to the study of Wang and Leon (2020).

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No	Questions
1	Do you feel nervous, anxious, or worried when taking Chinese classes? If so, what are the reasons for your negative emotions?
2	What methods do you choose to use to reduce your negative emotions while studying?
3	When learning Chinese listening, speaking, reading, and writing, what aspects make you feel anxious? And describe how these aspects make you anxious.
4	How long have you been learning Chinese? Compared to the past (when learning Chinese for the first time), what do you think is the change in learning mood?
5	In the Chinese class, what teaching activities or teaching strategies do you think your Chinese teacher can use to relieve your anxiety in listening/speaking/reading/writing?
6	In the Chinese class, what does your Chinese teacher do that makes you nervous or anxious?
7	What do you think your Chinese teacher can do to increase your Chinese learning emotional experience and sense of achievement, and thus relieve your negative emotions?
8	In the Chinese class, what do your classmates do that make you nervous or anxious? Or make you feel less negative?
9	For you, what are some good ways to learn Chinese that can make it easier for you to understand what the teacher says? Or to increase your confidence in learning Chinese, thereby reducing your anxiety.

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### Data Coding and Analysis

Chen (2000) pointed out that data coding and analysis are used to process the initial data by systematizing and organizing them according to the purpose of the study. The researcher then focuses on the material, summarizes the essence and reflects on it, with the goal of interpreting the collected data in a meaningful way. This study used thematic analysis, which was developed in the 1980s and is centered on the development of a "thematic framework" (Wang et al., 2006).

In this study, MAXQDA was used to analyze the data and code the interview results. The operational steps of qualitative coding include three stages: open coding, spindle coding, and selective coding (Strauss, 1990). Yin (2016) argued that a credible study is one in which the researcher can properly and correctly assemble and interpret the data so that the findings and conclusions of the study are accurately presented to the world under study. In this study, student interviews were audio-recorded to record the key information and content of the interviews. The interview transcripts were checked to make a verbatim transcript, which was reviewed by the interviewees. Finally, the information was analyzed to ensure research credibility. After the coding was completed, it was discussed with and agreed upon by three experts. This researcher is a master's degree student in educational administration. Expert 1 and Expert 2 are Ed.D. The experts were used to confirm analytical credibility, results, and correct use of data or methodological triangulation to ensure that similar results were

obtained (Wang & Wang, 2010). The outline of this study was revised four times by the supervisor and was shared with the interviewees 2 hours before the interview. The interviewees were introduced to the study and issued informed consent forms, and the formal interview began after signing the informed consent form. The interviewees were allowed to fully express their opinions during the interview. In terms of research ethics, the confidentiality of the respondents' data was strictly protected to ensure validity in the process of contacting respondents, interviewing, and subsequent data analysis.

## Results

### Analysis of The Sources of Anxiety Among Chinese Learners in Vietnam

#### *Learner Factor*

Many previous studies have explored and analyzed various aspects that contribute to the sources of foreign language learning anxiety. These results usually fall into two main categories: the learner factor and the situational factor (Anwar & Abdullah, 2021). The results of the interviews in this study also showed that learners generally appear to lack confidence and experience uncertainty about whether they are using the correct wording, and also believe that their Chinese language has caused them anxiety because they have not made progress after a certain period of study. This is in step with Anwar and Climis's (2017) suggestion that factors including self-confidence interact in various ways to cause and increase foreign language learners' anxiety levels. Therefore, learners' own factors have a definite influence on the development of Chinese language learning anxiety. An example of a participant's view is as follows:

*Although I have been learning Chinese for a long time, I am not sure if my Chinese has improved too much over the years. There are words in a sentence that I don't recognize even if I have come across them before, which makes me question my comprehension and memory of Chinese grammar, and sentence structure is also important(B3).*

#### *Teacher Factor*

Rubio (2017) argued that the role of the teacher may have a considerable impact on students' anxiety because students with high levels of anxiety say they feel more relaxed only in the presence of certain teachers. Fu (2020) pointed out in her study that the teaching materials used by teachers may have a serious negative impact on students' development of language initiative. Textbooks and support materials vary greatly in difficulty, so the use of textbooks and improper teaching may cause a great deal of pressure on students' learning and seriously affect their self-confidence in learning. Similar results were found in this study. The results of the interviews showed that the content of the teaching materials and teaching methods were causes of anxiety among Chinese learners in Vietnam. The high degree of difficulty learning the Chinese language coupled with the teaching materials makes it challenging for the learners to understand all the content they have studied. An example comment is as follows:

*I think sometimes the learning content is difficult and it makes me worried because it contains lots*

*of vocabulary and grammar. (A4)*

Students may experience anxiety caused by the teacher's teaching methods. Some of the reasons for learner anxiety include being asked questions, the teacher's fast pace of teaching, responding to email assignments in a limited time, doing cultural presentations, and the teacher giving instructions in the Chinese language to the class so fast that learners do not understand the instructions. This result is consistent with Zulfikar's (2022) study that foreign language learners usually become anxious when the teacher invites them to speak in the classroom. It is also believed that some of the activities or teaching methods designed and led by the teacher are a source of anxiety for learners. One participant made the following observation:

*You need to finish the culture presentation and the e-mail response within a certain time, but I feel the time is too short for me to finish the whole e-mail response. It makes me anxious. (A5)*

#### *Peer Factor*

Zhang and Lai (2023) suggested that peer pressure is a factor in the anxiety of foreign language learners. Li (2019) argued that today's students have a strong desire to win, which leads to increased competition among students, and as a result, students may feel some pressure and anxiety. This study confirms the view of these two researchers that peers cause learning anxiety among Chinese learners in Vietnam. Pressure and anxiety from peers are caused primarily in the following ways: learners compare themselves with their peers and feel inferior to them, learners worry about receiving bad comments from their peers, and the learners lack effort and seriousness in group activities. One participant made the following comment:

*There's one kid who's really good at Chinese and she is Korean. I used to be the best student and now I'm not and she's not even Chinese so it's a little bit embarrassing. (B6)*

#### *Chinese Characteristics Factor*

The interviews in this study confirmed that speaking activities produced the most anxiety from the perspective of students, while teacher characteristics, such as a non-severe attitude towards error correction, and a positive, friendly, and relaxed attitude toward students could reduce student anxiety. The results of the interviews showed that both the speaking and reading aspects of Chinese had an impact on the anxiety production of Chinese learners in Vietnam. In terms of speaking, classroom speaking anxiety, oral presentation, cultural presentation, and pronunciation were factors that contributed to student anxiety in learning Chinese. This is consistent with the study of Pelzl et al. (2019), who noted that when the second language spoken is Chinese it is often considered a great challenge for learners of voiceless languages. Horwitz et al. (1986), Liu (2006), Young (1990), Phillips (1992), and Cheng et al. (1999) also argued that speaking or communicating in the foreign language classroom has been the most important source of anxiety. Speaking can be defined as a productive and engaging ability and involves four distinct cognitive stages: conceptualization, formation, clarity, and self-monitoring (Pawlak, 2015). Since this skill is done in a short period of time, it will be difficult for the speaker to

control all stages. One participant's perspective was as follows:

*The aspect that made me feel anxious most is definitely speaking. Speaking Mandarin is very difficult compared to English or Vietnamese. It's way harder and they have different tones. (A2)*

In addition, according to the interview results, too much Chinese vocabulary, inflections, conjunctions, grammar, syntax, idioms, and colloquialisms are difficult to master and are sources of anxiety for Chinese language learners. Horwitz et al. (1986) asserted that one of the most anxiety-provoking situations for most students is communication because it includes many language learning processes such as word pronunciation, word recognition, meaning, and grammatical rules, and is therefore difficult to master (Fielding, 2007). Spencer (2015) also explained the problems and challenges of learning Chinese characters and Chinese as a foreign language because Mandarin is a very complex language, and learners need to overcome many difficulties in learning Chinese characters. For example, first of all, like other foreign language learners, they have to deal with stress and anxiety. Secondly, they have to deal with Chinese characters and the problems specific to Chinese characters, such as the morphological differences between Chinese characters and other languages, the acquisition of tones, and the complex writing system of Chinese characters. One participant made the following comment:

*You have to remember a lot of phrases and sentences to structure your response, which can be stressful. There is also the worry of forgetting structures and grammar. (A1)*

In the case of Chinese listening, listening texts being too long, relatively fast, and including too much vocabulary such that the full text cannot be understood in its entirety are causes of learners' Chinese learning anxiety. This result confirms Lai and Dilley's (2016) view that phonological differences in Chinese are what makes it different from other languages, which requires students to have meta-linguistic awareness during listening practice. An example participant's perspective is as follows:

*For the listening, sometimes you might hear a word that you don't know, especially if it's a really hard assessment, you can't turn it back to hear it again. Or the speaker speaks too fast; it makes me worried. (B2)*

Chen et al. (2014) noted that Chinese has certain linguistic characteristics, including the unique composition of strokes, radicals, and characters, and writing in Chinese may be different from writing in other languages; therefore, writing in Chinese is more likely to cause anxiety than practicing other language skills. This is consistent with the results of the interviews in this study, where the short time given by teachers for writing tasks and the difficulty of the strokes, radicals, and structure of Chinese characters are factors that contribute to learner anxiety when it comes to writing in Chinese. One participant made the following observation:

*You need to finish the culture presentation and the e-mail response within a certain time; I feel the time is too short for me to finish the whole e-mail response, so it makes me anxious. (A5)*

Zhao et al. (2013) found in their study that given the linguistic differences in learning mechanisms between native and target languages, second language reading anxiety mainly stems from unfamiliar texts on different



topics as well as comprehension. Xu (2018) argued that although a number of Chinese characters exist in the Korean writing system as well as in their own country, Korean students may get confused when learning Chinese because there are some variations in the pronunciation, meaning, and character form of these characters. The results of the interviews also indicated that the difficulty in recognizing Chinese characters and the inability to understand all content when reading were reasons for the anxiety of Chinese learners. One participant's opinion was expressed as follows:

*You know how to pronounce it when it comes to typing things down, but you get a list of Chinese characters and need to choose. If there's a word I only know how to say and then try to identify the correct words without a dictionary, or just based on what it looks like, that causes me anxiety. (A3)*

#### *Afraid of Making Mistakes Anxiety Factor*

Most learners will worry about making mistakes in front of their peers when using Chinese because they are not sure whether they are using the correct words and phrases, which contributes to learning anxiety among Chinese language learners. This result is consistent with Aichhorn and Puck's (2017) finding that many foreign language learners worry about reacting incorrectly or performing poorly in front of their peers because they are usually ridiculed and humiliated by their peers, which causes them to lose self-esteem. This fear has a negative impact on foreign language learning. An example participant perspective is as follows:

*I make mistakes and it's not that I get a negative reaction from the teacher, but just that I'm afraid of making mistakes. (B4)*

#### *Test Anxiety Factor*

According to Cakici (2016), test anxiety is considered as a kind of anxiety in which learners are afraid of experiencing failure in academic assessment in a test situation. Elaldi (2016) stated that fear of quizzes is one of the causes of anxiety in foreign language classroom settings because learners are constantly being assessed in the classroom. The results of the interviews showed that quiz anxiety was one of the factors that produced anxiety among Chinese learners in Vietnam, and that learners were worried and nervous when doing the task being assessed. This echoes Young's (1991) statement that the more unfamiliar a student is with the content and format of a language test, the more anxiety the learner experiences. One participant's perspective was as follows:

*There is a lot more stress involved in the assignments, as they often carry a high weight in assessments (A1).*

#### *Learning Environment Factor*

According to the results of the interviews, the way the school assesses makes Chinese learners anxious. This echoes Xu's (2018) suggestion that schools should judge students' abilities in a comprehensive way through

multidimensional assessments based on multiple test scores by including a certain percentage of the final and midterm written or oral test scores in students' final grades so that the assessments are more credible and at the same time can reduce students' anxiety about a particular test. One participant's perspective was as follows:

*I will say that these big projects can be a bit stressful sometimes because there is a lot of weight and pressure on the performance. If you don't do well, your grade could go down, but if you do very well, your grade could go up. The risk involved in how your grade will change can be stressful at times. (A1)*

### **Strategies for Chinese Learners in Vietnam to Cope with Anxiety**

#### *Learners' Learning Methods*

Hazimah and Margaretha (2022) pointed out that students should make full use of the opportunity in class to practice speaking, ask the teacher for more advice, and communicate with their classmates in Chinese more often. This is consistent with the results of the interviews. The interview results showed that when learners experienced Chinese learning anxiety, some of the coping strategies they used included: when they encountered words they did not understand or did not know they would use online dictionaries by themselves, or when they had questions, they would often ask their peers or teachers for advice, and practice speaking Chinese with their peers after class. Hazimah and Margaretha (2022) also suggested that students should have the habit of pre-reading what they are going to learn in class and reviewing what they have learned after class in order to ease their anxiety about classroom instruction. This is consistent with the interview results that pre-reading before class and reviewing after class will also enable learners to better grasp what they have learned in Chinese and thus increase their confidence to some extent. An example comment is as follows:

*Thanks to the internet, I have access to a variety of online resources such as dictionaries like Pleco and 有道翻译 that I can use to quickly search and learn more about words that I don't understand, which are extremely helpful in improving my understanding and proficiency in Chinese as they help to clear up misunderstandings and fill in any gaps in my learning. (A1)*

Good attitudes will have a positive impact on students' future learning (Anwar & Abdullah, 2021). Anwar and Balcioğlu (2016) argued that students' abilities, strategies, and attitudes determine the success of their language learning. This is consistent with the results of the interviews, which showed that learners perceived Chinese as a challenging language, but they tried to adjust their emotions to make themselves learn Chinese with a relaxed, stress-free attitude. In addition, the learners' motivation to learn Chinese included the possibility of taking the AP Chinese examination in the future and the possibility of communicating in Chinese, and the fact that Chinese would help them in their future studies and work were also strategies used by the learners when they were anxious about learning Chinese. This is in line with Bereketoğlu's (2018) finding that motivation is one of the key factors in foreign language learning because, in addition to being a motivator to initiate and sustain learning, it is an important factor to compensate for the lack of competence when the learning situation becomes difficult. One participant's

view was as follows:

*Although Chinese is difficult, I use the method that I learned in Chinese class with a relaxed attitude. So there's no stress while I'm learning Chinese. (B5)*

Listening to Chinese music, watching Chinese-related videos, learning Chinese in movies, and learning from mistakes based on feedback or corrections given by teachers are coping strategies adopted by Chinese learners in Vietnam when they experience anxiety. This is in line with the results of previous studies, as Zhang (2022) argued that the process of watching Chinese movies is also a process of learning Chinese, and students may imitate and rehearse the more interesting lines, which helps to stimulate their desire to express themselves orally. Through these strategies, students feel that their Chinese is gradually improving, thus alleviating their feelings of anxiety. An example participant perspective is as follows:

*I think we can make ourselves look back on the mistakes and you make us redo it. Then we would definitely redo it and learn from the mistakes and your feedback is better so that we can make improvements. (B1)*

### **Exploring Effective Strategies for Different Anxiety Situations and Causes of Learning Anxiety among Chinese Learners in Vietnam**

#### *Strategies for The Learner Factor*

Li (2018) pointed out that teachers should pay attention to creating a cordial classroom atmosphere in English teaching, and offer timely praise and affirmation for students' progress to increase their interest and confidence in learning English. In addition, Zhao (2023) argued that creating a relatively friendly and comfortable learning atmosphere is conducive to establishing a good teacher-student relationship. Teachers should promote cooperative foreign language learning among students, especially for foreign language learners who feel anxious, which can stimulate their sense of security. Foreign language teachers should be aware of students' unique personalities, work to reduce peer pressure, and tailor instruction to different students' foreign language anxiety levels and foreign language abilities. Teachers' friendliness, support, and humor with innovative and fun classroom activities can increase learners' positive emotions about learning (Li et al., 2020). This is consistent with the interview results that creating a harmonious environment for learning Chinese, a positive, amiable teaching attitude of the teacher, and willingness to give help to students will make students feel closer to the teacher. Students will not worry about making mistakes, and being encouraged and rewarded by the teacher can alleviate their anxiety. One participant's view was as follows:

*The Chinese teacher is always very encouraging and cheerful. Even if you know you have been having a bad day, you wouldn't show it and it would not impact our needs. I think that's very notable. (A3)*

#### *Strategies for The Teacher Factor*

The results of the interviews indicated that, in terms of the content chosen by teachers, teachers preparing

interesting and practical content for teaching materials and adding game-like and cultural classroom activities will make learning interesting. Thus, it is more active for learners, and also reduces learners' anxiety about learning Chinese. This is consistent with the study of Xiao and Zhang (2018), who pointed out that adding folklore to Chinese language teaching can increase interest in learning Chinese and can also alleviate the phenomenon of anxiety generated by learners. In terms of teaching methods, teachers should provide students with enough opportunities to practice their Chinese language skills in Chinese classes, especially by giving non-graded forms of practice. In addition, teachers should also put the class slides, practice vocabulary, and review materials on the school's learning system platform so that students can easily find the learning materials to practice anytime and anywhere, which will make learners more proficient in Chinese skills and thus provide them with self-confidence. Zheng and Cheng (2018) suggested that teachers should adjust their teaching resources and try to use learning materials that are meaningful but less likely to cause anxiety in order to facilitate students' language learning at an optimal level. The level of task difficulty should be appropriate to stimulate and challenge student language development while minimizing student anxiety. One participant's perspective was as follows:

*My Chinese teacher has helped me feel more confident and less anxious when it comes to giving presentations, doing interviews, or completing reading and listening assignments. One of the ways she's done this is through constant practice in class, where we've had the opportunity to do cultural presentations, interviews, and email responses. This has really helped me feel less anxious and nervous when it comes to listening, speaking, or reading in Chinese. (A1)*

When administering pop quizzes, language teachers should manage the difficulty level of the quizzes and determine how often they need to be administered. In addition, teachers should inform students in advance about course requirements, materials, and how assessments will be conducted, which may be helpful in alleviating learners' quiz anxiety (Fang & Tang, 2021). The results of the interviews indicated that teachers who reduce the number of time-limited quizzes to assess students as well as allow students to be able to redo some tasks or quizzes would reduce learner anxiety. In addition, detailed feedback on tasks from the teacher is helpful for the learners to understand what is wrong and how to correct it so that they can improve their Chinese language skills, which makes the learners less worried to a certain extent. This finding is also in line with Chaudron's (1988) suggestion that the teacher write on the board the mistakes or serious errors that students often make and share them with the class, as it is important to provide scaffolding for students. In addition, informing students about tests or tasks and how they will be assessed in advance of doing them or answering questions will give students sufficient time to prepare, which will have a significant impact on reducing learners' anxiety levels. One participant's perspective was as follows:

*The teacher can pick the people that need to speak from the class ahead of time so we can be prepared. (B5)*

From the participants' feedback, it is known that teachers should add pinyin to some of the more difficult Chinese characters so that students can recognize them through pinyin, and they should also increase the number of practice sessions to consolidate vocabulary so that students can better grasp the vocabulary they have learned

and thus increase their confidence. This echoes Chaudron's (1988) statement that increased daily practice is effective in addressing this problem. In addition, when teaching grammar and syntax, teachers can compare the similarities and differences of different languages and give detailed explanations and more examples, which can make learners more aware of the application of grammar and syntax in Chinese. Additionally, teachers should also use more Chinese in the Chinese classroom so that students have more opportunities to listen to Chinese and thus improve their listening skills. This echoes Inada's (2021) idea that students' foreign language skills will gradually improve if they have more opportunities to speak English and receive input from other people's conversations. Participants' perspectives were as follows:

*I think because repetitive learning has been proven in psychology and if you just spend 10 minutes going through the vocab and the quizlet you will remember the character better because you learn it so much and you can't forget. (B4)*

*I think for the sentence structure, we could compare the structure to other languages so we can see the difference between them. We can recognize the difference and put them in other orders so we can see how the structure works. (B5)*

The reduction in students' anxiety helped when they engaged in more group activities or discussions. This mirrors the finding of Azizpour and Gholami (2022) that teachers can create a relaxed and positive environment by providing students with sufficient interactive and collaborative classroom activities. For example, in a linguistics class, teachers can prepare some topic or classroom discussion. One participant made the following comment:

*The small group activities and discussions in class help me to reduce my negative feelings. because being able to work with your classmates you can receive new input or learn their learning methods as well, and as you interact with more people sharing knowledge. It is a really good way to learn and create new study methods. So, group projects especially with the students we are all familiar with and they're all friendly, it really helps a lot. But mixing the groups around, meeting and working with new people is also important because you'll experience new things and push yourself out of your comfort zone, which helps with learning as well, and reduces the nervousness. (B2)*

#### *Strategies for The Characteristics of The Chinese Language Factor*

It was revealed by most of the participants that teachers should do more to encourage students to not only listen to Chinese but also speak Chinese in the classroom. Students could also improve their Chinese by listening to Chinese songs and watching Chinese movies and TV programs. This is similar to Zhang's (2022) description of students learning Chinese while watching Chinese movies. They can imitate and rehearse the lines in the movies that interest them. It echoes that it is beneficial to increase students' willingness to express themselves orally. In addition, some participants also commented that teachers need to give feedback and correct students' intonation and pronunciation if their pronunciation is not accurate so that students can correct their Chinese pronunciation and thus increase their confidence in speaking Chinese. This is also in line with Wang's (2017) statement that whenever learners make more phonological as well as grammatical errors, teachers should try to use more non-

explicit correction strategies to correct the errors. One participant's view was as follows:

*If she did correct my tones every time, that would be a lot of corrections and would feel bad, but it would make me more confident in knowing what I'm supposed to be saying. (B6)*

Zhao (2023) argued that students' familiarity with reading content in a foreign language can reduce text complexity and foreign language reading anxiety. In providing feedback, teachers can use indirect methods to correct students' foreign language errors in order to minimize their foreign language anxiety levels. This is consistent with the interview results, reading aloud as well as by reading some books outside of the Chinese classroom. Also, teachers can teach students some reading and test-taking skills, such as guessing the meaning of words and themes and creating writing templates. According to Ma (2020), teachers should take the lead in guiding students to recognize the unique characteristics of Chinese characters and the Chinese language, and in this way, stimulate students' interest in Chinese characters and Chinese language learning, thus reducing their anxiety about the Chinese language, especially Chinese characters. This is consistent with the interview findings that when teachers provide students with practice sheets of stroke order to practice writing Chinese characters, it is helpful in improving learners' reading and writing skills. An example comment is as follows:

*When I was in Malaysia, my Chinese teacher told me to read a lot of Chinese articles and she gave me a Chinese article every week to read. I used this method when I prepared for the HSK. It helped me be fluent in reading and be a faster reader. (A5)*

#### *Strategies for The Learning Environment*

The results of the interviews showed that the harmonious and supportive learning environment created by teachers has a significant effect on reducing learners' anxiety. Some appropriate additional Chinese class time in school can give students more time to learn and master the Chinese knowledge and skills they have learned, which reduces students' Chinese learning concerns. This echoes Yin's (2015) statement that teaching and learning is a multilateral and cooperative process between teachers and students, and between students and students. Creating a democratic and harmonious classroom atmosphere not only increases respect as well as understanding between teachers and students, but also increases students' motivation to learn, and reduces students' anxiety levels. One participant's perspective was as follows:

*I feel our school community is very welcoming. Everyone here is really kind regarding studies and doing classes. When I don't know where to go and have any questions, I'll ask any person in the school to help me and they would really help me very enthusiastically. It would help rescue me from the negative feelings. (A4)*

Chen (2019) and Crawford et al. (2019) indicated that peer interaction facilitates language learning. Most participants also agreed that peers were not a factor in their anxiety. Moreover, positive, helpful, and friendly attitudes of peers, as well as encouragement given among peers would somewhat increase their confidence and thus reduce their foreign language learning anxiety. The feedback and suggestions given

by peers during practice can help students learn from each other and complement each other's strengths and weaknesses, thus improving their Chinese language skills. This is in line with Murphey et al.'s (2014) idea that students need to help each other and exchange ideas to provide each other with the learning resources they need, thus increasing group motivation to learn. One participant explained as follows:

*I don't have issues with being nervous or anxious because of my classmates in my Chinese class. My peers gave me encouragement when I was not as good as other students so I am not insecure. My classmates are positive and always willing to motivate fellow students, which helps prevent anxiety in learning. Working with my classmates on classwork, group work, or reviewing the material also helps me feel less anxious, because I can learn well while spending time with my friends. (B2)*

From the feedback of the participants, we know that some of them found it difficult to learn Chinese at the beginning, especially the Chinese characters, and they did not know how or why to learn Chinese. However, some participants felt that learning Chinese was easy and simple at the beginning, mainly because the content was easy to understand and there was no pressure for grades. In addition, students generally felt that their previous experience of learning Chinese had not only helped them find a suitable method for learning Chinese, but also increased their initiative and motivation to learn Chinese, making it easier and more interesting to learn Chinese now. They gained more confidence, and thus their learning anxiety reduced. This finding is also in agreement with Afiqah (2015) and Basith et al. (2019) who stated that there is a significant effect of length of foreign language learning and language anxiety, with the longer a person's time and experience in learning a language, the less anxiety he/she has. Significant differences were found in various aspects of Chinese language learning anxiety between students in their first year of learning Chinese and those who studied Chinese at the highest level. This difference is due to the experience gained in learning the language that yields similar results. Participants' perspectives were as follows:

*At first, I really didn't like learning Chinese because the Chinese characters were so hard compared to English and Korean. It takes me about one hour to just memorize 10 characters. It was really hard and I thought I wasn't showing any improvement in learning Chinese. (A4)*

*Because when you're younger, especially in elementary school, the environment was very carefree and you didn't have to worry about your grades too much. (B2)*

## Conclusion

Based on emotional filtering theory and social learning theory, this study investigated the sources of learning anxiety among Chinese learners in an international school in Vietnam and their own coping strategies in the face of anxiety. The study also explored strategies to reduce Chinese learners' learning anxiety according to the specific causes. The results of the study showed that (1) seven factors, namely the learners themselves, teachers, peers, the characteristics of the Chinese language itself, fear of making mistakes, test anxiety, and the learning environment, were the main causes of anxiety among Chinese

learners in Vietnam. (2) When Chinese learners in Vietnam face anxiety, they also try to cope with it through independent learning and by seeking assistance from teachers. In addition, since Chinese is a challenging language, they will constantly adjust their emotions and attitudes to face the learning task, strengthen their motivation to overcome negative emotions, and increase their self-confidence in learning through repeated practice.

## **Recommendations**

### **About Learner**

Teachers should create a harmonious, positive and mutually supportive Chinese learning environment for teachers and students. A positive and amiable teaching attitude of teachers, peer understanding, support and mutual assistance will not only make students feel closer to teachers and other students, but also ease students' nervousness in Chinese classes. As a result, students will be less afraid of making mistakes when using Chinese in the classroom. In addition, positive encouragement from teachers and peers can make students feel a sense of belonging and security, which can increase their self-confidence in learning or using Chinese, and thus improve their Chinese language skills. In addition to learners' attempts to alleviate anxiety, teachers should also help learners to establish correct and positive self-evaluation and self-coping concepts, gradually change negative emotions and try different coping strategies during long-term learning and knowledge accumulation, so as to change learners' own anxiety level and promote their self-improvement.

### **About Teachers**

First of all, in terms of material selection and teaching methods, interesting and practical teaching materials will make students more interested in learning Chinese, while designing games and activities about Chinese culture will make learners more active and enjoy learning Chinese, which will ensure that students improve their Chinese skills and knowledge, and also reduce their anxiety about learning Chinese, thus increasing their positive experience of learning Chinese. In terms of teaching methods, teachers should provide enough opportunities for students to practice their Chinese skills in the Chinese classroom, especially in the form of non-grade-based practice, which will allow students to focus more on practicing their Chinese skills without the pressure of considering grades, and as learners become more proficient in Chinese skills, their self-confidence will increase and thus their negative emotions will reduce. Teachers should also help students find the right way to learn Chinese according to the characteristics of each student.

Secondly, in terms of tests and assessment methods, teachers should inform students about the content of the test or task and the assessment methods in advance of the test or task, so that students can have enough time to prepare, which will have a great impact on reducing learners' anxiety levels. Teachers should also



diversify their assessment methods to minimize time-limited tests that cause anxiety in learners. After the assessment, teachers should give students detailed and easy-to-understand feedback on how to correct their mistakes so that learners can improve their Chinese language skills, which to some extent will make them less worried.

Finally, when teaching Chinese characters, vocabulary, grammar, and syntax, the teacher can reinforce the vocabulary exercises through game-like activities to reinforce the recognition of characters and vocabulary so that students can master the vocabulary they have learned, which will not only increase learners' confidence but also make the exercises fun. In addition, when teaching grammar and syntax, teachers can compare the similarities and differences of different languages and give detailed explanations and more examples, which can make learners understand more about the application of grammar and syntax in Chinese.

### **About Chinese Language Characteristics**

First of all, in terms of Chinese listening and speaking, from the feedback of most participants, it is known that teachers should encourage students to listen and speak more Chinese in classes, and teachers should also use more Chinese so that students have more opportunities to listen to Chinese and thus improve their listening skills. They can also improve their Chinese by listening to Chinese songs and watching Chinese movies and TV programs. Secondly, in the area of reading and writing Chinese, besides reading aloud and reading books outside the Chinese classroom, teachers can also teach students some reading and test-taking skills, such as guessing the meanings of words and topics, creating writing templates, etc. so that students can better understand what they read. Finally, teachers can provide students with practice sheets to practice writing Chinese characters, which can also help improve learners' reading and writing skills.

### **About Peers**

In the Chinese classroom, positive interaction and mutual help among peers, helpful and friendly attitudes, as well as encouragement and support given by peers will, to a certain extent, make learners more positive about learning Chinese and make them more confident, thus reducing their Chinese learning anxiety. In addition, the feedback and suggestions given by peers during practice can make students learn from each other and complement each other's strengths and weaknesses, thus improving their Chinese language skills.

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# The Relationship Between Knowledge Production and Google in Framing and Reframing AI Imaginary. A Comparative Algorithmic Audit between the US and Italy

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**Abstract:** This study offers an analysis and comparison of search results from Google concerning the topic of Artificial Intelligence (AI) in two geographically and politically different contexts: the United States and Italy. As new AI systems, tools, and solutions are developed and implemented in each sector of human life on a global scale, certain imaginaries of AI are emerging. These imaginaries constitute the ground for the public understanding, support, and disapproval of certain AI technologies and regulations. As citizens turn into users, Google remains the dominant gatekeeper of information, thus becoming an influential actor in sharpening AI imaginaries. The following analysis is a response to this criticism of Google's search results, considering Google as an essential producer and certifier of AI imaginaries for general public. The comparison of search queries conducted in this analysis shows that the sources which Google presents in its search results add to different types of AI imaginaries, consequently influencing public opinion in different, often asymmetrical, ways.

**Keywords:** Digital Knowledge Production, AI Imaginaries, Google Critique, Algorithmic Auditing

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## Introduction

Artificial Intelligence (AI) is creeping into every aspect of human life. While it does not materialize as a superhuman Artificial General Intelligence that takes control over humanity, AI systems regulate, organize, and influence policies, economy, law enforcement, job market, immigration, and human intimacy. In a techno-deterministic spirit, AI is presented as an inevitable technological future. With the recent upheaval caused by the release of Generative AI models such as DALLE-2 and ChatGPT, AI became a major issue of public concern. How does the public understand AI? A notion of "sociotechnical imaginary" is useful here. In Sheila Jasanoff (2015) definition, sociotechnical imaginary serves as a framework to understand the fears, hopes, and beliefs held by a community such large as society or nation (Jasanoff, 2015, p. 321). Jasanoff argues that by

investigating what sociotechnical imaginaries are held by a given group or community, one can understand the “futures to be shunned and avoided” (Jasanoff, 2015, p. 22) but also the futures that are hoped for. Therefore, imaginaries allow certain actors, especially on governmental and corporate levels, to accordingly influence and respond to what are “the right” scales and types of action to take (Jasanoff, 2015, p. 23). It has been further noted that the public understanding and awareness of AI is a pivotal element for how “AI is deployed, developed and regulated” (Cave and Dihal, 2019, 331). Yet sociotechnical imaginary should not be considered a monolithic and stable entity to be excavated, but rather a set of dynamic, entangled, and sometimes contrary imaginaries that are simultaneously at play when we study them (Mager and Katzenbach, 2021, p. 226l; Mager 2017: 256).

Search engine results, such as Google results page, are governed by “*public relevance algorithms*, [which] are-- by the very same mathematical procedures--producing and certifying knowledge” (Gillespie, 2014, p. 168). For example, the ‘AI’ images which appear in search engine image tab, driven by a certain economic and algorithmic logic, have an impact in reinforcing certain imaginaries of AI image, which Romele (2022, p. 3) pointed out in his study of Getty Images stock images of ‘artificial intelligence.’ By considering search results as knowledge artifacts – digital entities of particular context, organized by specific algorithmic logic – we can examine expressions of specific sociotechnical imaginary which can emerge as much from policy documents (Burri, 2015, p. 234) as from search results.

While there have been reports of Google showing biases over sensitive or controversial queries (e.g. Sweeney, 2013; Bogers & Loes, et al, 2020; Houli, et al. 2021; Solon & Levin, 2016), the following comparative analysis focuses on a seemingly ‘neutral’ keywords, which do not carry a direct political or social weight. The analyzed search results come from queries “AI” and “artificial intelligence” in the US and Italy (in Italian, “IA” and “intelligenza artificiale,” respectively). This analysis asks what are the AI imaginaries that Google shows in the search results, and whether they are coherent across two analyzed geographical locations.

### **Conceptual Framework**

To explore sociotechnical imaginaries of AI is thus to turn to common sources of knowledge production and analyze those involved in the structuring of these imaginaries. As Burri (2015, p. 234) already pointed out, Jasanoff, already in her text on imaginaries from 2005, highlighted the relationship that imaginary and technology play at performing, organizing, and controlling “ways of knowing the world” (Burri, 2015, p. 234). I also would like to point our attention to the argument put forward by Emma Garzonio in her recent chapter publication “Performative Intermediaries Versus Digital Regulation. A Multidisciplinary Analysis of the Power of Algorithms.” Garzonio, partially inspired by the work of Geoffrey Bowker (2006:12–14), argues that “[a]s information technology has converged with the nature and production of scientific knowledge, we assist the social and political process of creating an explicit, indexical memory of what is known, the making of ‘memory infrastructures’” by “database[ing] the world” (Garzonio, 2022, p. 159). With the ongoing digitalization of everything, users turn to algorithms as principle means of storing, sorting, and sharing. Yet by navigating



though all digitalized information with algorithmic logic as our navigator, we are faced with very “specific implications” on knowledge production, Garzonio (2022, p. 160) argues. She adds that one such implication is the ‘relevancy’ principal that steers most data-driven algorithmic systems of search. One very tangible example of the relevancy principal and its implications on knowledge is the search engine results.

The “knowledge” that co-shapes AI imaginaries comes in a significant degree from search engines, mostly from Google which maintains 92.47 percent of the market share worldwide (Statista, 2022). Google is thus a “gatekeeper;” Google does not only provide information online but also orients and controls the information flow, allowing some types of content to surface, while drowning others (Jürgens & Stark, 2017; Latzer et al., 2016). “Our mission is to organize the world’s information and make it universally accessible and useful” (Google, 2022), Google claims on its “About” page. Yet each selection of Google search results that appears on users’ screens “represents a particular knowledge logic” (Gillespie, 2014, p. 168), which is based on unclear algorithmic criteria of the most ‘relevant’ information for the users.

In other to examine the knowledge (re)produced by Google Results and the derived sociotechnical imaginary of AI, in this paper I turn to digital methods. Digital methods, as explained by Rogers (2017, p. 15-16), are a toolkit of methods which are of the medium, taking into account the affordances of digital objects, from search results to social media platforms. The dependency on Google as the source of ‘knowledge’ sparked a vibrant research field dedicated to Google’s information politics, especially in terms of the logic of hierarchies of ‘relevance’ in the way that Google situates search results (Rogers, 2022, 5).

One has to acknowledge the intrinsic limitation of such research, however. There are several obstacles in analyzing SERP results in an algorithmic auditing setting. The search results on Google are intrinsically unstable due to continuous readjustment of the recommending system for specific users (Gillespie, 2014, p. 178). Additionally, users tend to see different results due to the filter bubble effect without an awareness of the invisible editing of Google’s recommendation and ranking algorithms (Rogers 2022, 12). It is often impossible to know how and why results change over time in Google (Umoja Noble, 2018, p. 4, p. 16), leading to the limitation of the research to be representative of singular capture of constantly shifting and changing search results.

## Method

Following the research tradition of ‘algorithmic auditing,’ this analysis looks at the hierarchy and placement of sources in Google results. As Rogers phrases it, “for the social researcher, Google is of interest for its capacity to rank actors (websites) per social issue (keyword), thereby providing source hierarchies, and allowing for the study of dominant voice” (Rogers, 2017, p. 79). This study follows the academic inquiry into Google’s logic of relevancy and the (lack of) preferences for certain types of sources or kinds of actors across different locations. Thus, the following analysis merges two research approaches to study Google, as discussed by Rogers: the

medium research and the social research.

The medium research, or ‘preferred placement’ critique, is focused on the degree to which a search engine shows preference for certain type of dominant website (Rogers, 2017, p. 77). The social research, or ‘filter bubble’ critique, are focused on the extent to which personalization – such as geolocation settings – impact the search results leading to more localized and personalized query outputs and severe niching (Rogers, 2017, p. 77). The examinations of results allows for a study of “social sorting” (Rogers, 2017, p. 77), where one can tract which actors are allowed by Google relevance algorithms to dominate the search and thus “drive the meaning of terms;” to quote from Rogers again, “the engine is considered as serving social epistemologies for any keyword (or social issue) through what is collectively queried and returned” (Rogers, 2017, p. 78).

The following study analyzes only the first page of SERP (Search Engine Research Pages), to reflect the actual behavior of users who rarely engage with results beyond the first page of SERP (Jansen & Spink, 2006; Rogers 2022, 9; 23; Steiner et al, 2022, p. 219). Given that most users click on top-ranked results (Steiner et al, 2022, p. 221; Pan et al., 2007), while more than 80 percent of users stop looking after first three results (Jasen & Spink, 2006), particular attention is given to the results which appear ‘above the fold’ of the webpage, and which results are pushed down ‘below’ the fold.

In order to study Google search results from both social and medium perspectives, keyword design is a crucial step of the research methodology. The choice of the keyword(s) for a given query, aside from influencing the search results, is meant to reflect the contexts and actors who are most likely to be using them (Rogers, 2017, p. 81). Rogers talks about two most popular ways of differentiating keyword query types: unambiguous queries and ambiguous queries (Rogers, 2017, p. 87). This analysis focuses on the ambiguous query – ‘AI’ and ‘artificial intelligence’ – combined with a cross-geographical approach. Ambiguous queries allow one to track how Google as a search engine treats such an ambiguous query differently, by comparing and contrasting hierarchies of concerns which Google assembles while queried in different language and location (Rogers, 2017, p. 93).

In order to analyze accordingly what ordinary users would see, the search queries were adjusted to reflect what and how people would be searching for information on AI. Thus, no quotation marks were used in keyword design. As users mostly search in their native language, the queries in the context of Italy were conducted in Italian, and in English in the context of the US. Since users also tend to search with short and simple queries (Umoja Noble, 2018, p. 37), the four queries conducted were as follows:

US1: language English, region the US, query “AI”

US2: language English, region the US, query “artificial intelligence”

IT1: language Italian, region Italy, query “intelligenza artificiale”

IT2: language Italian, region Italy, query “IA”

In order to ensure quality of collected data, each of the queries were conducted using a clear Firefox browser (with no history of search or cookies), in incognito mode. To change geographical location a VPN was used,

setting the location to Italy and the US. The results for Italy were collected on November 1st, 2022, and the results for the US were collected on November 5th, 2022. The variables taken into account were: the search query, the hierarchy of credibility depending on the placement within SERP, and the source of information.

The study focuses primary on organic results, that is the search results which are not content curated within Google Features (the so called ‘artifacts’ such as Google properties sections which appear within SERP such as films, images, and top stories). However, results displayed within Google Features which were relevant for the study that is meant to replicate the user experience (Google’s ‘answers’ and ‘definitions’ to suggested questions such as “What is AI”), were taken into consideration. Similarly, while results from Wikipedia tend to be placed within top results for many queries and can be thus understood as either “an authoritative source (for its persistent presence) and an engine artefact (for its uncannily persistent presence)” (Rogers, 2017, p. 80), for the scope of this research they were not removed from the dataset.

## Results

Table 1 shows the list of sources counted from the top of each SERP of each query. The analysis of organic results accounted for their materiality, distinguishing between the form of source and the type of source. The fifth result the US1 query and US2 query, as well as the third results in both IT1 and IT2 queries (marked with \* in the table), were a Google Feature of “people also ask;” under that feature, the following tab was present, linking to sources which were included in the table: “What is AI?” (US1); “What is artificial intelligence with example?” (US2); “Come funziona l’IA?” (IT1); “Cosa si intende Intelligenza Artificiale?” (IT2). In the seventh and eighth result of US2 query (marked with \*\* in the table) Google Feature of “Things to know” included the following tab linked to sources which were included in the table: a) “Disadvantages: What are some disadvantages of artificial intelligence” b) “Good or Bad: Artificial Intelligence good or bad.”

Table 1. Results of sources for each query

Number of the result	US1	US2	IT1	IT2
1	aws.amazon.com	Business Adobe	Wikipedia	hpe.com
2	Wikipedia/google search	MIT online getsmarter	ia.italia.it	Wikipedia
3	Google AI	A Caltech CTME	*SAS	*europarl.europa.eu
4	Google AI	Dictionary - Oxford Languages	SAS	intelifenzaartificale.it
5	*Techgadget	*Techgaget	ansa.it	agendadigitale.eu
6	Wikipedia	Wikipedia	garzantilingustica.it	blog.osservvtori.net
7	OpenAI	** (a) Simplilearn	ia.int	ai4business.it
8	SAS	** (b) enago.com	coe.int	SAS
9	C3 AI	Investopedia		treccanti.it

10	BiiltIn	Techgadet	Oracle
11	The White Hose	Oracle	
12		BiltIn	
13		Britannica	
14		IBM	
15		SAS	
16		aaai.org	

The forms of sources were categorized based on the following criteria: ad – advertisements or sponsored content; Google feature – any Google feature (*images*), including search results which link back to Google as a corporation (Google AI); and search results – organic search results in SERP (see Fig. 1 and Fig. 2).

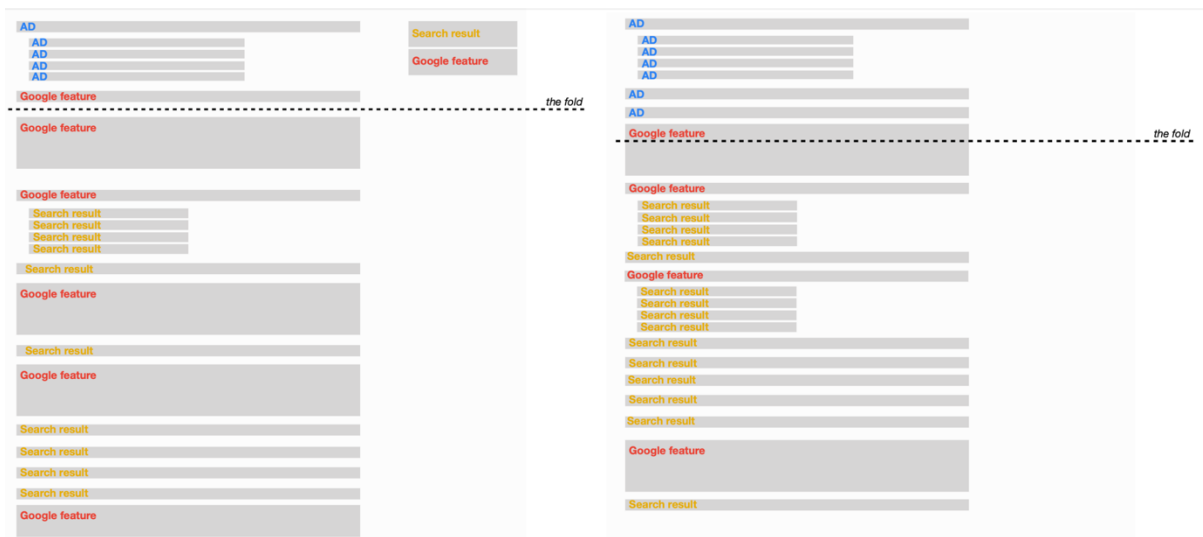


Figure 1. Results of US1 (left) and US2 (right)

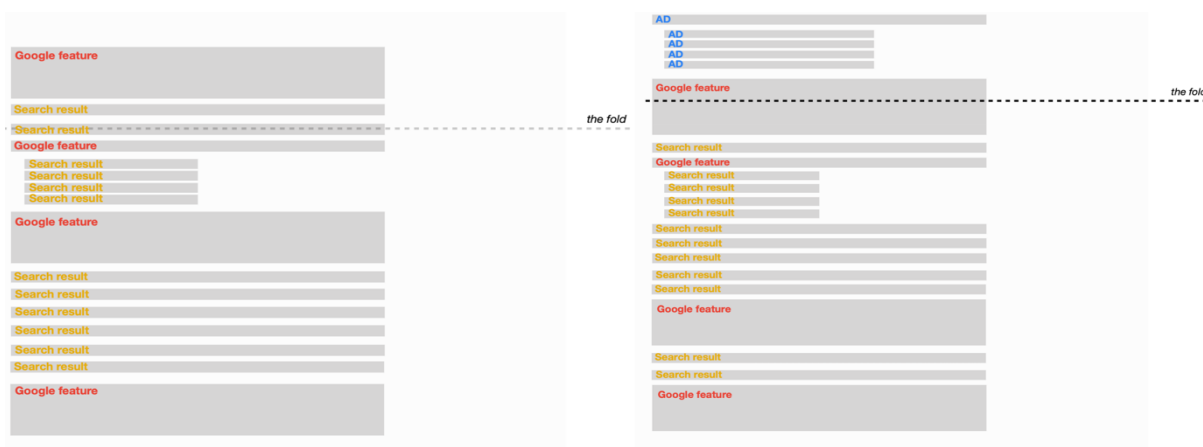


Figure 2. Results of IT1 (left) and IT2 (right)

The types of sources were assigned to one of the following categories of source types: industry – any company and business-oriented enterprise which either sells software (e.g. Google AI), AI solutions (e.g. SAS), or offers high-level online courses in machine learning and AI (e.g. MIT); government - the governmental representatives (the White House), official institutions affiliated with the national government or EU parliament (Italian Agenda for Digitalization); dictionary – sources which provide definitions (Wikipedia, Britannica, Google’s ‘definition’ was also considered as such); NGOs (any non-governmental organization, also non-for profit organizations such as ANSA); other (sources which did not qualify for any of the previous categories, such as websites with unclear ownership, e.g. intelifenzaartificiale.it) (see Fig. 3 and Fig. 4).

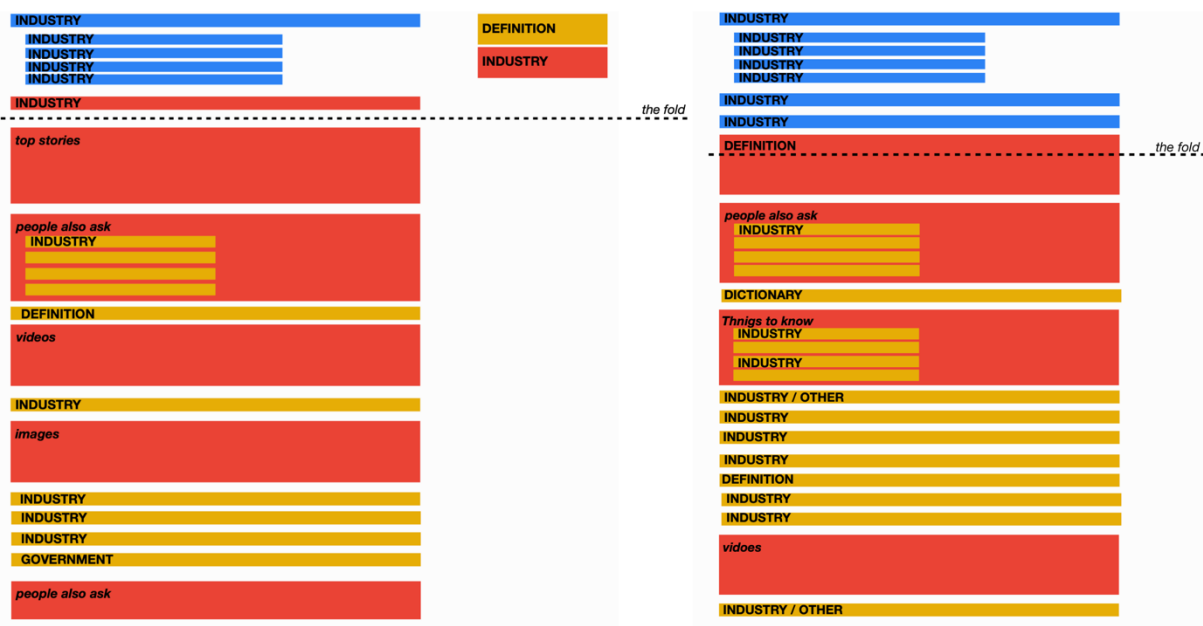


Figure 3. Results of US1 (left) and US2 (right)

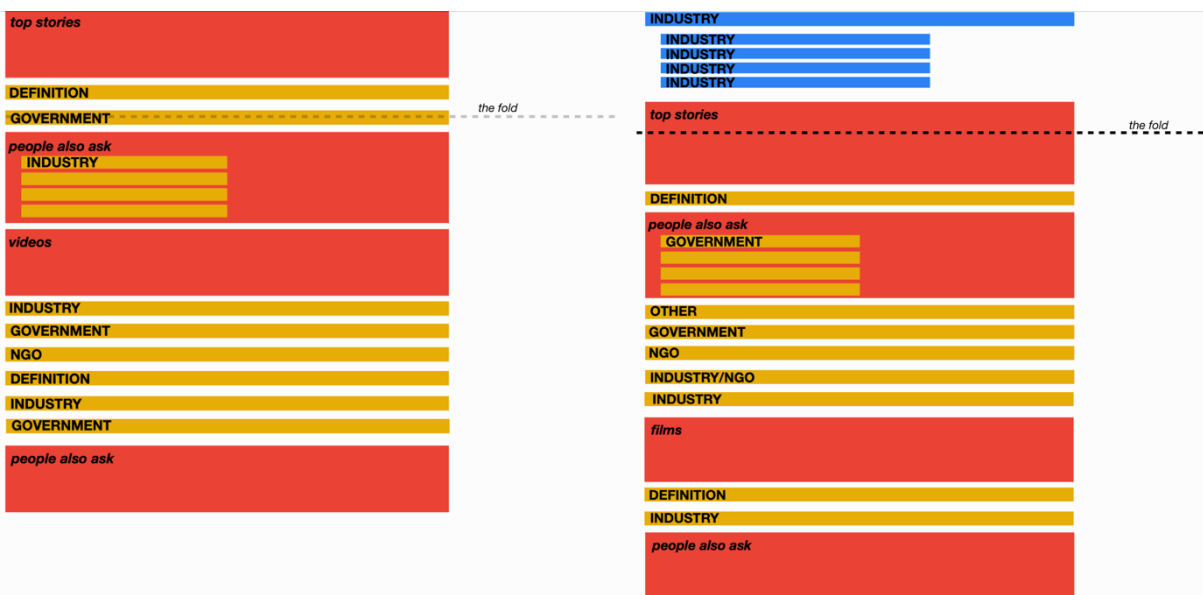


Figure 4. Results of IT1 (left) and IT2 (right)

There are several obstacles in analyzing SERP results in an algorithmic auditing setting. The search results on Google are intrinsically unstable due to continuous readjustment of the recommending system for specific users (Gillespie, 2014, p. 178). Additionally, users tend to see different results due to the filter bubble effect without an awareness of the invisible editing of Google's recommendation and ranking algorithms (Rogers 2022, 12). It is often impossible to know how and why results change over time in Google (Umoja Noble, 2018, p. 4, p. 16), leading to the limitation of the research to be representative of singular capture of constantly shifting and changing search results.

The queries performed resulted in four captures of the first page of Google results, one webpage capture per each query. As illustrated in all figures, the number and types of results which occupy the space 'above the fold' differ in each of the captures, depending on the layout for specific query, in specific location and, and one might assume, specific time. In cases US1, US2, and IT4 sponsored content is shown first (above the fold), followed by Google Features and organic search results. Notably, due to the specific layout, the number of total results for Italian queries is lower than in the US queries (US1: 17; US2: 18; IT1:16; IT2: 17). The number of organic results and their hierarchy also differs across the pages analyzed, depending on the layout of the page (see in particular fig. 1 and fig. 2).

As illustrated in fig.1 and fig. 2, the content related to Google Features (not the organic search results) is similarly present in each case, both above and under the fold. A particular case of Google pushing forward its own content is visible in US1, where Google AI (a branch of Google) appears in two search results, both situated above the fold. It is also in the case of the US query (US2) that aside from the 'standard' Google Features such as *people also ask*, a unique Google Feature appears, titled "Things to know." Given the relevance of certain results within Google Features, some of them were considered while analyzing types of sources (see fig. 3 and fig. 4).

Despite the fact that the organic search results in Italy (IT1 and IT2) were fewer than in the US, the resonance of diversity of types of sources, particularly governmental ones, is particularly resounding (see fig. 3 and fig. 4). On the contrary, in the US context search results (US1 and US2), 'industry' sources prevail (see fig. 5).

## Discussion

The fact that sponsored content takes the most prominent place in the results reflects that, first and foremost, Google is an example of an "advertising platform" (Srnicek, 2017, p. 49). Google is not an information company, but an advertisement company, biased towards its own properties and sponsored content (Rogers 2022, 26). As Umoja Noble phrased it, "Google creates advertising algorithms, not information algorithms" (2018, p. 38). Following this argument, one has to consider that the 'credibility' of information provided by Google's hierarchy of results can reflect advertising interests, or "an intersection of popular and commercial interests" (ibid., p. 36). Therefore, in each four cases analyzed, a significant presence of sources coming from

the ‘industry’ is not that surprising.

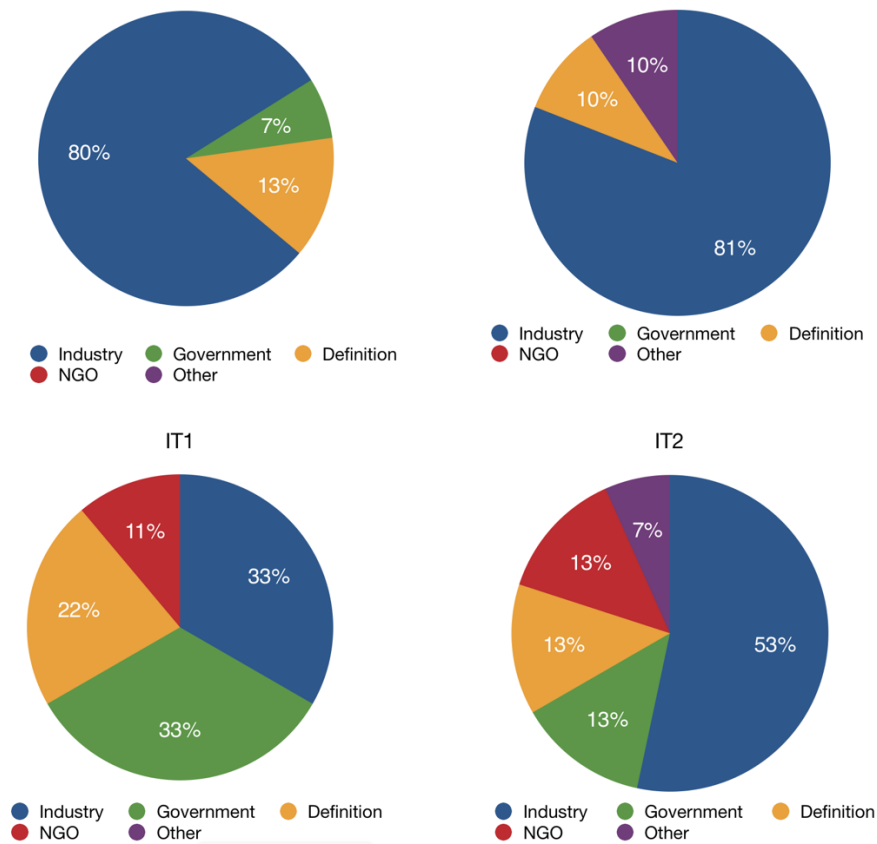


Figure 5. Percentage of source types per query

While AI imaginaries have been influenced by myths perpetuated by science fiction (Bareis & Katzenbach, 2022, p. 857), this is hardly reflected in Google results. Yet if one assumes that contemporary myths are mostly generated by science and technology (Bory & Bory, 2015, p. 67), then the significant number of ‘industry’ sources, prominent in the US context, adds to the imaginary of AI being mystified, highly complex, and incomprehensible for laymen. ‘Industry’ sources also tend to reflect a rather overly optimistic approach to AI developments, shared by people in the field (Sartori & Bocca, 2022), focused on advantages and the unlimited potential that AI can unleash particularly for businesses. The high presence of ‘industry’ actors also reflects a more ideological phenomenon, that of global corporate presence – out of which, that of Google is the most prominent –in pushing utopian visions of digital technologies (Mager and Katzenbach, 2021, p. 227).

This analysis of Google search results on AI in the US and Italy has proven something quite different, namely that the type of sources and the form of sources differ significantly across borders. In fact, these differences reflect the political imaginaries of AI that the US and Italy (which tends to follow the general EU narrative) have been propagating for years. In their analysis of political approaches to AI imaginaries, Bareis & Katzenbach discovered that countries such as Germany and France tend to promote AI imagines “along ethical lines” focusing on “humanist ethos,” security, and risk assessment (2022, p. 871-872). The US approach, as they

argue, is the contrary; both under Trump's and Biden's administration, AI is presented as a tool of "empowerment of the American worker, strengthening local industry, or fostering a deregulating free-market approach" which depends on "the competitive economic strength of a proud nation building" (ibid., p. 872-873). Hence, the global discourse of creating a nation-specific AI imaginary (ibid., p. 856), can be said to be reflected in the asymmetry between 'industry' actors and 'government' actors in the search results of Google.

Mager and Katzenbach point out that today, "the circulation of imaginaries is often not motivated and propagated by state actors and their interests, but by commercial actors' assumptions about technology that directly shape the design of their products" (2021, p. 227). In terms of constructing AI imaginaries worldwide, as noticed also recently by Bareis & Katzenbach, the primary actors are "business actors [who] feature much more often in AI reporting than other stakeholders" (Bareis & Katzenbach, 2022, p. 857). Google seems to be reflecting that trend. Avis argues that the imaginaries which surround the 4<sup>th</sup> Industrial Revolution, which is driven by AI development and implementation, consist of a range of tensions and contradictions across regions which are nonetheless united by the overarching dominance of the capital (Avis, 2018, p. 342). One wonders whether Google's search results reflect a greater shift between the US and EU AI imaginaries, thus perpetuating the political hegemony, or whether in both cases the most prominent actors (industry in the US, government and NGOs in EU/Italy) are using SEO, and, by constructing 'credible' websites, dominate in SERP.

"All knowledge is a condensed node in an agonistic power field," stated Donna Haraway (1988, p. 577), and all 'knowledge' of Google is no different. Ultimately, knowledge is related to power relations, and AI imaginaries are intrinsic to socio-political realms in which they emerge. As Umoja Noble argues, "we must ask when we find these kinds of results, Is this the best information? For whom? We must ask ourselves who the intended audience is for a variety of things we find" (2018, p. 5). The way Google and other algorithm-driven systems categorize and configure knowledge can influence users' perception – and, as we might add, their imaginaries – of the reality beyond the digital. As Garzonio (2022, p. 161). rightfully notices while referring to the Google results,

a complex, automatic, profit-driven mechanism drew a line between what we could easily find and access and what was to remain silent. Again, this represents an exercise of power, both in terms of control over the availability and concrete accessibility of knowledge and in terms of influence on the meaning we subsequently construct over that same knowledge.

The search queries conducted in the US and Italy reveal that depending on geographic location, Google's search algorithms 'give' power to specific actors to shape the imaginaries of what AI is. It has been noticed that 'hyped' AI imaginary is spread by both companies and governments (Kazansky & Milan, 2021, p. 374). Operating between 'government' actors and 'industry' actors, Google does not dispel any "counter-imaginaries" of AI in the first page of its SERP, rendering civic counter-imaginaries of AI (Kazansky & Milan, 2021, p. 364) invisible for laymen. Instead, users, particularly in the US, are being delivered a 'hyped' industry-driven AI imaginary rather than a survey of actual socioecological AI issues and their possible consequences. Yet with a few algorithmic tweaks, the two different AI imaginaries that surfaced from the study discussed here, could be



switched or changed completely, without users noticing. Or, the diversity that's more apparent in the Italian context could be replaced with a single answer to the question posed by a pop-up Google Feature "what is AI." One could argue that such consolidation of 'knowledge,' or "transforming the web from a browsing and surfing space to a single Q&A" (Rogers 2022, 23), is what Google seems to strive for.

## Conclusion

This study focused on differences in Google search results which appear in the SERP for queries on AI in the US and Italy. As Google remains the dominant gatekeeper of information online, it influences the imaginaries that people construct on such topics as AI. As part of its questionable objectivity and invisible logics of sorting information, Google's search results should not be taken as 'objective,' even in terms of queries which relate to topics that are not, seemingly, controversial, such as general knowledge of what AI is. In the spirit of sponsored content, one can state that Google's search results reflect both Google's interests and the interests of its most infomercial stakeholders; in case of AI, the industry (in the US context) and the government (in the context of Italy). Google's search results are in principle a survey of "the wisdom of the crowds" and "certified authorities" (Gillespie, 2014, p. 187). However, most users are not aware that they are only given a 'slice' of the content, or a different slice compared to what they could stumble upon if they searched from a different geographical location. Google's complete lack of transparency clashes with Google's strategy to appear 'objective' (Umoja Noble, 2018, p. 45). Google's monopoly on information is exercised upon billions of users across the globe in their daily searches.

While the US and the Italy (EU) results are different, and so are the sociotechnical imaginaries that emerge locally, some of the crucial differences and similarities that a layman user can perceive are well reflected in the localized Google search. Despite significant differences, queries performed in both contexts of the US and Italy are similar in that they exclude for the debate any perspectives, NGOs, or companies from the Global South. Instead, they show a certain transnational cooperation among corporations and localized results of NGOs or government specific actors. Given the small sample of this study, follow-up research could expand the scope on by focusing on different countries, and collecting a larger and more diverse data sample. One also has to note that this study was conducted before the release of OpenAI's ChatGPT, which significantly influenced the public debate around AI technologies and caused both a hype and panic globally, which had surely influenced (in both positive and negative ways) the public imaginary of AI.

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## The Effects of Using QAR Strategy on ESL Young Learners' Reading Comprehension of Narrative Text

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**Abstract:** Nowadays, Malaysian ESL students struggle to read English texts, particularly narrative texts. Lacking in utilising and applying the suitable reading strategies are among factors that hinder reading comprehension. This study aimed to investigate the effectiveness of Question-Answer Relationship (QAR) strategy on ESL pupils' narrative reading and to find out their perceptions toward QAR strategy in narrative reading. This study employed a non-equivalent pre-test and post-test quasi-experimental design. A total of 72 pupils from a government primary Chinese vernacular school were chosen as participants for this study and data were collected using a multiple-choice reading test and a questionnaire. The findings indicated that QAR strategy to teach narrative reading significantly improved the pupils' narrative reading comprehension achievement. Therefore, the result of this study is expected to contribute something for the development of the process of English teaching and learning especially for the teaching of reading comprehension of narrative text.

**Keywords:** Reading, QAR strategy, narrative text, ESL young learners, comprehension

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### Introduction

English is the compulsory second language for all Malaysian pupils in the primary and secondary levels in the Malaysian education system. The primary education curriculum in Malaysia aims to equip pupils with fundamental language skills that will enable them to communicate effectively in a variety of contexts conducive to their development. As reported by AD-Heisat, Mohammed, Sharmella and Issa (2019), in the primary school

English curriculum, the teaching of reading strategies was not mentioned, and the reading skills to be taught are word attack skills and reading for main ideas. It was also found that although primary school teachers know reading strategies, these are seldom applied in the teaching of reading. Reading strategies should be exposed to pupils to facilitate them in improving their reading comprehension and be critical in their reading.

Comprehension has become a critical component of reading in the vast literatures of reading research, both in terms of instruction and assessment (Adams, 2019). It reaffirms the notion that the purpose of reading is to comprehend information contained in texts, a process that involves interaction between the reader, the text, and the context. Good readers are deeply involved in those processes, constantly monitor and evaluate what they read, and make use of what they read in their daily lives. As a result, instructing students to become proficient readers is a difficult and time-consuming task that necessitates specific comprehension instructions (Block, Gambrell & Pressley, 2002).

As a result of the preceding definition, there are numerous difficulties encountered while learning English in school, one of which is answering some questions about reading texts. Many students spend an inordinate amount of time answering comprehension questions. They frequently read all the texts in order to answer one question, then return to the same text to answer subsequent questions. As a result, many students run out of time and are unable to complete the test optimally. Additionally, many students struggle to master the reading language skill. They are typically passive learners, unable to use their literal knowledge to express their ideas or opinions in discussions about text-related issues or to use their higher-level thinking to comprehend the text. They are often afraid to ask questions about material they do not understand during the teaching learning process, and they lack a firm grasp on the elements or aspects of reading they should master.

Unfortunately, some English teachers continue to teach reading in a traditional manner in class, which usually results in pupils becoming bored and having difficulty comprehending the materials due to the method's monotony. As a result, the teacher should devise another method, technique, or strategy for resolving this issue. Thus, the teacher can employ an appropriate strategy to ensure the efficacy of English instruction in order to boost students' achievement. Numerous strategies are used in the classroom to teach reading; one of them is the Question Answer Relationship (QAR) strategy. The teacher can incorporate this strategy into the teaching process, particularly when it comes to reading.

The QAR strategy is intended to facilitate a deliberate and common way of thinking and speaking about effective sources of information when answering questions. QAR is a comprehension-improving strategy used during reading. This strategy teaches pupils that not all questions are the same and that understanding the different types of questions will assist them in answering the questions presented in this strategy. This strategy establishes a three-way relationship between questions, text content, and reader knowledge (Raphael, 1986).

QARs provide a reasonable starting point for addressing the barriers that prevent all students from attaining high levels of literacy. QAR enables students to think critically about the text they are reading and beyond it. Hence,

this study aims to investigate the use of Question-Answer Relationship (QAR) as a strategy in teaching reading comprehension to ESL pupils . Specifically, it looks at;

- a. To what extent is the effectiveness of Question Answer and Relationship (QAR) strategy on ESL pupils' reading of narrative text?
- b. What are ESL pupils' perceptions toward Question-Answer Relationship (QAR) strategy in reading of narrative text?

## Literature Review

### Reading Comprehension

Reading comprehension was influenced by a variety of factors, including the type of reading, the reader's characteristics, and the reading technique used. At the elementary stage, there was a lot of evidence that reading fluency has a major effect on reading comprehension (Liao, 2015). Once pupils enter middle school, however, fluency was no longer considered a major factor in comprehension. Other variables should be weighed instead. Recent research also supports the teaching of cognitive techniques to enhance reading comprehension ability (Casteel, Isom, & Jordan, 2010). Proficient readers use a variety of techniques to enhance their comprehension of a text (Casteel et al., 2010). Motivation was a reader trait that can be related to reading comprehension (Liao, 2015). It can influence pupils' reading comprehension in a variety of ways. It has been hypothesised that pupils who were more curious or interested in reading have higher levels of reading participation, implying that intrinsic motivation plays a role. Another possibility was that pupils with higher self-efficacy were more likely to put in more effort in attempting to decipher the significance of a letter. It was likely to result in improved reading comprehension.

The text and its context awareness were the two key sources of information in the QAR system. Children were clearly taught that not all answers can be found in the text using this technique. Many inexperienced readers were unaware of this and will profit from such guidance. These two basic classifications, "in the book" and "in my mind" can be further divided into four groups. "Right there" questions and "think and check" questions fall under "in the book" category. The questions right there were very literal, allowing pupils to define textually explicit details including definitions and evidence. They were easily found in the text, so readers just have to deal with small quantities of text to respond to such queries. Readers were asked to summarise, clarify, compare and contrast details, and describe cause and effect relationships in response to think and search questions. Readers must be able to combine and interpret data. They must discuss the whole text when they perform these tasks (Raphael & Au, 2015).

A good teaching method was needed to enhance pupils' reading comprehension because it teaches or assists pupils in resolving difficulties they encounter when reading the text. For instance, how to locate the main idea, the subject, the fact, and the opinion. Reading comprehension may be influenced by a successful or appropriate teaching method in order for pupils to better understand and comprehend the text.

Subdivide text into unnumbered sections, using short, meaningful sub-headings. Please do not use numbered headings. Please limit heading use to three levels. Please use 12-point bold for first-level headings, 10-point bold for second-level headings, and 10-point italics for third-level headings with an initial capital letter for any proper nouns. Leave one blank line (1.5 times spaced) before and after each heading. (Exception: no blank line between consecutive headings.) Please margin all headings to the left.

## **QAR Strategy**

QAR was a reading comprehension technique designed to help pupils understand the ways they can view reading narrative texts and answering questions. It also displays the ways to decipher the kinds of questions they were questioned and clues to look for the solutions (Raphael & Au 2015). Tompkins (2010) elaborates that the Question, Response, and Relationship (QAR) Strategy consists of three steps, namely predicting, clarifying, and questioning. The ability to predict the subject of what was being read was known as prediction. It means that pupils can link their background knowledge to new information about the text or problem. Furthermore, pupils may anticipate or hypothesise what the author will address next in the document. The ability to explain the difficulties encountered when reading the document was known as clarifying. For example, if pupils were confronted with unfamiliar terminology, a muddled reference, or other issues, they can try rereading or requesting classification. The ability to ask a question that was related to the text was known as questioning. It asks pupils to find new knowledge in the form of a question and then self-test to show that they can answer it. The Question-Answer-Relationship (QAR) strategy engages students in the process of questioning and demonstrates to them that a variety of resources were available to assist them in answering questions (Jones & Leahy, 2006). QAR does not classify questions in isolation; rather, it considers both the reader's prior knowledge and the text. This method reflects the prevalent view of reading as an immersive activity influenced by the text, the reader, and the context.

## **Methodology**

### **Research design**

The study employed a non-equivalent pretest-posttest quasi-experimental design. There were two groups in this study: an experimental group that received treatment via the QAR strategy and a control group that did not receive treatment. A pre-test was administered to both groups. Only the experimental group received treatment. There were a few steps in putting the QAR strategy into action. The teacher described narrative text, including its general structure and characteristics. The teacher clarified each form of query in order to introduce the idea of QAR. A class was divided into five groups by the teacher. The teacher assigned a short text for the pupils to read. They recited a text about a story. Teacher guided the pupils to answer each question form. Teacher continued this exercise with the pupils, increasing the number of questions of each form. The teacher instructed the pupils to read a longer passage and create a series of questions for their peers to find and answer. The

teacher enquired about the pupils' difficulties in teaching and learning. The materials were completed by the teacher and the pupils.

### Participants

The population was the ESL pupils at a government primary Chinese vernacular school which consists of 126 pupils in total. Due to the homogeneity of the population, cluster random sampling was used in this study. The sample was drawn at random from two classes out of four, with 36 pupils in 4A and 36 pupils in 4B. Then, using coins as random assumptions, class 4A was created as the experimental group using the QAR method, and 4B was created as the control group using conventional techniques.

### Reading Test

Pupils were tested using multiple choice reading tests in the pre- and post-tests for the experimental and control groups. The total number of questions was 25 items. The texts were taken from a children's book and an internet script. The questionnaire scale is based on the Likert scale technique and was adapted from Peng, Hoon, Khoo, and Joseph (2017). Scoring was a term that referred to the outcome of a test or examination, which was typically expressed numerically. The score categorized as presented in Table 1 below.

Table 1: The Classification of Pupils' Score

The Range of Score	Classification	Score
80-100	Excellent	A
65-79	Good	B
50-64	Fair	C
40-49	Poor	D
<40	Fail	E

(Source: School Administration of a government Chinese vernacular primary school in year 2021)

### Results

#### The effectiveness of QAR strategy on ESL young learners' reading of narrative text

Data from pre and post-tests in the forms of reading comprehension questions were analysed to investigate the effectiveness of QAR strategy on ESL pupils' reading comprehension of narrative text. The data were obtained from both control and experimental group.

According to Table 2, majority of the pupils' reading scores from both groups fall under fair to excellent categories. Only one third of the participants in below average or poor to fair categories. This somewhat indicates that the participants from both groups were similar in terms of their reading comprehension skills.



Table 2. Classification of reading comprehension categories pupils' pre-test scores

The Range of Score	Number of Pupils (Control Group)	Percentage	Number of Pupils (Experimental Group)	Percentage	Reading Comprehension Categories
80-100	0	0%	2	5.6%	Excellent
65-79	4	11.1%	7	19.4%	Good
50-64	15	41.7%	16	44.4%	Fair
40-49	13	36.1%	9	25.0%	Poor
< 40	4	11.1%	2	5.6%	Fail
Total	36	100%	36	5.6%	

Table 3. Classification of reading comprehension categories pupils' post-test scores

The Range of Score	Number of Pupils (control group)	Percentage	Number of Pupils (experiment group)	Percentage	Reading Comprehension Categories
80-100	2	5.6%	12	33.3%	Excellent
65-79	9	25.0%	12	33.3%	Good
50-64	17	47.2%	11	30.6%	Fair
40-49	6	16.7%	1	2.8%	Poor
< 40	2	5.6%	0	0%	Fail
Total	36	100%	36	100%	

Based on Table 3, it was found that pupils in experimental group show an increase in their reading scores as the number of participants in fair to excellent categories escalated. Additionally, only one pupil in experimental group was in poor category as compared to reading scores in pre-test. The results also illustrate that the pupils' in experimental group performed better in post-test as compared to pupils from control group.

Table 4. Analysis of pupils' reading scores in experimental group

QAR Strategy	Paired Sample T-Test		
	T	Df	Sig. (2-tailed)
	4.294	35	0.000

The results in Table 4 further validate that there was a significant difference of reading scores in pre and post-tests among pupils in the experimental group. This implies that the pupils in the experimental group performed significantly better in their post-tests.

Table 5. Analysis of Pupils' Post-test Scores in Control and Experimental Group

QAR Strategy	Independent Sample T-Test		
	T	Df	Sig. (2-tailed)
	4.121	70	0.000

Table 5 demonstrates results derived from post-tests scores of both groups. The findings implied that there was a significant improvement in learners' narrative reading comprehension scores taught using the QAR

technique compared to those who were not.

### Pupils' perception toward QAR strategy for reading of narrative text

A questionnaire consisted of 10 items was administered to participants in experimental group after post-test had been conducted. Through the questionnaires, the researcher asked the pupils' opinion whether they became better at reading comprehension after learning by using QAR strategy Table 6 shows the results of each item.

Table 6. Questionnaire on pupils' perception toward QAR

No.	Item	Response				
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I know how to use the Question-Answer Relationships (QAR) strategy to answer	35 (97.2%)	1 (2.8%)			
2.	I was good at answering comprehension questions before learning the QAR strategy.	27 (75.0%)	5 (13.9%)	4 (11.1%)		
3.	I became better at answering comprehension questions after learning the QAR strategy.			1 (2.8%)	3 (8.3%)	32 (88.9%)
4.	I feel confident answering comprehension questions after learning the Question-Answer Relationships (QAR) strategy.			2 (5.6%)	3 (8.3%)	31 (86.1%)
5.	I find the Question-Answer Relationships (QAR) strategy for answering comprehension questions helpful.				3 (8.3%)	33 (91.7%)
6.	I will continue to use the Question-Answer Relationships (QAR) strategy when answering comprehension questions.			2 (5.6%)	4 (11.1%)	30 (83.3%)
7.	I will recommend the Question-Answer Relationships (QAR) strategy to other students.			1 (2.8%)	6 (16.7%)	29 (80.6%)

The questionnaires consist of ten questions provided in English language. It is used to get more information about pupils' perception toward QAR strategy for reading comprehension of narrative text. All the pupils were not familiar with QAR strategy before the treatment was given. 35 pupils (97.2%) strongly disagree with the statement while a pupil (2.8%) disagree with the statement. The data also signifies those 27 pupils (75%) strongly disagree that their ability in reading comprehension was good before learning QAR strategy. 32 pupils (88.9%) strongly agree that their comprehension becomes better after learning by QAR strategy. There are three pupils (8.3%) and one pupil (2.8%) who agree and neutral to the statement respectively. The data proves that 31 pupils (86.1%) strongly agree that they are confident at reading comprehension after learning QAR strategy. 3 pupils (8.3%) agree that they felt confident at reading comprehension. Yet, there are 2 pupils (5.6%) consider that they still do not feel confident. I assume those pupils rarely got involved at reading comprehension.

However, almost all the pupils (94.4%) gave positive responses toward QAR strategy.

33 pupils (91.7%) strongly agree that QAR strategy is very helpful. Moreover, there are 3 pupils (8.3%) confirms that they agree with the statement. Then, no one of the pupils agree with the question statement. it can be seen obviously that 30 pupils (83.3%) and 4 pupils (11.1%) agree that they will continue to use QAR strategy. 2 pupils (5.6%) are neutral to the statement. Thus, none of the pupils gave negative responses regarding the statement. Lastly, 29 pupils (80.6%) strongly agree that they will recommend the QAR strategy to other pupils. 6 pupils (16.7%) agree the statement. However, there is a pupil (2.8%) who was neutral to recommend the QAR strategy to other pupils.

## Discussion

According to the findings described previously, there was a significant improvement in pupils' pre- and post-test scores in the experimental group taught using the QAR strategy and there was a significant difference in pupils' post-test scores between the control and experimental groups. The findings indicated that the QAR strategy may be an effective method for teaching narrative reading comprehension. This finding is consistent with the findings of Murtado (2019) and Wahyuni (2018), who discovered a significant difference in pupils' reading comprehension ability after they were taught using the QAR strategy.

The experimental group's narrative reading achievement increased after they were taught the QAR strategy. Additionally, pupils' narrative reading achievement also improved in the control group, but not as significantly as in the experimental group. Meanwhile, the independent sample t-test revealed a significant difference in the post-test scores of pupils in the experimental groups who were taught using the QAR strategy and the control group who were taught using the strategy used by the school teacher. This finding was consistent with numerous studies, including those conducted by Sari (2012), who discovered that the QAR strategy aided pupils' reading comprehension achievement in narrative text, and Iqbal (2013), who discovered that the QAR strategy aided pupils' reading comprehension achievement in narrative text.

According to Guzzardo (2005), QAR strategy can motivate students to use their prior knowledge to acquire information. Furthermor, Iqbal (2013) posited that the QAR strategy was effective for teaching reading because it increased pupils' enjoyment and participation in class, which resulted in an increase in reading comprehension. As a result, this strategy is effective at assisting pupils in reading comprehension by allowing them to make inferences based on their existing and prior knowledge.

Based on the questionnaires, most pupils agree or strongly agree that they improved their reading comprehension after learning the QAR strategy. This finding is consistent with previous research (Seng, 2009; Alzu'bi, 2019; Ys et al., 2018) indicating that the strategy is effective at assisting students with their reading. It can be concluded that all students agree that the QAR strategy improves their reading comprehension ability.

According to the questionnaire analysis, most pupils agree that the QAR strategy is extremely beneficial and that they will continue to use it in reading comprehension. Additionally, the QAR strategy instilled confidence in the pupils' reading comprehension abilities.

Given the positive response from students regarding the use of the QAR strategy, it can be concluded that students are eager and receptive to being exposed to strategies that will help them become more critical and reflective readers. This study focused on pupils' attitudes toward using the QAR strategy in their reading comprehension because their attitudes were critical in educating teachers about the strategy's benefits and drawbacks. The study's findings may assist teachers in developing instructional strategies that further enhance students' learning processes. Additionally, the findings could be used to develop more comprehensive and appropriate approaches that are more suited to the current learning environment.

Finally, after examining all the test and questionnaire results, it can be concluded that incorporating the QAR strategy into reading comprehension instruction improves the ability of young learners in a government primary school. It was concluded that the QAR strategy's implementation resulted in a significant improvement and difference in pupils' narrative reading comprehension at the school. The QAR strategy successfully motivated students to learn narrative reading comprehension and sparked their interest and engagement in English learning. It could be assumed that the QAR strategy is effective at teaching pupils reading comprehension.

A positive outcome from implementing the QAR strategy suggests that it may have a beneficial effect on pupils' English reading abilities. Pupils who received strategy instruction used a broader variety of strategies. The use of the QAR strategy resulted in more efficient reading, which aided pupils in improving various aspects of their English reading abilities. This indicates that the use of the QAR strategy influences pupils' academic reading success. It is therefore critical for English teachers to instil a sense of value in their students regarding the importance of reading strategies. However, as the pupils observed, additional reading practise both inside and outside the classroom is necessary if pupils are to improve their reading effectively and develop into highly successful or skilled readers. Pupils must take an active role in developing their abilities.

The experimental group's positive results suggest that the QAR strategy used in this study may be successfully applied in other teaching contexts. To ascertain whether this is the case, English teachers may apply the research methodology used in this study to other subgroups of English major students – for example, students with a higher level of language proficiency. The obtained results can be compared to those obtained for lower-level groups of English major students. This will demonstrate whether the QAR strategy has an effect on or improves the reading performance of groups of pupils with varying levels of proficiency. This demonstrates an adequate preparation for pupils entering higher education or reading in the real world.

The authors of materials should consider which strategies might benefit pupils in terms of academic reading and reading in everyday life, as well as how and in what contexts a particular strategy is best applied. Teachers should be guided in order to make the most effective use of the reading activities provided. This means that strategies can be used effectively and appropriately in a wide variety of reading situations and contexts. A

meaningful reading course supplemented by the QAR strategy should result in increased reading comprehension success for students. Given that the QAR strategy employed in the study appears to have been effective in encouraging participants to employ a broader range of strategies and to improve certain aspects of their English reading abilities, additional research could be conducted to examine variations on the QAR strategy in other contexts.

## Conclusion

The Question Answer Relationship (QAR) Strategy is fairly successful on students' reading comprehension of explanation material, according to the research findings. The experimental group's positive results suggest that the QAR technique utilised in this study could be successfully adapted to other instructional environments. English teachers, particularly those in secondary schools, can use the QAR strategy as an alternative strategy for enhancing pupils' narrative reading achievement and the teaching and learning process. The QAR strategy suggests that pupils should learn to read more interestingly and attractively, not just narrative texts, but also other types of texts, as the QAR strategy can be applied to a variety of types of texts. This research can serve as a theoretical foundation for future researchers who wish to conduct similar studies using a variety of variables and conditions and concentrating on aspects of reading comprehension.

By incorporating various techniques, such as the QAR strategy, into their English instruction, teachers can assist students in developing their ability to learn English skills, particularly reading. The QAR strategy can be used to pique pupils' interest and involvement in reading descriptive text, ensuring that they are not bored while learning to read in English. Pupils must understand that learning English is not a one-way street. To accomplish the learning objective, pupils should participate in the classroom activity designed by the teacher. By participating in the activity, pupils can also improve their English proficiency and social skills. Proficiency is not solely the responsibility of the teacher; it is also contingent upon the pupils' active participation in the language learning process.

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## Public-private Partnerships in Energy Projects in Low- and Middle-income Countries and Decarbonization of the Global Economy

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**Abstract:** Decarbonization of the world economy by 2050 is impossible without a significant increase in the energy efficiency of the economies of developing countries. Nowadays, developing countries are transforming and expanding their energy systems, solving the problems of energy poverty of the population, developing energy-intensive industries, which generally leads to an increase in energy consumption on a global scale. With tight budget constraints, developing countries are predominantly using the public-private partnership (PPP) model to finance their energy infrastructure development needs. Therefore, the choice of technologies for implementation in the framework of PPP projects can have a significant impact on changes in the energy efficiency of the country's economy in general. The purpose of this study is to assess the effectiveness of PPP projects in the energy sector in middle- and low-income countries in terms of improving energy efficiency and decreasing carbon intensity. Data Envelopment Analysis methodology is used to evaluate the effectiveness of PPP projects. As inputs, we consider the number of PPP projects in the energy sector implemented on the territory of the country for the period 1990-2016 and their total funding. Changes in a country's energy efficiency and carbon intensity from 1990 to the present are considered as outputs. The CCR model with output orientation is considered. The efficiency scores and projections for each output are calculated.

**Keywords:** energy efficiency, public-private partnership, Data Envelopment Analysis

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### Introduction

Over the last few decades, decarbonization became the one of the most important goals of the development of the world economy. According to International Energy Agency (IEA, 2021), already by 2021 about 110 countries committed their net zero emissions target by 2050 - 2060, including the largest emitters as China and Russia. The beginning of this process was laid back in 1997 by the adoption of the Kyoto Protocol. And, although the ratification of the protocol took place for a long 8 years, in 2005 it nevertheless entered into force. In 2015, the Kyoto Protocol was replaced by the Paris Climate Agreement, which made the goals of decarbonization even more explicit.



However, the current gap between declared goals and reality on emissions is significant. The reason is that achieving the goals of decarbonization requires a transformation of the entire energy system, which, in turn, requires huge investments in the development of new technologies, building a new energy infrastructure and changing patterns of energy consumption (Ratner et al., 2022). International Monetary Fund and IEA estimate total annual energy investment needs for energy transition as USD 5 trillion by 2030 (IEA, 2021). The need to attract such significant investment is a challenge even for advanced economies, and even more so for middle – and low-income countries that are struggling with energy poverty and lack of access to modern ways of consuming energy.

With tight budget constraints, developing countries are predominantly using the public-private partnership (PPP) model to finance their energy infrastructure development needs. PPP is considered in the literature as effective mechanism not only for lessening public sector budget constraints, but also for promoting innovations, increasing technical and technological cooperation, sharing risks (Andrews and Entwistle, 2015; Boyer and Scheller, 2018; Yurdakul and Kamasak, 2020). According to Private Participation in Infrastructure (PPI) database, low- and middle-income countries implemented more than 4300 projects in energy sector for the period from 1990 to 2016 with total investments more than trillion USD. Therefore, the choice of technologies for implementation in the framework of PPP projects can have a significant impact on changes in the energy efficiency of the country's economy in general.

The aim of this study is to evaluate the effectiveness of PPP projects in the energy sector in middle- and low-income countries in terms of improving energy efficiency and decreasing carbon intensity. The study uses the difference in GDP per unit of energy use (constant 2017 PPP \$ per kg of oil equivalent) in year with last available data and in 1990 as a metric for measuring the improvements in energy efficiency (data from World Bank). As a metric for improvements of carbon intensity, the study uses the difference in CO<sub>2</sub> emissions (kg per 2015 US\$ of GDP) in a year with last available data and 1990. The effectiveness of PPP projects in the energy sector is considered as a ratio of invested resources and achieved improvements in energy efficiency and carbon intensity.

The paper uses the Data Envelopment Analysis (DEA) method to measure countries' efficiency in implementation of PPP-projects in energy sector. DEA is used to measure the relative efficiency of Decision Making Units (DMUs) that operate under similar conditions and transform similar resources (inputs) into outputs. The main advantage of this approach is that the modeling of the relationship between inputs and outputs does not require the assignment of weights (Charnes et al., 1978; Banker et al, 1984; Cooper, 2007).

The rest of the paper is organized as follows. Section 2 gives a brief review on existing literature about PPP in energy sector. Section 3 describes the theoretical model of PPP efficiency and DEA model. Since DEA is a data driven-methodology, Section 4 gives some descriptive statistics on data and variables used in the study. Section 5 reports the results, Section 6 concludes.

## Literature review

The theory of PPPs were laid down in the work of Leibenstein (Leibenstein, 1966), who introduced the concept of "X-efficiency" to explain the difference in productivity between public and private firms with intangible "X-factors" such as labor relations, organizational structures, incentive systems and recruitment. PPPs may help governments and public firms to eliminate inefficiencies that arise in their organizational structures. PPPs can increase both the amount of capital for investment in infrastructure and the efficiency of operations through the transfer of knowledge, skills, and experience from the private sector (Ahwireng-Obeng and Mokgohlwa, 2002). Traditionally, PPP is used in many countries for the implementation of infrastructure projects, including in the energy and transport sectors. Given that both of these areas are strongly influenced by global energy transition trends, an increasing number of PPP projects have the ultimate goal of improving energy efficiency, reducing carbon intensity, developing renewable energy, etc. (Song et al., 2021; Xu et al., 2015; Luo et al., 2021; Cedrick and Long, 2017).

To bring a country through energy transition is a difficult task for governments to pursue alone, especially in light of fiscal constraints and other monetary liabilities. Notwithstanding, and especially in developing countries, reforms to improve and extend infrastructure level and quality have a huge effect on economic growth, economy's productivity, energy efficiency, and competitiveness (Guasch, 2004). PPP projects in the field of green energy and energy efficient technologies are often implemented with the participation of large international high-tech companies, financial and insurance institutions (Cedrick and Long, 2017). The diversity of partners is both quantitative and qualitative, which suggests greater openness of PPP projects in the field of renewable energy and energy efficiency to the participation of various stakeholders.

Another feature of PPP projects in the field of green energy and energy efficiency is that, as a rule, new energy technologies have a higher capital intensity than traditional ones, and their practical use is associated with additional risks. Many studies on the energy efficiency gap indicate that the introduction of energy efficient technologies may have a so-called "hidden cost" (Nichols, 1994). This term refers to a situation where engineering and economic investigations do not take into account such costs as the cost of an energy audit, the cost of creating and maintaining an energy management system, the cost of disposing of previously used equipment, the cost of retraining personnel, etc. In such a situation, the widely advertised affordable market prices of energy efficient technologies do not reflect the full cost of their implementation. In addition, in the case of energy efficient technologies, environmental factors such as energy price uncertainty, especially in the short term, have a significant impact on investor expectations and their risk assessment (Lazanyuk et al., 2023). All above-mentioned features make the decision for governments and private firms to engage in PPP project in green energy and energy efficiency very challenging in developing countries (Kamasak et al., 2019). Therefore, some developing countries (for example, China, India, Honduras, South Africa, etc.) take up the implementation of green PPP projects, for example, the construction of power plants on renewable energy sources (Xu et al., 2015), and some prefer more traditional technologies and, as a result, use financial and human

resources less efficiently in terms of achieving climate goals. The issues of the effectiveness of the implementation of PPP projects in the energy sector in this context have not yet been studied in the literature. As Shahbaz with co-authors points out, the empirical evidence that prove the linkage between public-private partnerships and carbon emissions is very limited (Shahbaz et al., 2020). We can mention the study of Lu et al. (Lu et al., 2022), where authors demonstrate that China's economic growth and public-private collaboration lead to increase in the volume of carbon emissions. They come to conclusion that PPP in energy sector must be more efficient to reduce carbon emissions. Another paper, that can be mentioned in this context, is the study of Anwar with co-authors (Anwar et al., 2021), which explores the influence of PPP investment in transport sector, renewable energy consumption, and urbanization on transport-induced carbon emissions in China. To the best of our knowledge, there are no studies on cross-country analysis of the effectiveness of PPPs in the energy sector in the literature.

## Methodology

Data Envelopment Analysis (DEA) methodology are currently being actively developed, covering new areas of management and new classes of management tasks (Emrouznejad and Yang, 2018; Panwar et al., 2022). The ability to assess the comparative efficiency of economic agents, having minimal knowledge about the production functions and technologies they use makes DEA an attractive tool for decision-making. Other important features of DEA are the possibility to choose benchmarks for each inefficient economic agent (or system) and optimize their strategy for achieving efficiency. The ability to use well-developed software (including open access software) for solving DEA problems makes it available tool even for professionals with weak IT skills.

However, basic DEA models used in open-source software have important limitations on the type of input and output values (Wang et al., 2017), for example, basic CCR and BCC models use only non-negative inputs and outputs. In reality, negative output values are possible in the situation when the useful result of the production activity of the economic agent under study is not achieved. Problems of this kind are often happen in practical situation with carbon intensity and energy efficiency: money spent on new energy projects do not necessarily help to achieve the desired goals of reducing emissions. Overcoming the above-mentioned limitations can be done by the procedures for normalizing and shifting the scale in which the performance indicators of the DMUs are measured (Ratner and Zaretskaya, 2020). This study uses the same approach.

Let's consider the number of PPP projects in energy sector and the total sum of investments in energy PPP projects in 1990-2016 as two inputs of each DMU (low and middle income countries). The differences in energy intensity and carbon intensity between the last available year in the sample in 1990 (data from World Bank) are considered as outputs. With such a set of inputs and outputs, DEA CCR model can be formulated as following:

$$\max_{u,v} \sum_{m=1}^M u_m y_{m0} \quad (1)$$

s.t.

$$\sum_{m=1}^M u_m y_{mk} - \sum_{n=1}^N v_n x_{nk} \leq 0 \quad k = 1, 2, \dots, K, \tag{2}$$

$$\sum_{n=1}^N v_n x_{n0} = 1,$$

$$u_m, v_n \geq 0 \quad m = 1, 2, \dots, M \quad n = 1, 2, \dots, N;$$

where

0 – index of DMU under consideration;

X – vector of inputs, dimension N (N=2);

Y – vector of output, dimension M (M=2);

K – number of DMUs

Since some DMUs can have negative inputs, they can be translated by a simple procedure of shifting the scales in which the outputs are measured according to the following formula:

$$z_{i,j} = y_{i,j} + |\min y_{i,j}| + 0,001 \tag{3}$$

The introduced transformation allows avoiding the negative values of the outputs, without corrupting the common logic of the formulation and solution of DEA model.

### Data

The study uses the data on the number of PPP projects in energy sector and the total sum of investments from Private Participation in Infrastructure (PPI) database (<https://ppi.worldbank.org/en/customquery>). This source contains panel data on PPP infrastructure projects in 137 low- and middle-income countries for the period from 1990 to 2016. Top-10 countries by the number of PPP projects in energy sector are presented on figure 1. Top-10 countries by the total sum of investments in PPP projects in energy sector are presented on figure 2.

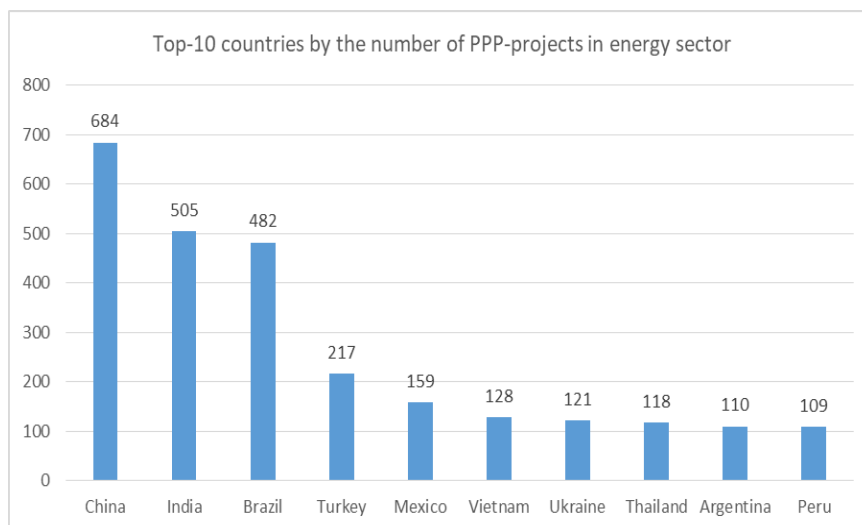


Figure 1. Countries with the biggest number of implemented PPP projects in energy sector

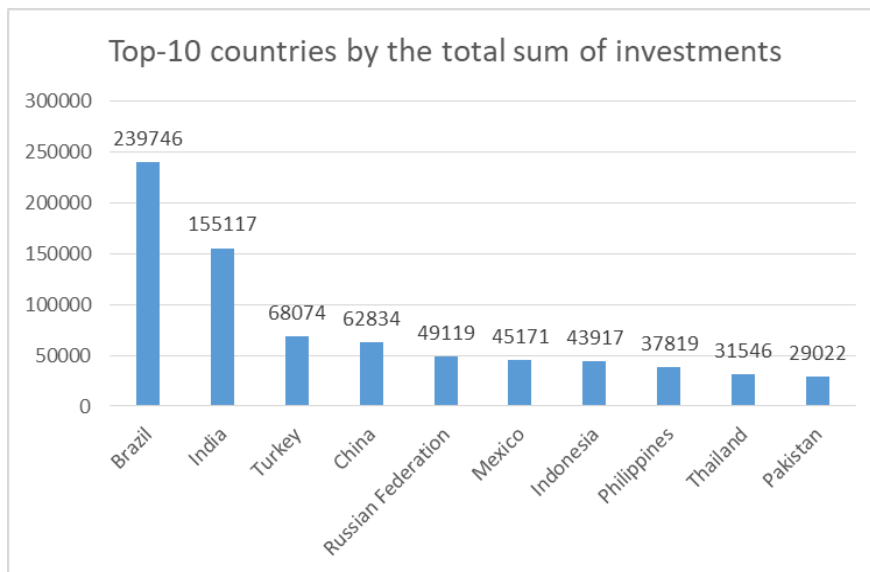


Figure 2. Countries with the largest investments in implementation of PPP projects in energy sector

The data on GDP per unit of energy use (constant 2017 PPP \$ per kg of oil equivalent) and CO2 emissions (kg per 2015 US\$ of GDP) received from World Bank database (<https://data.worldbank.org/indicator>). Since data on specific energy consumption and specific greenhouse gas emissions are not available for all countries, 89 countries remained in the final sample. Top-10 countries by improvements in energy efficiency during 1991-2019 are presented on figure 3.

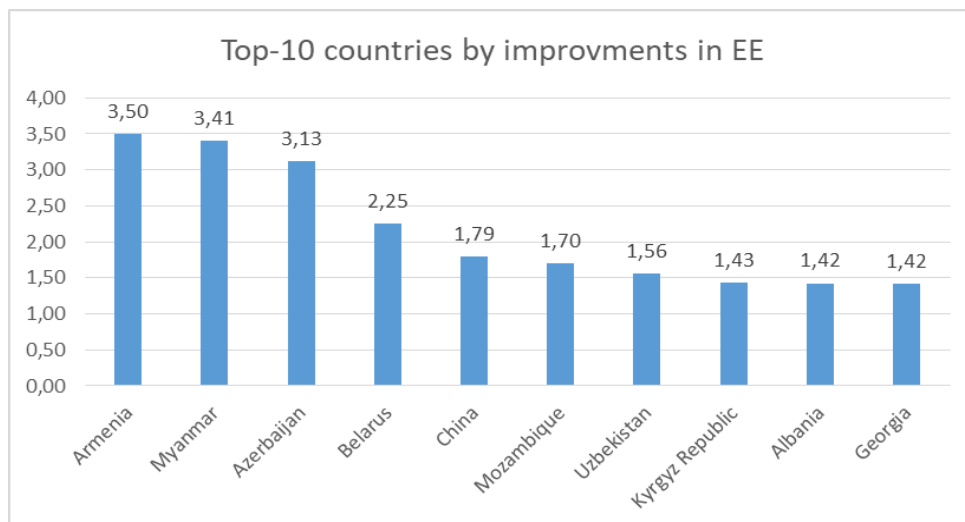


Figure 3. Countries with most notable improvements in energy efficiency in 1991-2019.

There has been no improvement in energy efficiency in countries such as Gabon, Haiti, Congo, Dem. Rep., Côte d'Ivoire, Iran, Islamic Rep., Bhutan, Dominica, Gambia, Togo, Fiji, Guatemala, Bolivia, Thailand, Algeria, Comoros, Zimbabwe, Senegal, Brazil, Malaysia, Costa Rica, Namibia, Tonga, and Kenya.

Top-10 countries by decrease in carbon intensity 1991-2019 are presented on figure 4.

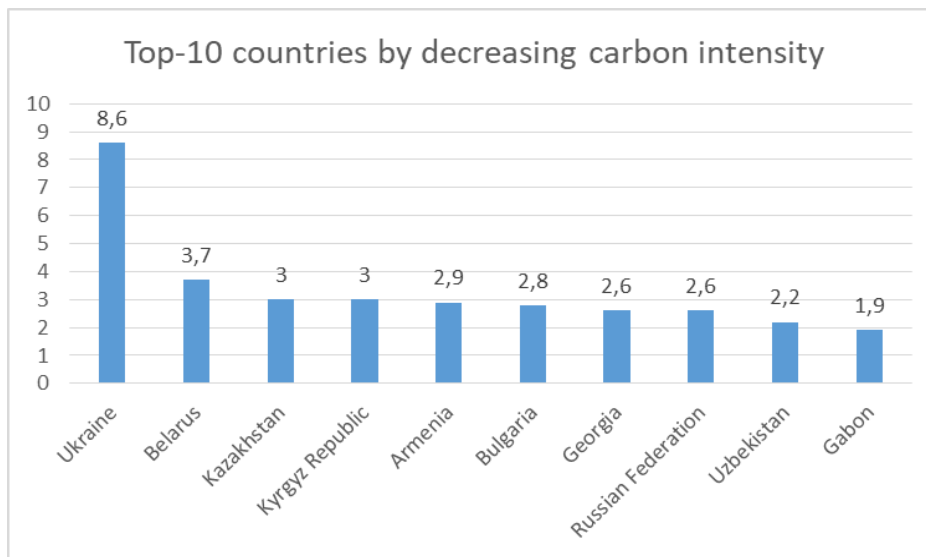


Figure 4. Countries with most notable decrease in carbon intensity in 1991-2019.

On the next step of the study, some more countries were excluded from the sample, because PPP projects were never financed (Comors, Fiji, Gambia, Lesotho, and Timor-Leste). Therefore, the calculations were carried out on a sample of 84 countries. Descriptive statistics of input and output data are given in Table 1.

Table 1. Sample statistics (inputs and outputs)

Variable	Number of projects X1	Total investments X2	Change in EE Y1	Change in CE Y2
Mean	46.81	11969.18	0.44	-0.18
Standard error	11.21	3417.25	0.08	0.18
Median	9	1766	0.26	-0.4
Standard deviation	105.75	32238.34	0.76	1.71
Variance	11184.41	1028976601.93	0.58	2.93
Kurtosis	20.83	32.38	5.56	7.56
Skewness	4.34	5.27	2.11	1.61
Minimum	1	0.0004	-0.61	-4.6
Maximum	684	239746	3.5	8.6
Number	84	84	84	84

## Results

The efficiency scores of 84 countries, calculated by MaxDEA 12.0 software are presented in table 2 and 3. As one can see from table 1, only two countries (Kyrgyz Republic and Tonga) have the highest efficiency score equal 1. Seven countries have an above-average efficiency ratio (greater than 0.5) and another 14 countries have an efficiency ratio in the approximate middle range (from 0.2 to 0.5). This last group includes three post-Soviet countries - Tajikistan, Azerbaijan and Belarus.

Table 2. Countries with high efficiency of PPP projects in energy sector

Most efficient countries	Countries with the score in the upper middle range	Countries with the score in the middle range
Kyrgyz Republic (1)	Belize (0.632)	Bosnia and Herzegovina (0.474)
Tonga (1)	Eswatini (0.592)	Azerbaijan (0.457)
	Dominica (0.590)	Lebanon (0.448)
	SãoTomé and Príncipe (0.566)	Haiti (0.343)
	Uruguay (0.514)	Myanmar (0.326)
	Guyana (0.507)	St. Kitts and Nevis (0.322)
	Botswana (0.501)	Tajikistan (0.274)
		Zimbabwe (0.246)
		Cabo Verde (0.244)
		Belarus (0.233)
		Bhutan (0.224)
		Ethiopia (0.212)
		Congo, Dem. Rep. (0.206)
		Solomon Islands (0.202)

The group of countries with low efficiency ratios is much more representative. Twelve countries can be assigned to a group with a score in the low-middle range (from 0.1 to 0.2). This group includes two European countries (Montenegro and Serbia), two post-Soviet countries (Uzbekistan and Armenia) and, most of all, African countries. The largest group of countries (32 objects) are countries with a low efficiency coefficient, the values of which lie in the range from 0.01 to 0.1 (table 3). This group of countries is very diverse and includes countries from almost all continents.

The group of the least efficient countries in terms of introducing energy efficient and "clean" technologies in the energy sector through the implementation of PPP projects consists of 17 countries, and it includes such large economies as China, Russia, Brazil, India and Indonesia. It is worthy to mention, that all countries of the BRICS group are included in this group. China, India and Brazil have the lowest efficiency scores. The results obtained indicate that, unfortunately, during the implementation of PPP projects in the energy sector for 17 years from 1990 to 2016 in the largest countries with rapidly developing economies, preference was given to the introduction of not the most energy efficient and carbon neutral technologies.

Table 2. Countries with low efficiency of PPP projects in energy sector

Countries with the score in the low-middle range	Countries with low score	Less efficient countries
Uzbekistan (0.152)	North Macedonia (0.090)	Russian Federation (0.009)
Mongolia (0.145)	Iraq (0.088)	Bangladesh (0.008)
Armenia (0.144)	Angola (0.082)	Colombia (0.007)
Namibia (0.141)	Jamaica (0.077)	Pakistan (0.006)
Montenegro (0.128)	Côte d'Ivoire (0.072)	Indonesia (0.006)
Gabon (0.122)	Albania (0.071)	Philippines (0.006)
Algeria (0.116)	Zambia (0.069)	Malaysia (0.006)
Mauritius (0.106)	Cameroon (0.059)	Argentina (0.005)

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Mozambique (0.103)	Ghana (0.057)	South Africa (0.005)
Serbia (0.102)	Ecuador (0.050)	Peru (0.004)
Togo (0.101)	Nigeria (0.049)	Vietnam (0.004)
Tunisia (0.100)	Senegal (0.035)	Mexico (0.003)
	Morocco (0.029)	Thailand (0.003)
	Tanzania (0.028)	Turkiye (0.002)
	Bolivia (0.028)	China (0.002)
	Cambodia (0.027)	India (0.001)
	Georgia (0.027)	Brazil (0.001)
	Costa Rica (0.026)	
	Nicaragua (0.025)	
	Honduras (0.022)	
	Kenya (0.022)	
	Jordan (0.020)	
	Dominican Republic (0.019)	
	El Salvador (0.019)	
	Kazakhstan (0.017)	
	Guatemala (0.017)	
	Nepal (0.017)	
	Iran, Islamic Rep. (0.016)	
	Sri Lanka (0.015)	
	Ukraine (0.014)	
	Egypt, Arab Rep. (0.014)	
	Bulgaria (0.013)	

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Therefore, further planning and implementation of PPP projects in the energy sector should take place more intelligently and with greater regard for climate goals.

## Conclusion

The study showed that in most countries classified by the World Bank as countries with medium and low incomes, the implementation of PPP projects in the energy sector was carried out from 1990-2016, mainly without taking into account the climate agenda. The group of BRICS countries turned out to be the least effective in terms of achieving climate goals through PPP projects in the energy sector. These studies suggest that the policy for the implementation of PPP projects in the energy sector should change significantly in order to increase the efficiency of projects in the context of increasing energy efficiency and decarbonization. Given the fact that, as a rule, large corporate and financial structures (including international ones) take part in the implementation of PPP projects, it is advisable to develop and adopt at the international level a set of criteria that a PPP project must satisfy in order to receive international support. On the other hand, the experience of the most efficient countries should be studied in more detail to identify the best practices for implementing PPPs in the energy sector.



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## Implementation of New Education Policy in India and the Prospects of Transformational Female Leadership in Indian Higher Education

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**Abstract:** Aim: To investigate to what extent the stakeholders believe in females having attributes of transformational leadership to rise at higher positions in institutions of higher education in India while implementing New Education Policy in India. To know where we are right now and where we need to go in terms of promoting female leaders in Indian higher education. Methods: Both qualitative and quantitative methods are used. Qualitative responses from 10 Indian women leaders are collected from those 03 qualitative responses are quoted in the paper and considered in the analysis. MLQ\* tool (Multifactor leadership Questionnaire) used to collect responses of 51 different stakeholders of higher education. Findings: The study shows that female leadership can be trailblazing in organizational management in institutions of Higher Education in India while implementing the New Education Policy. The results anticipate providing insights to initiate Indian policymakers and recruiting bodies to motivate women to take up leadership positions. Originality and Cognitive Value: The area of the prospects of transformational female leadership in Indian higher education in the context of implementation of New Education Policy in India is a novel exploration as education policy is implemented recently in 2020 and gender equity is a major aspect of concern in achieving Sustainable development Goals.

\*Source : Multifactor Leadership Questionnaire by Bernard M. Bass and Bruce J. Avolio (1995)

**Keywords:** Female Leaders, Higher Education, Transformational Leadership, Organizational Management

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### Introduction

*"I am the queen, the gatherer of treasures, established in/as ultimate reality, the primary object of worship. The luminous divine powers have dispersed me in many places, having many abodes, causing me to be all-pervasive.*

*Even eating, seeing, breathing, or hearing the spoken word is accomplished through me alone. Even the non-perceivers amongst you dwell near me. Hear me, for I reveal the truth. While creating all beings, I merely breathe forth like the wind. So expansive is my power, possessing greatness beyond heaven and earth.”*

*-Rig Veda 10.8.125, Devi Sukta*

Hindu philosophy with its theological aspect, with its extensive commentaries and denominations, narrates God the Mother as *Shakti* or the divine power, Mahadevi or God the Mother. A hymn from the Rig Veda is the first to refer to Divine Mother as the Supreme Reality (1900-1700 BCE). It belongs among the Hindu canon's oldest books. *Devi Suktam*, which sees the feminine divine as the creative and ultimate source, creative power, and universal power, may be found in the *Rig Veda*. *Ambhrani* is a well-known women sage (rsika) who wrote the *Devi Suktam*. It seems to have been written in an ecstatic, mystically unified condition of seeing the self as encompassing, limitless, and non-local. Her experiences are described in the hymn's verses.

The *Devi Suktam* (Goddess hymnology) serves as proof of the early Vedic authority given to women's enlightened consciousness and a pioneering expression of the divine feminine conception as a congenial, auspicious experience, presence, and creative power. The *Devi Mahatmyam*, the holy book of 'God the Mother', includes the *Devi Suktam*, which is being chanted today. Its incorporation into the *Devi Mahatmyam* (Importance of female power and strength) is proof that the Hindu experience of the unmatched world continues to flow with the vision of the divine feminine as the ultimate truth. In Hindu way of life and beliefs, the feminine principle operates as the energetic and inventive creative extremity of the speculative twofold reality of Hindu philosophy. Mother God is a dyadic, united god in Hinduism that consists of both the divine feminine, and masculine. Mother Goddesses' creation does not limit her it brings limitless pre-eminence and integrity to the whole universe. The *Devi Mahatmyam* of the Markandeya of the *Markandeya Purana* comprises chapters 81-93 it is attributed to the sage Markandeya. (Bhattacharya, 1996).

There are innumerable verses attributed to the Mother Goddesses in Hindu scriptures to connote the character of the divine mother, Goddess. Here one example is quote : *Ya Devi sarva-bhutesu , cetane-tyabhidhiyate, Namas-tasyai, namas-tasyai, namas-tasyai namo namah.* "Praise to the divine mother immanent in all, who is the consciousness in all being salutations to her." Hindu religion places a significant emphasis on Goddess worship and refers to her as 'The Mother'. According to Sara Mitter's the quotation of Heinrich Zimmer's concept of Shakti, which may be understood to mean dominance, as "ability, capacity, faculty, strength, energy, prowess; regal power; the power of composition, poetic power, genius." (Mitter, 1991) The goddess is revered in many different forms and is admired for her diversity in the Shakta tradition. They are regarded as the ideal mothers and gurus/spiritual teachers because they exemplify the goddess' strength and wisdom. (Feuerstien, 1998).

The concept of the mother goddess silhouetted from the confrontation and consensus between potent matriarchal cultures that prevailed in India before 2500 B.C before the patriarchal male-dominated Aryan race migrated to India. The Indus valley people believing in the mother goddess never really gave place to the dominance of the

male. The mother perennially is an entity of devotion to Hindus as the source that nurtures the seed and flourishes it  
([https://archive.org/stream/TheWonderThatWasIndiaByALBasham/The+Wonder+that+was+India+by+A+L+Basham\\_djvu.txt](https://archive.org/stream/TheWonderThatWasIndiaByALBasham/The+Wonder+that+was+India+by+A+L+Basham_djvu.txt)).

Mothers hold the majority of the authority in a matriarchal society, according to evolutionary theories. This concept was well-known in the nineteenth century, and Friedrich Engels used it as a cornerstone in his book *Origin of the Family, Private Property, and the State* (1884). Engels claimed that because of their reproductive capabilities, women would have held positions of authority in the first hunter-gatherer cultures, which lacked property rights. In contrast, when sedentary agricultural and pastoralist societies developed, private property rights over land and commodities meant that males needed to establish the legitimacy of their progeny to pass on money through descent. Thus, the patriarchal system came into being, when males started to dominate women's reproductive abilities and women lost the political influence they had under the matriarchal system. (Gordon Marshall, <https://www.encyclopedia.com/social-sciences-and-law/anthropology-and-archaeology/anthropology-terms-and-concepts/matriarchy>).

The main issue with gender equality is power. However, achieving equal power will not happen automatically. This is a male-dominated planet with a male-dominated society. To achieve equality, we must cooperate with vision and determination. We must alter societal standards. We need to do more to appoint women to higher positions and implement laws and policies that encourage women in leadership, such as special measures and quotas. (<https://www.unwomen.org/en/news/stories/2021/3/statement-sg-international-women's-day>).

According to the All-India Survey of Higher Education Report 2019-20, 42343 Colleges, 1043 Universities, and 11779 Stand Alone Institutions are listed on the AISHE website, while 39955 Colleges, 1019 Universities, and 9599 Stand Alone Institutions responded to the survey. In addition to the 145 Universities in other categories, there are 23 Law, 66 Medical, 63 Agriculture & Allied, 177 Technical, 522 General, 12 Sanskrit & 11 Language Universities. At All-India levels there are merely 74 female teachers for every 100 male teachers. Similarly, in the SC group, there are 58 female teachers per 100 male teachers and in the case of OBC and ST, it is 72 and 69 females per 100 male teachers, respectively. The number of total instructors at the university level is about 2.14lakh out of which 37.1% are female and 62.9% are male. (AISHE, <https://aishe.gov.in/aishe/home>)

## Literature review

It is always great to hear and see that female enrolment in education has substantially increased it always seems to be a trailblazing occurrence a step further towards achieving Sustainable Development Goal 5. The spectacular addition of the number of female students is not in pace with the placement of women in senior leadership roles in higher education in Indian universities. Most of the key positions in universities are occupied by male leaders. The notion of leadership was instilled with stereotypically masculine attributes like

competitive, domineering, aggressive, assertive, etc. since men have historically occupied the majority of leadership roles in society. Leadership is often associated with men. Scholars investigated the problem and concluded that no gender disparities in leadership efficiency when they examined the fundamental components of leadership. This study is not an expression of disheartening feelings about the underrepresentation of women in positions of leadership in higher education. It is to draw the attention of leadership development, executive search committees, governing bodies, and human resource experts and investigators working in the area of Gender Equality to take note of it, and appoint female leaders in higher education that comes closest to the students and other stakeholders in education.

According to historical analysis, conventional higher education has a long history of male domination in leadership roles (American Council on Education, 2017; Mason, 2013). Most senior organizational positions are not filled by women, even if they often take on adjunct roles. Although HE reform has produced new middle management posts, such as marketing managers, community engagement, innovation, and quality assurance (Morley, 2003; Deem, 2003; Noble and Moore, 2006; Fitzgerald and Wilkinson, 2010). Scholars often lament the lack of female executives in high-ranking positions around the globe (Tiggeman and Gardiner, 1999).

Literature on leadership and gender most of the time envelops the views on whether or not gender provides rise to a predilection to highlight the various dimensions of leadership at the expense of the other and some research focuses on the notion that female leaders tend to be more relationships oriented and male leaders more task-oriented. (Park, 1996) After the nineties, transformational and transactional leadership is in trend (Hater and Bass, 1988). Transformational leadership is often regarded as the higher style of leadership, which is derived from transactional leadership but not vice-versa (Bass, 1985).

Higher education reform has given rise to a potent cultural ideology that holds that effective organizational change requires strong leadership. In Northouse's definition of leadership, a leader is a person exerts influence over a group of people to accomplish a common purpose. Haake (2009) says that leader identity is constituted through power relations. The narratives of different expectations for the advancement of women and how specific individuals are recognized or they identify themselves as legitimate leaders need additional examination (<https://www.ses.unam.mx/curso2015/pdf/23oct-Morley.pdf>).

Women have a great opportunity to change the academy at a time when their skills are much needed. They are relative outsiders who must develop new leadership styles since they were not socialized in line with the male-centric leadership paradigm (Dunn, 2014). The study deals with female leadership and need for encouraging female to take up leadership positions while implementation of new education policy in India. NEP document Part II, the section is on higher education. Excellence shall be further encouraged via suitable incentives, promotions, recognitions, and advancement into institutional leadership, according to Section 13.5. Meanwhile, faculty who fail to uphold fundamental standards will be held responsible ([https://www.education.gov.in/sites/uploadfiles/mhrd/files/NEP\\_Final\\_English\\_0.pdf](https://www.education.gov.in/sites/uploadfiles/mhrd/files/NEP_Final_English_0.pdf)).

## Discussion

### Bernard Bass and the Concept of Transformational Leadership

Leadership that went beyond contingent reinforcement has long been acknowledged by political scientists, sociologists, and historians. Such research was exemplified by Weber's investigation of charisma between 1924 and 1947. The basic idea for the study of leadership, however, was contingent reinforcement, which attracted the attention of both psychology and economics. For them, leadership included an exchange of power. The transactional interaction is enhanced by transformational leadership. Such leadership is a development of transactional management. The four pillars of transformative leadership have been outlined in studies dating back to Bass in 1985 and Avolio and Howell in 1992. Leadership has a charismatic quality that causes followers to want to identify with and imitate the leader. With challenge and persuasion, the leader motivates the followers by giving them a purpose and an understanding. The leadership expands the follower's usage of their skills by stimulating their minds. Finally, the leadership demonstrates respect for every individual by providing the subordinate with mentoring, coaching, and assistance. MLQ may assess each of these elements. (Bass M, 1996)

### Bass' Characteristics of Transformational Leadership

**Charismatic leadership:** Transformative leaders exhibit behaviour that make them become examples for their followers. People look up to, respect, and have faith in the leaders. The leaders are admired by their followers, who want to be like them.

**Inspirational motivation:** To inspire and encourage others, transformational leaders act in a manner that provides significance and challenge to their followers' efforts. It's a team effort. Optimism and enthusiasm are evident. The leader establishes expectations that are clearly stated and that followers desire to full fill while also exhibiting dedication to the common objectives and vision.

**Intellectual stimulation:** Transformational leaders encourage their followers to be inventive and creative by questioning assumptions, avoiding problems, and adopting a new perspective on familiar situations. It is encouraged to be creative. Individual members' mistakes are not disclosed publicly. Followers are asked for innovative ideas and unique solutions to problems. Rather than criticizing followers' ideas because they vary from the leaders', leaders encourage their followers to explore new techniques.

**Individualized consideration:** By serving as a mentor or coach, transformational leaders pay close attention to each person's requirements for success and development. Colleagues and followers are developed to progressively greater potential levels. It is recommended that communication be two-way. (Bass M, 1996)

Participative versus directive leadership can be as follows Table-1.

Table 1: Descriptions of participative Vs Directive Leadership

	<b>Participative</b>	<b>Directive</b>
<i>Laissez-Faire</i>	<i>“Whatever you think is the correct choice is OK with me.</i>	<i>If my followers need answers to questions, let them find the answers themselves”</i>
<i>Management-by-</i>	<i>“Let’s develop the rules together that</i>	<i>“These are the rules and this is how</i>

<i>Exception</i>	<i>we will use to identify mistakes.”</i>	<i>you have violated them.”</i>
<i>Contingent Reward</i>	<i>“Let’s agree on what has to be done and how you will be rewarded if you achieve the objectives.”</i>	<i>“If you achieve the objectives I’ve set, I will recognize your accomplishment with the following reward...”</i>
<i>Individualized Consideration</i>	<i>“What can we do as a group to give each other the necessary support to develop our capabilities?”</i>	<i>“I will provide the support you need in your efforts to develop yourself in the job.”</i>
<i>Intellectual Stimulation</i>	<i>“Can we try to look at our assumptions as a group without being critical of each other’s ideas until all assumptions have been listed?”</i>	<i>“You must reexamine the assumption that a cold fusion engine is a physical impossibility. Revisit this problem and question your assumption.”</i>
<i>Inspirational Motivation</i>	<i>“Let’s work together to merge our aspirations and goals for the good of our group.”</i>	<i>“You need to say to yourself that every day you are getting better. You must look at your progression and continue to build upon it over time.”</i>
<i>Idealized Influence</i>	<i>“We can be a winning team because of our faith in each other. I need your support to achieve our mission.”</i>	<i>I’ve decided to cross the Rubicon. So, there’s no going back) You must trust me and my direction to achieve what we have set out to do.”</i>

Table :1(From Avolio & Bass. 1991)



Figure 1. Based on Bass M 1996 Characteristics of Transformational Leadership

As the transformational leader reveals personalized contemplation and transforms crisis into developmental challenges, transformational leadership is required. Such leadership relates in a different way to the staff and co-workers. Beyond self-interest, the transformational leader tries to change the company culture, envisions, fosters self-worth, empowers, mentors, coaches, and encourages others. The Multifactor Leadership questionnaire is based on the attributes of the transformational leader.



### *Leadership and Organizational Culture*

As per the opinion of Deak & Kennedy, the organizational culture is an ingrained behavioral pattern that is passed down from one generation to the next. It encompasses the beliefs that members hold to be true about what is vital, right, and good. As a source of identity and unique competency, organizational culture serves as the binding agent that binds the organization together. They strive to integrate recruits into the ideal transformative organizational culture. Challenges in this pure organizational culture are prospects rather than risks (Bass M. 1996).

Bass explains the strength of female transformational leadership along with surveys and examples. The study by Bromer & Brenner, 1981; Wintermantel & Kruse, 1986 cite research that suggested women needed to adopt masculine behaviour and attitudes to prosper in the workplace, which was considered to be a man's domain. Women were thought to be promoted for exhibiting the traits of ambition, competitiveness, and task orientation, which were considered to be traits associated with men. Accordingly, it was believed that successful female executives had acquired male traits via socialization or training as they rose through the ranks of the organization. According to Rosener's 1990 research, there is a woman's manner of leadership that is distinct from the conventional male techniques. Helgesen concurred in 1990, stating that women leaders were more likely than males to prioritize regular interaction and information exchange through webs of inclusion, as well as flatter organizational structures. Bass provides a few examples of how transformational leadership differs. According to anecdotal, survey, and experimental data, women in leadership roles tend to be slightly more transformative and less likely to use managing by exception than their male colleagues. They are seen as marginally but considerably more effective and satisfying leaders by their team members and direct reports. Anecdotal Evidence During a survey feedback session, participants in an early training course on transformational leadership in 1985—12 females and 12 males at high levels of management of a Fortune 50 company—noticed some potentially interesting sex disparities in transformational leadership ratings. Each of these 24 leaders was profiled by three to five subordinates using the Multifactor Leadership Questionnaire. Without revealing their names or sexes, the profiles for each leader were solely identifiable by code numbers throughout the workshop exercise. In his 1985 study, Bass chose four of the 24 managers with the highest MLQ scores for charismatic leadership, which explains the largest proportion of variation in transformational leadership, to take part in a team activity. Although prejudices and earlier literature would have predicted that all four would be males as officially shown in the study, such as that by Kruse & Wintermantel in 1986, the likelihood was that two of the 24 would be men. Contrary to predictions, the top four charismatic leaders were all women, and by a significant margin. Bass saw their extraordinary abilities, presence, and self-assurance as they were participating in the activity. The finding that women exhibit stronger transformative leadership is supported by data from four distinct studies collected at the CLS (Center for Leadership Studies) between 1986 and 1992 using the Multifactor Leadership Questionnaire (Bass M, 1996).

According to Eagly's study from 1991, the gap between men and women in transformative leadership may be attributable to women's well-documented propensity for being more caring. Women leaders see themselves, as

more feeling. According to 1990 research by Eagly & Johnson, women leaders are more socially sensitive and interested in others than their male counterparts. According to Komives' research from 1991, women leaders seem to exhibit traits more consistent with transformative leadership. Additionally, they are more inclined than their male colleagues to ascribe their relationship skills to their transformative leadership. Another justification for expecting women leaders to be more transformative, according to research by Kuhnert & Lewis, is the moral value component of transformational leadership, which emphasizes responsibility and caring in women while emphasizing rights and justice in males. According to 1990 research by Eagly & Johnson, women's leadership styles may be more transformative than men's since they often exhibit less self-serving authoritarianism. Additionally, women tend to be a little more transformative than males, which makes them more likely to be considered successful and satisfying leaders than men. Why women may be more successful and rewarded as leaders have a rational explanation. Arguments are made against the empirical results. For instance, it is argued that a woman must possess more qualifications than her male counterpart to hold the same leadership position. However, the opposite might equally be said given the way that affirmative action measures have been handled. It follows that if women are more transformative in comparison to their male colleagues, they will be more successful and satisfying, given the positive relationships between transformational leadership and effectiveness and contentment among those led. The corporate cultures of the 1990s and beyond may fit women executives better (Bass M, 1996).

### ***Gender Equality as Fundamental Value***

The Indian Constitution explicitly states that gender equality is a fundamental value. In addition to guaranteeing women's equality, the Constitution gives the State the authority to use measures of positive discrimination in their favor to offset the accumulated political disadvantages and socio-economic that women suffer. Several projects have been introduced by India's Ministry of Women and Child Development to empower women. Honourable Minister, during the Fourth World Conference on Women, which took place in New York in September–October 2020, WCD virtually delivered the National Statement through a pre-recorded video message that was played during the Plenary Segment on October 1st inside the United Nations General Assembly Hall. The Indian government has taken new, specific steps and made pledges to expedite the accomplishment of empowerment of all girls and women and gender equality in our nation (<https://wcd.nic.in/annual-report>).

### **The Handbook on the Attributes of a 21<sup>st</sup> Century Vice-Chancellors**

The leadership of the institution must devise a plan to demonstrate how disparate elements may come together, how one can overcome challenges, and how discord can give way to harmony. Realized that obtaining the university community's voluntary commitment rather than coerced compliance is ultimately what determines success. Although not officially required, from the viewpoint of stakeholders, the vice chancellor's qualities include:

University Grants commission apex body of Indian higher education in ‘Total Quality Management’ (TQM) states that quality is indispensable in higher education. Many requisites are mentioned for the quality mandate in the handbook. But two points are visible in leadership, (b) leadership to foster a culture of excellence; (c) Tiers of leadership for promoting a high-quality culture. Both points (b) and (c) focus on leadership which is a very vital part of HE’s strengthening and development.



Figure 2. based on : [https://www.ugc.ac.in/e-book/VC%20handbook\\_complete.pdf](https://www.ugc.ac.in/e-book/VC%20handbook_complete.pdf)

**Methods and Materials**

Both qualitative and quantitative methods are combined. Qualitative responses from 10 Indian women leaders were collected. MLQ tool is used to collect responses of 51 different stakeholders of higher education responses received from male (22) and female (29) and the ratio of male female stakeholders are reflected in Figure 3.

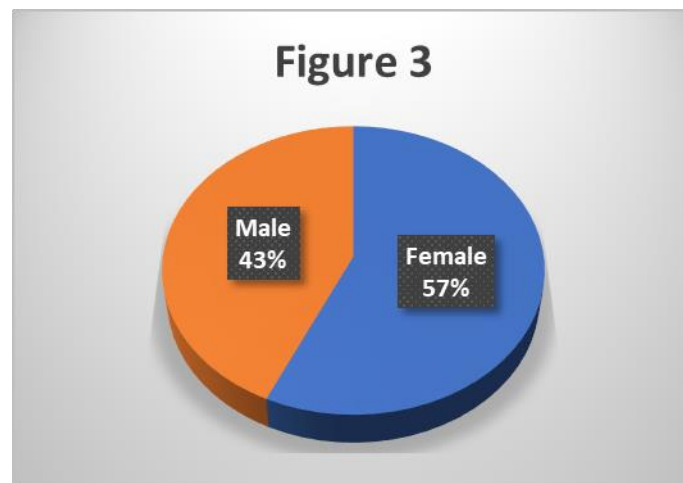


Figure 3.

**About the Tool**

The Multifactor Leadership Questionnaire is an inventory based on psychological traits of different kind of leadership styles and its outcomes. The MLQ tool was researched and constructed by Bernard M. Bass and Bruce J. Avolio with the objective to examine full range of leadership styles. MLQ comprises of 9 scales and 3 leadership styles. In this particular research Transformational style is under consideration. The MLQ takes 15 around minutes for completion it can be experimented either on group or an individual. It has been used widely to spot effective leaders and is an validated across cultures and institutions for development and research pertaining to leadership. The MLQ is multi – rating 360 degree instrument, it considers the leader’s self-assessment and assessment from the point of view of their superiors, peers, subordinates and others. In this study the assessment from others is implemented, Multi factor Leadership Questionnaire form is used as tool in this study. The MLQ is often combined with the Authentic Leadership Questionnaire (ALQ) to assess the self-awareness, transparency, ethics/morality, and processing ability of leaders the ALQ was constructed by Avolio with William L. Gardner and Fred O. Walumbwa in 2007 ([https://en.wikipedia.org/wiki/Multifactor\\_leadership\\_questionnaire](https://en.wikipedia.org/wiki/Multifactor_leadership_questionnaire)).

**Data Analysis**

The data analysis method employed was a grounded concept. This technique involves gathering, analysing, and exploring evidence before generating new hypotheses that are pertinent to the topic. The technique is especially helpful for revealing underlying beliefs, circumstances, and experiences of persons engaged in a phenomenon (Strauss & Glaser, 1999). In this study, all the data is analysed keeping in mind the transformational leadership theory of Bass. Analysis of each question of MLQ ( Multi factor Leadership Questionnaire) is as follows.(Figure 4)

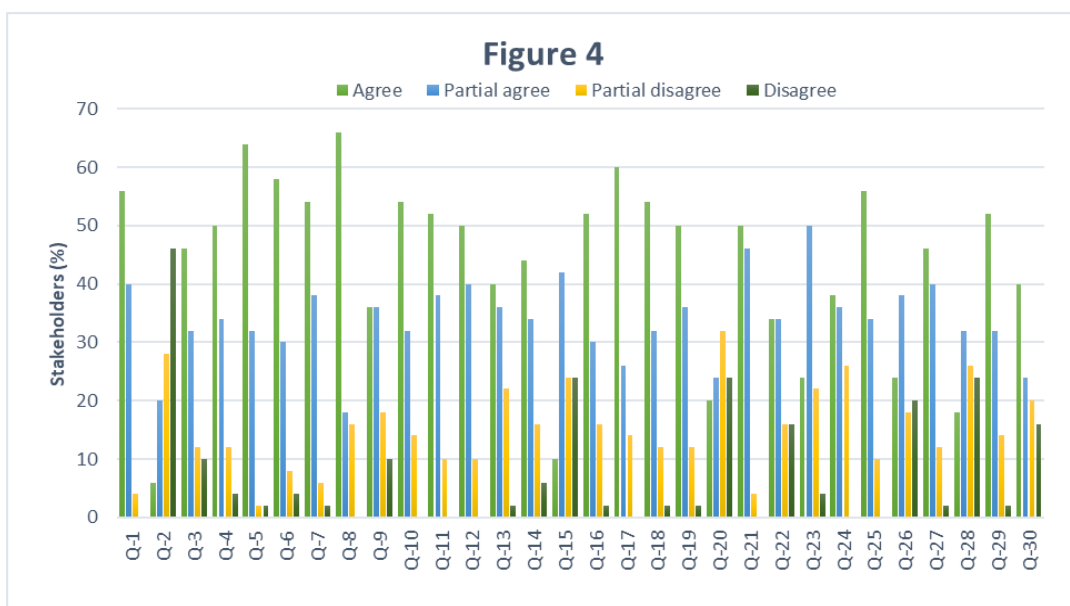


Figure 4. Analysis of MLQ Data collected in this research study

**The female leader provides support in return for the efforts of the stakeholders and displays behaviour that makes them become role models for their followers.**

From the total sample, 56 % of individuals agree with the fact that female leaders provide support and they assist in the exchange of hard work of stakeholders. 40% partially agree with the statement. Two individuals, 4% partially disagree and no individuals disagree about the women in a key position or if given power positions will fail to assist or value the work or endeavour invested by the stakeholders. It is evident that the work done will not go unnoticed under female leadership and this is a positive aspect of female leadership it can transform the energy of the team and the people around. The transformed collective energy and collective consciousness in positive directions can yield exceptional results and can achieve greater goals in institutes of higher education under transformational female leadership. Here there is no comparison that female leadership is either more or less transformational. The argument is keeping aside the gender roles leadership must be endorsed by capabilities. And aspiring female leaders must avail equal opportunities to prove their worth.

**The female leader falls short of intervention until the problem becomes severe.**

The second statement is about solving problems and crises. If there is a problem in the institute or connected arena the analysis shows that female leaders will immediately get involved and take necessary action to solve the problem. Only 6% disagree and say that female leader does not take timely interventions, and 20% partially agree thinking that female leaders wait till the issue gets worse. 28% partially disagree they think that female leader would not like that any crisis or issue becomes grave they want that each dilemma each catastrophe must be solved before it becomes bigger. 46% fully agree and believe that they immediately take initiative to know the problem going to its roots to solve it in the best possible way. Research repeatedly would like to argue that female leaders are more efficient than males is deviating from the focus and missing the point. Arguably rapidly changing organizational management in changing times is abounding with crises and conflicts with competing demands so institutions need leaders with flexibility with a vibrant range of leadership qualities without labelling masculine or feminine qualities.

**The female leader focuses attention on indiscretion, inaccuracy, derivations, and exceptions from standards.**

Here, 46% of respondents agree while affirming that female leaders pay attention to deviations from the standard, mistakes, and abnormalities, they do so to make their fellow employees aware of the fact that they can put in better, and they have the potential to elevate the institutes to higher grade if they stretch their limits. This can enrich the organizational culture. 32% partially agree think as leaders sometimes are liberal looking to the circumstances of the employees and situation of the working conditions. For example, one can be patient for a stipulated time slot but if it happens recurrently then it needs to be focused and addressed methodically for future improvements. 12 % partially disagree and 10% disagree so it falsifies the myth that female leaders can't be harsh and female leaders seldom accomplish what male leaders do. Here again, it can be said leadership is not just relative to gender. Femininity is an attribute of women but matriarch is a power of creativity and creation.

**The female leader maintains self-integrity and goes beyond self-interest for the good of the team and the institute.**

50% agree that they go beyond self-interest. 35% partially agree extent. 12% partially disagree and only 4% disagree. It demonstrates how female leaders put the interests of the team and the organization ahead of their own. We all know that self-interest is psychological as well as an economic term. The term provokes personal benefits. Female leaders brushing aside, the personal benefits voyage in direction of holistic good, focusing on the organic whole and benefits of the organization as a sole entity. As a leader, she is proactive and upbeat pursuing the mission of the organization. She put in efforts to identify with the mission and vision of the institute and formulates strategies and plans to achieve long-term and short-term objectives keeping aside personal interests. The holistic vision where self-interest hardly counts brings in the idea of a shared vision and keeps the female leader externally and internally focused which adds much to the growth and development of the institution. When self-interest is not that important, it brightens up the self-integrity of the leader indifferent to the gender. Leaders become role models they are emulated, so the leaders with potent self-integrity create an aura they influence their ecosystem and the people around them bring integrity to the whole organizational management and culture, ultimately resulting in making the institution great and successful.

**The female leader considers the moral and ethical consequences of the choice and decision, illustrating high standards of morality and ethics. She avoids misusing her position for selfish ends.**

To this statement, 64% agree, 33% partially agree, 2% partially disagree and 1 % disagree. Ethics means everything to the organizational culture. 64% agree and 32 % to an extent agree that ethics matters a lot to the female leader while making choices and decisions in the institution. Female leaders acknowledge their role in shaping the organizational ethics they create a culture that strengthens the bonding and the foundation on which the success of the organization depends. Leaders who disregard ethical consequences of choice and decisions run the risk of personal and institutional liability in contemporary tough legal settings. It promises integrity to the institution.

**Female leader talks optimistically display enthusiasm and help others to develop their strengths, she exhibits behaviours that inspire and encourage others around them by giving their followers job purpose and challenge.**

58% agree, 30% partially agree, 8% partially disagree, and 4% disagree. The maximum number of respondents agree that the female leader is optimistic and helps others to develop their strengths. Female leaders know how to look to the brighter side of the things they know how to their as well as the staff's strengths and accomplishments. 58% agree that they know how important it is to add to the value of the institution by strengthening the individuals and giving them opportunities to grow and advance. Their growth is equal to the growth of the institution.

**Female leader frequently keeps in contact to find out if all is well.**

54% agree, 38% partially agree, 6% partially disagree and 2% disagree. More than half of the individuals believe in the fact that female leaders frequently keep in contact to make sure all is well. 54% agree and 38 %

somewhat agree that women are much inclined towards purposeful networking they frequently keep in contact to know that all is going well. They understand how important it is to keep in communication and keep connected with the stakeholders to get feedback for further improvements. They at times interact and know good things and they know how to influence people to get work done successfully.

**A female leader clearly explains the goals, objectives, and targets and engages followers in imagining desirable future scenarios, fostering a sense of teamwork.**

66 % agree, 18% partially agree, 16% partially disagree, and 0% disagree. It is derived that female leaders clearly explain the targets. The highest number of stakeholders believe those female leaders have a clear mindset regarding targets and goals. It is a myth that females have less clear goals shared with others. But on contrary it is seen that female leader continuously share their plans, make-believe the stakeholders in their plans and achieve their targets within the stipulated time. There are many age-old societal and organizational barriers for any leader either men or women which brunt the advancement of leaders. Despite the impediments, female leaders are much sure about what they can achieve.

**The female leader demands competence and efficiency at any cost.**

36% agree, 36% partially agree, 18.8% partially disagree, 9.2% disagree. Here 36 % plus 36% are with agreeing and partially agree so at times if it is not in the capacity of the person to fulfill the task the female leader will either have the patience to train the person in a particular task or will assign the task to other person and try to find out that the person who proved to be unskillful in certain task is best at which skill. In a way, instead of getting frustrated will explore the skill and possibilities to develop that particular skill of a person to get the best out of him and thus make him/her an asset to the institution.

**The Female leader assertively and confidently expresses thoughts and opinions and establishes expectations that are clearly stated and that followers wish to satisfy while also displaying a dedication to the common objectives.**

54% agree, 32% partially agree, 14% partially disagree, and 0% disagree. More than half of the stakeholders agree that female leaders voice the institutions assertively and confidently. Putting forth the voice to be heard and voicing the ideas and thoughts transforms the institutions. As unless you assert nobody hears and if you are not heard no action can be expected. Female leaders assert and make bold moves at times to fulfill their new leadership roles such moves are often indispensable to be successful as a leader in the longer run.

**The female leader provides training and mentoring to others, by serving as a coach, and gives particular attention to the demands of every individual for success and progress. By doing this, colleagues and followers are gradually developed to greater potential levels.**

52% agree, 38% partially agree, 10% partially disagree, and 0% disagree. The evidence of 52% shows that female leaders are good trainers and mentors. Leadership is about the team and teamwork. Leaders need to train others to make a strong team. No endeavor is a sole endeavor; the leader and the stakeholders are interdependent entities. Female leaders cultivate strong internal and external sets of connections to get the work done. As

leadership is setting an example by working and at the same time making others work equally.

**The female leader is the defender of progressive dreams ideas or action plans of execution she believes in.**

50% agree, 40% partially agree, 10% partially disagree, and 0% disagree. Nearly half of the stakeholders believe that female leaders defend themselves while they think, articulate, and accomplish what they dream for the institution. They believe develop, append, and guarding the principles and vision, and action plans of the institution.

**The female leader believes in confidentiality to not disclose the personal matters of the staff or other stakeholders.**

40% agree, 37% partially agree, 22% partially disagree, and 1% disagree. Stakeholders believe that female leader can maintain confidentiality in the institutions it can be about the performance, disciplinary actions, confidential reports, etc. It's all about equilibrium between preserving the confidentiality of the staff and at times completing an investigation that is required and necessary for all concerned parties. During institutional investigations or performance and disciplinary actions, confidentiality is very vital and is maintained by the female leaders. Female leaders know how to excel in organizational management and work well in their ecosystem supporting the efforts of the staff and all stakeholders.

**The female leader is concerned if the employee remains absent without prior notice.**

44% agree, 34% partially agree, 16% partially disagree, and 6% disagree. Stakeholders are clear when they agree with the fact that females are much concerned about their staff as their family. They consider their staff as family, as female leaders inquire if all is well when the employee remains absent without prior notice. Here it must be noted that females to excel as leaders are not required to alter their basic nature of being compassionate, empathetic, kind, and concerned. They are not some version of males in command while in leadership roles. The real charm of female leadership is winning while maintaining the identity and basic feminine traits. The respondents say that female leaders tend to be much more humane and that adds to the strength of the leader as well as the team.

**The female leader does not allow altering or shifting days off.**

9% agree, 46% partially agree, 33% partially disagree, and 12% disagree. Stakeholders believe that female leaders are flexible and they allow shifting days off the condition will be that the work must not suffer and quality cannot be compromised. Female leaders make the staff feel constantly that they are an indispensable part of the institution and each one can replace the other by multi-tasking and skill development. Staff can alter roles, enrich their experiences by altering roles and bring new progressive effects to the institution. So, leadership helps the team to perform tasks alter roles, and reach their goal. It encourages functional behaviours clearing the path towards a unified goal, by being flexible when required with the subordinates. Here potentially diverse groups with different skills and talents by altering roles at times work together towards a common output.

**The female leader allows the staff to leave if private matters arise.**



52% agree, 30% partially agree, 16% partially disagree, and 2% disagree. Stakeholders have faith that female leaders give leave to employees to attend the urgent situations and their private matters. As females tend to understand the difficulties of others, if the employees are stress-free they give better output and they tend to be more productive when in a cheerful mood. The pensive mood of the employees hinders the work process. Leaders communicate the targets and visions, accomplishments are possible only by high performance and teamwork, such expectations from the team are fulfilled when the members of the team are allowed to cater to their private matters when urgent and important.

**The female leader organizes events to update and improve the knowledge of the employees.**

60% agree, 26% partially agree, 14% partially disagree, and 0% disagree. Sixty percent of the stakeholders believe that female leaders are always keen on updating the staff with the new knowledge and most recent developments in the field as it is directly related to the organization's development and growth as a holistic entity. Female leaders emphasize results. They want each one to grow with the growth of the institution, they spend more time updating the knowledge and communicating the same to the staff, they invest more resources in organizing the updating and innovation and it is observed that they all have more exchanges of off-task feedback and comments to obtain positive results.

**The female leader knows the capabilities and potential of each staff member.**

54% agree, 33% partially agree, 12% partially disagree, and 1% disagree. Stakeholders agree with the fact that when we look at the socio-emotional behavior of female leaders they invest more time in knowing their employees, they are more likely to meet the socio-emotional needs of their team. They discover which member gel well with the other and set the tasks accordingly when one member becomes complementary to the other this gives the best outcomes. Female leaders are interpersonally demonstrative and sociable during interactions and this helps them discover the potential of each member of the team.

**The female leader tries to ensure that employee does not go unpaid if he/she works overtime.**

50% agree, 36% partially agree, 12% partially disagree, and 2% disagree. Female leaders value the work done and believe in listening as a skill at both ends. This makes the two-way communication more open stakeholders believe that if any of the staff works more female leader inquires and makes sure that the services don't go unpaid and there is no space for exploitation. Value of time and work is paid which boosts the enthusiasm of the employee to continue putting on extra efforts as and when required.

**The female leader allows the staff to work unsupervised.**

20% agree, 24% partially agree, 32% partially disagree, and 24% disagree. The female leader is at times not supervising a total of forty-four percent come to agree and partially agree fifty-six percent partially disagree and disagree. She supervises the work on and off after assigning the task. Females believe in repeated reminders of deadlines, males are more moderate after assigning the task. At times frequent supervision becomes a requirement to avoid the crisis of deadline submissions but at certain tasks results matter, the team even if unsupervised can yields the best results when they acclimatize with the organizational culture.

**The female leader organizes regular meetings to improve communication and organizational management.**

50% agree, 46% partially agree, 4% partially disagree, and 0% disagree. Here the data evidence show that female leaders are highly competent leaders who regularly arrange a meeting for organizational communications.

**The female leader encourages transparency by giving information to all.**

34% agree, 34% partially agree, 16% partially disagree, and 16% disagree. Stakeholders believe that female leaders keep the organization's secret intact. They keep confidential matters within the closed circuits in the goodwill of the institution. This retains the value and standard of the institution. But when it comes to transparency they are extremely transparent about the organizational management. The superannuation benefits, regular increments, salaries, service books, and leave records can be obtained by anyone as their right. All required notifications are displayed on the institutional website anyone can access the information at any time. No one is deprived of their right to get any relevant necessary information.

**The female leader admits the mistake and accepts the mistakes.**

24% agree, 50% partially agree, 22% partially disagree, and 4% disagree. Stakeholders believe that at times if there is a mistake female leader accepts and tries to rectify it by accepting the mistake. She goes to the root of the issue and tries to find out where there was a lapse in the team, as any endeavour in an institution is a collective endeavour, one mistake on part of one member leads to the error of the whole team. True leader male or female admits mistake when it is genuine as her mistake not levying and imposing them directly on the team member. And when it comes to giving credit for success true leader gives credit to teamwork and the whole team. When such kind of culture develops, each member works fearlessly, without getting afraid of being accused or blamed for errors. To err is human and those who work are bound to err, learning from their mistakes. A female leader takes responsibility for the mistakes of the team.

**The Female leader pacifies arguments and avoids causing aggravation.**

38% agree, 36% partially agree, 26% partially disagree, and 0% disagree. The respondents say that female leaders make peace by avoiding heated aggravations. They have patience in dealing with sensitive issues; they negotiate for the successful outcome of stressful situations or problems. They like peace and promote institutional harmony not letting in personal differences and biases. They built the ecosystem with trust and synchronization.

**The female leader speaks to all staff and always maintains protocols and is straightforward.**

56% agree, 34% partially agree, 10% partially disagree, and 0% disagree. Fifty-six percent believe that maintaining protocols is in the basic nature of females. Respecting the top management and giving due respect even to the class three and four employees of the institution is required to maintain a cordial atmosphere in the institute. Mutual respect and being straightforward and maintaining protocols build healthy esteemed culture.

**The female leader is at times unpredictable.**

24% agree, 38% partially agree, 18% partially disagree, and 20% disagree. Twenty-four percent agree and thirty-eight percent partially agree that female leaders are having a clear understanding of a situation and making quick decisions per the demanding situations. Female leaders are able at making decisions as leader understands the culture of the institution and situation well. The evidence shows that at times female leaders are shrewd and unpredictable and it affects their decision-making. In fiscal matters and certain policies, it may be that female leaders take time and consultancy to come to decisions.

**The female leader is frank.**

46% agree, 40% partially agree, 12% partially disagree, and 2% disagree. Respondents gave clear evidence that female leaders are frank and have the clarity they do not entertain beating around the bush. Clarity of thought, purpose, and goal with a clear roadmap is displayed by the leader. This clear roadmap is displayed in front of the team making them visualize the accomplishment. There is frank communication on how to reach the goal and who will be the second, third, and fourth lead with the team. This frankness avoids confusion in the team otherwise confused people confuse others.

**The female leader demands the whole team to work continuously.**

18% agree, 32% partially agree, 26% partially disagree, and 24% disagree. The evidence shows a mixed response. It is observed that female leader tries to find out what is the root cause if any team member fails repeatedly to cope with the team. There are causes why leaders lose teammates; it is mistrust, ego, lack of timely communication, and much more. When a leader gives a break and works to make the individuals one team one unit it brings the best results. Continuous demands can sometimes be replaced by opportune considerations there can be no harm in doing so.

**The female leader is sensitive to people and situations around them.**

52% agree, 32% partially agree, 14% partially disagree, and 2% disagree. More than half of the respondents are sure that female leaders are sensitive enough to understand others and their situations. Being sensitive means having compassion towards the employees and co-workers. Here sensitivity means understanding other person's facial expressions, gestures, and body language and paying attention to them. Nonverbal communication, as well as verbal communication, is important for female leaders set a concerned tone and are having a magnanimous approach to mistakes. They see the issues, problems, and difficulties through the eyes of employees. Female leaders never overlook the fact that employees are also human. They are more kind in admiring; at times they criticize to appreciate. They have clarity about the well-wishers and empty flatterers among the employees. They care for employees outside the task and try to create an association with them as persons.

**The female leader has no time for levity.**

40% agree, 24% partially agree, 20% partially disagree, and 16% disagree. Evidence shows that serious matter is never treated lightly but there is always a place for sensible humor for female leaders. No disrespect is

shown for serious issues. As the leader cannot effort to fire disconnected ideas from the key position. It is so important to be aesthetically creative but a leader cannot be devoid of scientific realism at the same time. A female leader earns respect from others as she seldom throws everything at everyone.

In more than 15 statements the stakeholders agree above 50%. In statement 5, 8, and 17 they agree above 60%. The highest agreement is on statement 8. Thus, the overall analysis and evidence show that stakeholders credibly believe in female leadership as a transformational one, and their capabilities as leaders must be recognized and employed in higher education in India while implementing New Education Policy.

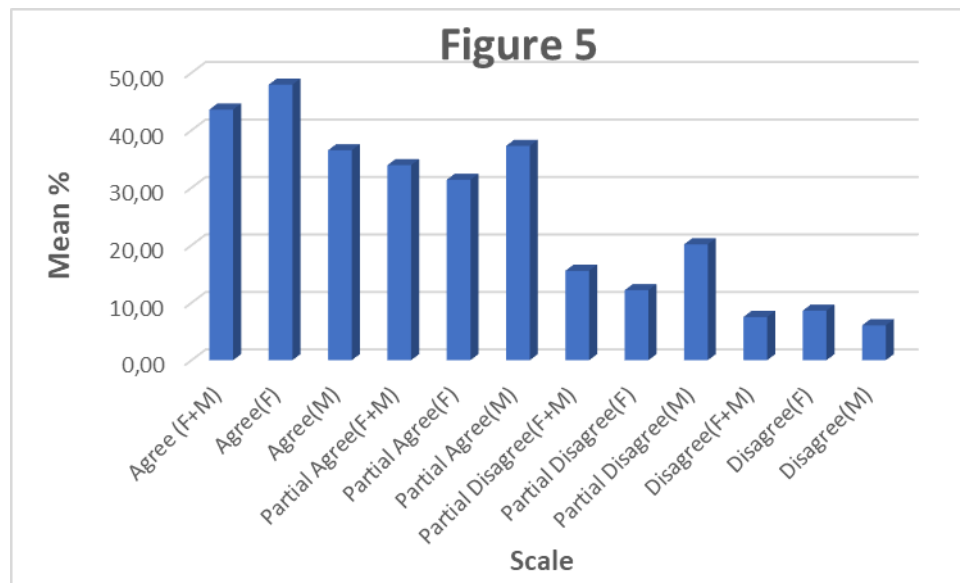


Figure 5: Mean value gender wise.

Analysing the responses collected from male and female separately, the findings made are very interesting. The column height of female response is higher than the total (Male+Female) of agree column, while the column height of male is lower than the total (M+F) as shown in Figure 5. The ratio of female feedback is higher than the male as well as both (F+M) for the agree scale. The ratio for partial agrees statements, the female ratio is observed slightly lower than the F+M and Male. Such observation clearly indicates that females believe more that the female leadership can be really transformational while implementing New Education Policy in India. Higher females' responses show that females are more supportive to the females and they firmly believe that females rising at leadership positions in higher education institutions can make a positive difference.

Calculation of the Mean values for taken responses from female and male are separately analysed. The mean values for total (F+M) is in decreasing order from agree to disagree scales and the same trends was observed for the female and male responses when separately analysed, the results are reflected in Table2. This trend also favours female leadership that can be transformational while implementing NEP in India.

Calculation is done also by single sample method t-value and observed the corresponding p-value at Df=29, the results showed that it is significant at  $p < 0.01$ . (Table 2)

Table 2: Calculation of Mean, SD, Variance and t-value single sample.

	Female + Male (51) 100%				Female (29) 56.84%				Male (22) 43.14%			
	Agree	Parti al Agree	Parti al Disagree	Disagree	Agree	Parti al Agree	Parti al Disagree	Disagree	Agree	Parti al Agree	Parti al Disagree	Disagree
Mean	22.2	17.3	7.93	3.83	13.9	9.10	3.53	2.50	8.03	8.20	4.43	1.33
SD	7.65	3.42	3.77	5.63	5.19	2.56	2.28	3.97	3.51	2.24	2.07	1.95
Variance	50	56	77	29	52	43	54	19	83	99	92	35
T-Value	58.5	11.7	14.2	31.7	26.9	6.57	5.22	15.7	12.3	5.06	4.32	3.81
p-value	989	345	713	299	897	59	30	759	782	21	30	61
	15.9	27.6	11.5	3.72	14.6	19.4	8.46	3.44	12.5	19.9	11.6	3.73
	082	614	023	74	547	368	81	75	063	623	788	84
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	00	00	00	04	00	00	00	09	00	00	00	04

\*p < 0.01.

Now calculate the paired t-value for male and female responses. The hypothesis is  $H_0 =$  While implementing NEP 2020 Female leadership can prove to be transformational (successful),  $H_1 =$  While implementing NEP 2020 female leadership cannot prove to be transformational (not successful). Calculated the  $\bar{X}_1$ ,  $\bar{X}_2$ , S and  $t_c$ -value from the following equations (1) to (3).

$$\bar{X}_1 = \frac{\sum X_1}{n_1} = \frac{30.01}{29} = 1.034 \text{ and } \bar{X}_2 = \frac{\sum X_2}{n_2} = \frac{22.74}{22} = 1.033 \quad (1)$$

$$S = \sqrt{\frac{\sum(X_1 - \bar{X}_1)^2 + \sum(X_2 - \bar{X}_2)^2}{n_1 + n_2 - 2}} \quad (2)$$

$$t_c = \frac{|\bar{X}_1 - \bar{X}_2|}{S \times \sqrt{1/n_1 + 1/n_2}} \quad (3)$$

From the equation (2) and (3) the calculated value of S and  $t_c$  - value is 2.78 and 0.0012 respectively. At Df=49 the  $t_{0.05} = 1.95$ . Now,  $t_c = 0.0012$  and  $t_{0.05} = 1.95$ , Therefore  $t_c < t_{0.05}$  Then  $H_0$  is acceptable.

Qualitative responses were invited from the female leaders of the academic fraternity. The Following exemplary three qualitative responses are quoted to exemplify the views of the female leaders.

### Qualitative Response: 1

**Honorable Dr. Ujwala Chakradeo. Vice-Chancellor of SNDT Women's University, Mumbai, India**

*The greatest means of bringing about social change is education. The British knew it and they used Education to drive Indian society away from its roots. With National Education Policy 2020 the possibility of connecting with our origin has now been established. Education is essential for realizing one's potential as a person,*

*creating a fair society, and advancing the development of the country, according to the NEP. Appropriate implementation under the able and enlightened academic leadership only will pave the smooth path ahead. Academic leadership has to have all those qualities necessary for any leadership with an additional edge to motivate, inspire and mold the future, not only of the individual but collectively that of the society and that of a nation. Appropriate vision and insight are necessary for every leader to reach the set goals. Beyond achieving targets academic leaders have to have sensitivity towards every learner who is directly or indirectly a part of the system. Education is the expression of the perfection that each person already has, according to Swami Vivekananda. In the process of this manifestation, the role of an academic leader is very crucial. Administration, management, and teaching are the basic responsibilities of an academic leader. However, the focus on these activities varies with the position acquired by the leader on the ladder of promotion. Academic excellence is the soul of these activities. Excellence can be achieved by pushing the boundaries. Motivating the student/learner to slowly expand and go beyond is what the academic leader has to achieve at every point in time.*

*This entire universe is the blend of Purusha and Prakruti (male and female component) Prakruti, the female is the creator, and the entire creation is possible because of the tender motherhood encapsulated within Prakruti's womb. Purush or the man is the ability to manifest the creation; to manage the logistics necessary to make the creation of Prakruti a reality.*

*The logical thinking of men and the creative ability of women are inevitable components of every individual whether a man or a woman. That is the reason why men are equally contributing to the creative fields. Love, compassion, and empathy are essential feminine qualities. These are the qualities that with utmost tenderness can unravel the perfectness of every individual in the process of education. These feminine qualities are inherent. They are there, very rarely can be acquired by training from outside. Whereas, managerial and administrative abilities can be obtained by training. This makes the authority of women in academic leadership more meaningful. The development of each person's creative potential is a focus of the National Education Policy 2020. It is based on the idea that education must foster the development of not only cognitive abilities—including "foundational" abilities like literacy and numeracy as well as "higher-order" abilities like problem-solving and critical thinking—but also social, emotional, and ethical abilities and dispositions.*

*Thus, now is the time to sensitize teachers and administrators of education sectors to envisage this change. Thus, to implement the essence of NEP, 2020 suitable sensitization of academic leaders to acquire as many feminine abilities (the essence of matrutva) is imperative.*

### **Qualitative Response: 2**

**Dr. Ila Gupta, Director, Amity School of Architecture and Planning, Coordinator, Amity Mega Center for Natural and Man-made Calamities, Amity University, Gurugram.**

*Women have strengths of compassion and empathy which make them good leaders. However, their sacrificing tendencies and family responsibilities make them take a back seat in their careers. Gender bias is deep-rooted in our consciousness and taking that out would need many years of continuous effort. While our academic institutions are gender-neutral and propagate equality, the industry is not. This fact affects our careers in*

academia too. We are living in the age of technological revolution and education has to keep pace. There is a continuous development of new technology, material, software, hardware, government initiatives, etc. New challenges and prospects are developing all the time. It is more important for us to keep updating our knowledge if we have to remain relevant. In this scenario, strong industry experience and collaborations are the need of the hour. Academia is no longer a choice for an easy and comfortable means of living. We are required to come out of our comfort zone which is not possible for all women. That is the reason, despite all the reservations, encouragement, and gender-neutral policies, very few women are seen holding higher designations in universities.

### **Qualitative Response: 3**

**Dr. Vaidehi Vijaykumar, Vice-Chancellor, Mother Teresa Women's University, Kodaikanal.**

*The much-needed adjustment for our educational system is the New Education Policy (2020). The policy supports a comprehensive development of the kid in addition to ending the practice of rote learning that is now used. The primary goal of NEP 2020 is to provide children with a balanced exposure to academics, practical learning, and extracurricular activities.*

*Speaking of gender, the "girl child" has traditionally been the main focus of the majority of educational policy. It is obvious because 50 years ago, girls and women were in a worse situation than they are now. If we look at it from a comparative perspective, many modern families do not consider females as a burden; instead, they want them to be independent and educated. Although there are still gender preconceptions that limit women from becoming "homemakers" and family providers, this development is undoubtedly progressing in the right way.*

*In the NEP20 under the Section Effective Governance and Leadership in HEIs, it is specified that All positions of authority and institution heads will be given to those with strong academic credentials, a track record of executive and leadership success, and the capacity to handle challenging circumstances.*

*The NEP has no gender disparity in its statement. That means women with the required qualifications and strong leadership skills have equal scope to occupy the decision-making, professions in Higher Educational Institutions. The data on women in leadership in India, however, presents a dismal picture notwithstanding this encouragement. According to the most current Times Higher Education Globe University Rankings 2021, 41 out of the top 200 higher education organizations worldwide, or 20% of them, are run by women. But as of 2020, India has over 1000 universities, divided into 159 Institutions of National Importance, such as IIMs, AIIMS, IISERs, IITs, NITs, and IITs, as well as 416 State Universities, 54 Central Universities, 361 Private Universities, and 125 Deemed Universities. But multiple studies reveal the percentage of woman vice-chancellors/Directors in India as shockingly 6.67%. That means only 54 Universities out of 810 institutions of higher education are headed by the woman academic leaders.*

*I hope the NEP 2020 will change this picture. The selection of academic leaders will not be based on old assumptions and prejudices. The problem of a glass ceiling and the notions of what a woman can perform will gradually change and many women academicians would soon emerge as leaders of Higher Educational Institutions and lead the Institutions as top-notch Institutions.*

## Findings and Analysis

Summarizing the analysis of quantitative MLQ and the qualitative responses from female leaders in higher education the research findings attention to the capabilities of female leadership which is transformational and it is due time for recognition of transformational female leadership in institutions of Higher Education in India. But the tendency to employ female leadership is often not very much present or obvious sort of investigation in higher education policy making at all levels unless it relates to (girl) student enrolment. Quality counts instead of equality is a justification often given to justify the under-representation of women leaders in higher education. In the Indian education system, more girls are enrolling, and more women are becoming faculty members but when it comes to leadership few females rise to a senior leadership position. In this context, we can say that number of female faculty may have increased, but the representation of females particularly in key leadership decision-making positions is still not much. This is research-based, evidence that stakeholders want to see more females in a leadership position they believe in women as transformational leaders. It is a known fact that there are many hurdles to women's leadership females are to date largely identified only with domestic spheres and family responsibilities. Sometimes economic background and socio-cultural backdrop also play a vital role in constraints if women pursue academic careers and aspire for leadership positions. Societies frame compelling messages regarding gender-appropriate behaviour. There is a very common notion that females cannot have authority over males while governing assemblage. Social circumstances overlap with gender while determining the status of women who can enter leadership positions.

This study shows that stakeholders are inclined to invest faith in transformational female leadership in higher education. The qualitative responses from successful female leaders quoted in this study show how females learn their job to be leaders and how important it is to develop oneself as a leader, how they have attributes to transform things for good, better, best, and excellent. In the higher education sector of India while implementing and executing NEP 2020 we need structured intervention to develop and encourage female leadership. In India, we need more formal mentoring arrangements for females aspiring to be leaders in higher education, and more programs focusing on capacity building and career advice to inculcate female leadership. Testimony of organizational management of academic culture of India, reports the patriarchal nature of higher education institutes, often standoffish towards females, when they aspire and show willingness and have proven attributes and credentials to rise to leadership positions.

## Observations

- The study reveals that we need to accommodate more women in leadership and their able leadership attributes must be more
- Their transformative leadership traits can add to the progress of India's higher education institutions.
- It is recommended that it is due time to find ways to eliminate the apprehensions when at times females are forced to believe by their social surroundings that if women rise to leadership positions it will be a diversion



from their commitment to family tie-ups.

- To undo the myth when females are led to believe that administration at the helm of leadership position is an extremely over demanding situation. To function as a leader, one requires 24x7 readiness to be available and females cannot give in to this performance-oriented demanding academic culture in organizational management as leaders.
- Those female leaders whose responses are quoted in this study and some other distinctive female leaders like them who serve in key leadership positions are contended with what they have achieved and are serving as an inspiration to other women out there aspiring to be future leaders in Indian higher education institutes. Mentoring and training programs must be organized under such leaders. The empowered and able guidance of such female leaders will empower other women.
- Empowered women indeed empower other women. For these women, their academic skills and excellence are transferred into their competencies as leaders. Recognition of the compatibility of female leaders with transparency is required.
- Appointment in a leadership position must not be vulnerable to gender preconceived notions, men with high visible public profiles are preferred and here calculations often go against women. This must be rectified by taking necessary steps at all levels.
- Policy making and regulations of recruitment of individuals on leadership positions need to be reviewed that give way to more transparency and accountability to let women in decision-making positions in institutes of higher education.
- More evidence-based research on female leadership must be vigorously done and findings must be submitted for review by the policymakers and government bodies.
- The study shows that stakeholders believe in females as transformational leaders. Stakeholders show total readiness to support the policymakers and recruiting bodies if they aspire to appoint female leaders in a key position in institutes of higher education. When stakeholders believe in females the Matriarch as transformational leaders, while implementing New Education Policy in India it is high time, to make leadership positions more accommodating and welcoming for women.
- Women who want to rise to leadership roles in higher education must be encouraged. Disturbing elements for females to rise to key positions include inaptness or having an aversion to politics and networking, male domination, administration, and lessening of one's research and academic platform. When a woman is in charge, seclusion and aloofness breed antagonism from male co-workers who fail to appreciate the capabilities and influence of female matriarchs as transformative leaders. Plans and strategies are required to be made in these aspects to make the conditions conducive for females to aspire for the leadership position in institutes of higher education in India while implementing and executing NEP 2020.

## Conclusion

In closing lines, I recall the confident thought-provoking words of transformational female leader Honourable Hansa Mehta. She served as the Vice-Chancellor of the Mumbai-based SNDT Women's University. She was

appointed vice-chancellor of Baroda University in 1949. She was the first female Vice-Chancellor of India to head a university that was not confined just to women. She voiced for social, economic, and political fairness for females and shared her opinions in the assembly on how women would be affected by the implementation of basic rights. She advocated for political, social, and economic fairness for women and expressed her ideas in the following soul-stirring manner at an assembly.

*The typical woman in our nation has endured inequities imposed on her by people whose laws, traditions, and practices have regressed from the heights of the civilization we are all so proud of for generations. Today, thousands of women are excluded from basic human rights. The Indian female has been rendered so vulnerable that anyone looking to profit from the situation may easily prey on her. Man has degraded himself by demeaning women. The name of Mahatma Gandhi has been used on the floor of this House, and it has been said that by uplifting her, man would not only elevate himself but also the whole country. I would be lacking in appreciation if I did not recognize Mahatma Gandhi's immense debt of gratitude for everything that he has done for Indian women. Without the support of women, our old nation cannot take its proper and valued position in this world. I thus warmly regarded this Resolution for the immense potential it embodies and hopes that its goals will be realized rather than only remaining on paper.* ([https://netri.co/wp-content/uploads/2020/08/hansa\\_compressed.pdf](https://netri.co/wp-content/uploads/2020/08/hansa_compressed.pdf))

Let us all applaud the rising of Matriarchs and the strength and transformation that can be brought by encouraging female leadership. By giving due recognition to Matriarch – the female leadership in institutions of higher education in India while implementing New Education Policy, we'll contribute to the 2015 global adoption of the 2030 Agenda for Sustainable Development by all UN member states and offers a common vision for world peace and prosperity, a safe, secure present, and a bright future for humanity. We will be directly contributing to human development and SDGs 4, 5, and 16 and equally contributing to all other goals in one or other way by promoting female leadership in higher education. The 17 SDGs (Sustainable Development Goals), aim at making the world harmonious, peaceful, and a better place to live in for present and future generations. It is a clarion call for action for promoting and encouraging female leadership in higher education, it can be firm and steady steps towards making a stronger Nation, New India @75.

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## **An Investigation into the Implementation of a Mentoring Program for EFL Novice Teachers at an English Center in the Mekong Delta**

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**Abstract:** Professional development (PD) plays a crucial role in promoting teachers' linguistic competence and teaching quality, contributing to enhancing and maintaining sources of effective teachers, especially novice teachers with little teaching experience. Mentoring has emerged as a PD activity in which a novice teacher is mentored and directly supported in various aspects by an experienced professional. It has been popularly adopted in several countries in the world, including Vietnam. This study was conducted to investigate the extent of various types of support that the mentoring program provided. Additionally, it aimed at exploring the level of satisfaction of EFL novice teachers regarding the types of support in the program. The study was designed as a mixed-method study, using a questionnaire and interviews as data collection instruments. The study involved the participation of twenty-two EFL novice teachers who have less than three-year experience in teaching and took part in a mentoring program held by a private English center in the Mekong Delta. The finding showed that all types of support in the program, including instructional support, emotional support, physical support, and institutional support were provided to a high extent. The participants hold a high level of satisfaction with these types of support. Based on the findings, some recommendations were suggested to promote the quality of the program and meet participants' needs and expectations.

**Keywords:** Mentoring programs, EFL novice teachers, Support novice teachers

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### **Introduction**

Mentoring has emerged as a popular professional development strategy for both novice and experienced teachers worldwide. It has become the key feature of induction and continuous improvement in a wide range of settings, including teaching. Nowadays, mentoring has played a prominent role in assisting teachers' initial preparation, induction, and early professional development (Crisp & Cruz, 2009) and has been proven to boost novice teachers' confidence, skills, and motivation (Zembytska, 2015). In the context of Vietnam, the English language has become the first foreign language in schools and universities. The National Foreign Language 2020 Project of the Ministry of Education and Training has been a lever to encourage almost every language

institution to organize a variety of professional development programs to help EFL teachers to improve their teaching practices. Nevertheless, retaining effective teachers poses a problem for every educational institution. Inexperienced educators are encountering a range of challenges, such as career motivation, deficient competencies, and psychological distress, particularly when their academic training is overly theoretical. It is imperative for educators to bridge the divide between academic knowledge and practical application in the field of teaching. Insufficient support has been identified as a primary factor contributing to the high rate of attrition among novice teachers within their first year of teaching. Its efficacy has been substantiated by various studies. (Crisp & Cruz, 2009; Ehrich et al., 2004). It is believed to help novice teachers facilitate their professional growth (Peeler & Jane, 2005; Wang et al., 2008). The impact of mentoring on novice teachers has been popularly supported in Western contexts (Peeler & Jane, 2005; Wang et al., 2008); however, there is little research concerning the roles of mentoring in enhancing novice teachers' professional development in the Vietnamese context in general and in particular, the Mekong delta. For the reasons above, this study was conducted to gain insights into these interests to operate PD programs for novice teachers so that their effectiveness can be maximized.

## **Teacher Professional Development**

The concept of teacher professional development involves a systematic approach whereby educators engage in individual or collaborative efforts to enhance their teaching performance, expand their knowledge base, and improve their psychological interactions. These efforts are deemed essential to the advancement of their teaching careers (Day, 1999). Additionally, Craft (2002) added that professional development refers to teacher professional improvement as a result of reflecting and learning through both personal experiences such as workshops, short-term or long-term training programs, and informal learning through professional publications, and documentaries about education. The development is also likely to influence perspectives and methods and thus may contribute to the enhancement of the way people learn and teach (Day & Sachs, 2004). The goals of professional development initiatives are twofold: to empower and assist educators, irrespective of their teaching location or professional background, and to provide optimal instructional assistance to enhance their competencies, confidence, and dedication, while also fostering a sense of gratification in their teaching practice (Day & Sachs, 2004).

## **Mentoring**

Emerging in the early 1980s, the concept of mentoring was initially implemented as a strategy to address the prevalent issue of high turnover rates among inexperienced educators in various nations (Feiman & Nemser, 1998). Anderson & Shannon (1998) defined mentoring as a nurturing process in which a more experienced teacher teaches, sponsors, encourages, and counsels a less experienced one for boosting later professional and personal development. (Giannakaki et al., 2011) described it as the support offered by a more experienced person for the growth and improvement of another, and for their integration into and acceptance by the

community.

### **Why needs mentoring**

The shift from the role of a student teacher to that of an autonomous teacher can be perceived as a jarring encounter. Blakley (2006) described this process as a “reality shock” as novice teachers’ expectation confronts reality. The researcher discovered that inadequate support has been the primary factor affecting the professional growth of inexperienced educators. It was pointed out that successful induction programs play crucial roles in assisting new teachers to overcome challenges, boosting their coping ability, and helping them reduce their doubts about their decision to teaching careers (Blakley, 2006). Throughout decades, mentoring has been accepted as an effective strategy for supporting student teachers to step into their teaching profession (Sundli, 2007). Lai (2006) supported this viewpoint by stating that mentoring can prepare new teachers with opportunities to learn within the context of teaching. Successful implementation of mentoring programs has been believed to provide novice teachers with various types of effective support during the induction stage.

### **The types of support for EFL novice teachers**

When studying the roles of mentoring for beginning teachers, Lipton & Wellman (2001) pointed out four types of support that new teachers primarily need to be provided during the early stages of their careers. These four types of support were subsequently consolidated and strengthened by Tina H. Boogren (2012) when she studied strategies to support new teachers.

#### **Physical Support**

According to Boogren (2012), new teachers, when confronted with a new teaching environment, often face resources, materials, and logistical issues. The assistance in relation to these aspects is considered to be physical support. It involves helping new teachers with school procedures such as getting familiar with the paperwork system, arranging furniture, managing teaching materials provided, and the like. Novice teachers only need this type of support for a certain period when they have just started to get familiar with a new environment. Physical support is likely to assist new teachers with daily concerns and familiarize them with the operation and function of the new educational environment. Boogren (2012) also recommended some strategies to support new teachers. It is advisable that mentors can give a tour of the new school to familiarize new teachers with the environment, introduce them to the physical layout of the school and explain to them how to perform their duties and tasks. Another activity is to help describe a typical day in a classroom including school time, regulations, common size and capacity of the classrooms as well as how to arrange facilities and resources in the class. In addition, the author suggested that mentees should receive guidance on the utilization of technological equipment provided by the educational institution, including but not limited to projectors, televisions, and CD players.

### **Emotional Support**

Emotional support has been researched in many studies, most of which revealed it strongly benefits novice teachers from strengthening their psychology during the period of socialization in teaching to enhancing teachers' level of confidence in teaching performance (Bradbury & Koballa, 2008; Salleh & Tan, 2013). The feeling of fatigue, isolation, and self-doubt lead to pressure and stress during a few first years of a career. New teachers often find it difficult to balance work and personal life. The individual experiences self-doubt regarding their capacity to manage their workload, leading to uncertainty regarding the continuation or termination of their teaching career. According to Nora & Crisp (2007), emotional support mainly involves psychological issues including the sense of listening, offering moral support as well as a kind of relationship in which common understanding, the connection between mentors and mentees, and problem recognition can be easily found. Emotional support is mainly provided through collaborative interactions and reflective activities on pedagogical issues in mentoring activities.

### **Instructional Support**

After the beginning stage in which novice teachers need to be provided with physical and emotional support, they begin to settle into their crucial role which is teaching. At this phase, high-quality instructional support becomes their vital need. Boogren (2012) viewed this stage as an appropriate time to ensure that beginning teachers are using effective instructional strategies in the classroom, facilitate their current skills of these strategies and guide them towards the improvement of expertise level. Boogren (2012) pointed out that mentees should be provided with timely instructional support to boost their professional skills and enhance their level of expertise with an eye toward future performance. This puts an expectation on mentor teachers to well master pedagogical knowledge and skills (Alhija & Fresko, 2014; Aspfors & Fransson, 2015).

### **Institutional Support**

As new teachers complete their certain time dealing with psychological issues, gaining confidence in teaching, and improving their instructional strategies, they may consider their opportunities for growth and development on a greater scale. They begin to seek expansion in the connection and relationship with their coworkers, school, district, and educational systems (Boogren, 2012). At this phase, mentors should assist them with institutional support. This kind of support helps new teachers find their place in their teaching profession. According to Schaefer et al (2012), teachers in their early years rely upon the connection with others. They need to be offered support that goes beyond mentoring and induction which can encourage and improve these connections. Birkeland & Johnson (2002) concurred that having their roles in the faculty, positive relationship with colleagues and the presence of supportive structures bring a sense of success to beginning teachers during the first stage of their career. The social environment provides a strong underpinning for beginners to develop their personal identities and allow the empowerment of teachers' development (Uusimaki, 2013). To facilitate the relationship to work effectively, mentoring training should consist of contextual dimensions and an



understanding of the institution's culture and context (Aspfors & Fransson, 2015). In this way, mentors could understand and master a high level of sensitivity to contextual and cultural differences in the school (Aspfors, & Fransson, 2015).

## Participants

A sample of 22 participants, who are EFL novice teachers, were selected to participate in a mentoring program at a language center for the purpose of gathering quantitative data. The sample population comprises of 15 individuals who identify as female, representing 68.2% of the total, and 7 individuals who identify as male, accounting for 31.8% of the total population. All individuals fall within the age range of 22 to 29 years. The majority of participants are recent graduates who possess a Bachelor's degree in English teacher education and English language studies.

With respect to teaching experience, the individuals involved possess limited teaching experience, spanning from under one year to three years of teaching. Two participants indicated a lack of prior teaching experience, while thirteen out of twenty-two participants reported having less than one year of experience as tutor. Additionally, seven novice teachers reported having one to three years of teaching experience as part-time instructors at private centers.

## Research instruments

The investigation employed a combination of quantitative and qualitative methodologies, thereby facilitating a comprehensive comprehension of the research concerns. A questionnaire was developed utilizing a Likert scale consisting of five points to gather numerical data. The survey comprises 35 items that were developed in accordance with Boogren's theories (2012) on supporting novice teachers. The interview data were interpreted based on the framework of the rating scale adapted from Oxford (1990). There are four ranges of levels that are shown in the table below.

Table 1. Rating scale adapted from Oxford (1990)

Levels	The extent of support	Satisfaction
4.5 to 5.0	Very high	Very satisfied
3.6 to 4.4	High	Satisfied
2.5 to 3.5	Medium	Medium
1.0 to 2.4	Low	Unsatisfied

Before distribution to the participants, the questionnaire underwent translation into the Vietnamese language, as not all respondents were proficient in English, particularly those who were not majoring in the language. Then the questionnaire was checked by using SPSS to calculate its Cronbach's coefficient alpha. The pilot questionnaire has a Cronbach's coefficient alpha value of 0.855. Following the piloting phase, the questionnaire

was formally utilized to collect quantitative data, as evidenced by a Cronbach's coefficient alpha exceeding 0.9, indicating the questionnaire's reliability.

Table 2. Cronbach's Coefficient Alpha

Reliability Statistics	
Cronbach's Alpha	N of Items
0.906	22

Qualitative data was gathered through the implementation of semi-structured interviews, which were subsequently transcribed to unveil the findings. Eleven open-ended questions were formulated in accordance with the questionnaire's content. In order to acquire qualitative data, semi-structured interviews were administered to a sample of 6 participants who were selected at random and had previously completed the questionnaires. The interviews were recorded in audio format, transcribed, and subsequently translated into the English language. The participants were duly apprised that their personal data would be utilized solely for research objectives and maintained in a confidential manner.

### Results from the questionnaires

Table 3 provides statistics for each category of teacher support. The degree of four types of support was high. Physical and instructional support received the highest scores ( $M=4.27$ ,  $SD=.45$ ;  $M=4.27$ ,  $SD=.42$ ) while the lowest score can be seen in instructional support ( $M=3.90$ ,  $SD=.58$ ). The mean score for emotional support was above 4.0, specifically at 4.19 ( $SD=.59$ ).

Table 3. Descriptive Statistics of Four Types of Novice Teacher Support

Types of support	N	Min	Max	Mean	SD
Physical support	22	3.33	4.83	4.27	.45
Emotional support	22	3.20	5.00	4.19	.59
Instructional support	22	3.38	5.00	4.27	.42
Institutional support	22	2.60	5.00	3.90	.58

The following table displays the degree of physical assistance provided to inexperienced teachers in the mentorship program.

Table 4. The Extent of Physical Support

No.	Physical support	Disagree %	Neutral %	Agree %
1	I was introduced to important locations including classrooms, libraries, teacher rooms, administrative offices, and so on.	4.5	0.0	95.5
2	I was provided with essential teaching materials for	0.0	9.0	91.0

	every lesson.			
3	I was offered to use technological devices such as TVs, CD players, projectors...	0.0	9.1	90.9
4	I was instructed to arrange a typical classroom.	0.0	22.7	77.3
5	I was told about a typical lesson including classroom size, time rules, classroom regulations...	4.5	18.2	77.3
6	I was assisted in printing teaching materials before the lessons.	4.5	4.5	91

Table 4 reveals that a majority of the mentees received significant support in the physical aspects of the mentoring program. Four out of six items (Item 1,2,3,6) hold a very high proportion of agreement levels (from 90.9% to 95.5%) which means that the extent of physical support in relation to institutional familiarization, teaching materials, technological devices, and printing service is very high. The percentage of participants' disagreement and neutrality of these items is minor (less than 9.1%). Regarding physical support in arranging typical classrooms and providing typical lesson information (Item 4,5), results indicated that the intensity of support is quite remarkable (77.3%).

The table below illustrates how novice teachers received emotional support through the mentoring program.

Table 5. The Extent of Emotional Support

No.	Emotional support	Disagree %	Neutral %	Agree %
7	My mentor listened to my difficulties actively and supportively.	4.5	4.5	91
8	My mentor and I usually contacted each other via email, message, or phone call.	0.0	18.2	81.8
9	My mentor usually asked how I felt after my lesson.	0.0	4.5	95.5
10	I often got encouraging messages from my mentor.	0.0	13.6	86.4
11	We celebrated success when I had improvement in teaching.	4.5	18.2	77.3

Table 5 displays data indicating that the degree of emotional support is statistically significant, with participant agreement percentages ranging from 77.3% to 95.5%. The table above highlights that item 6 "My mentor usually asked how I felt after my lesson" received the highest agreement rate of 95.5% among participants. Only 4.5% of participants remained neutral, and no one expressed disagreement with it. The active and supportive listening skills of mentors during the program (Item 7) were highly appreciated by 91% of the respondents. Two forms of emotional support, namely frequent contact (Item 8) and receipt of positive messages from mentors (Item 10), have garnered a significant level of agreement among participants, accounting for 81.8% and 86.4% respectively. 77.3% of the mentees agreed with Item 11 which states that "We celebrated success when I had improvement in teaching." whilst the percentage of neutrality and disagreement is 22.7%.

The extent of instructional support which novice teachers received in the mentoring program is presented in the following table.

Table 6. The Extent of Instructional Support

No.	Instructional support	Disagree %	Neutral %	Agree %
12	My mentor helped me set appropriate growth goals.	0.0	18.2	81.8
13	My mentor used a scale to measure my growth in teaching	4.5	22.7	72.8
14	I was given constructive feedback after every lesson.	0.0	0.0	100.0
15	My mentor helped me identify my strengths and weaknesses.	0.0	4.5	95.5
16	My mentor encouraged me to have a reflection on improving my teaching performance.	0.0	13.6	86.4
17	My mentor and I usually discussed effective teaching ideas.	0.0	9.1	90.9
18	My mentor helped me establish a common language of instruction.	0.0	4.5	95.5
19	My mentor instructed me on how to deal with unexpected situations in the classroom.	0.0	18.2	81.8

Data from Table 6 indicated that the majority of participants surveyed concurred with the high support in terms of instructional aspects. Specifically, the outstanding point from the above table is seen in Item 14 which investigated the extent of support regarding giving constructive feedback in the program. Interestingly, 100% of participants highly appreciated the feedback that their mentors provided after every lesson. A very high percentage of participants (95.5%) agreed that their strengths and weaknesses were identified by their mentors (Item 15). Similarly, the same proportion is seen in Item 18 which stated that “My mentor helped me establish a common language of instruction.” Additionally, a significant number of participants showed their agreement with their mentors’ crucial roles in setting appropriate growth goals, encouraging teaching reflection, and familiarizing with unexpected situations (Items 12,16,19), accounting for 81.8%, 86.4%, and 81.8% respectively. Controversial ideas were seen in Item 13 with 4.5% of respondents expressing disagreement and 22.7% expressing neutrality.

The following table reports how physical support was provided to novice teachers in the mentoring program.

Table 7. The Extent of Institutional Support

No.	Institutional support	Disagree %	Neutral %	Agree %
20	I was encouraged to have collaborative time with peer teachers.	4.5	31.8	63.7
21	I was given opportunities to establish relationships with other teachers.	4.5	13.6	81.9
22	I was encouraged to take part in extracurricular activities.	9.1	40.9	50.0

23	I was invited to workshops, conferences, and small talks to share teaching experiences.	13.6	9.1	77.3
24	I knew the people whom I should contact to have appropriate support.	0.0	9.1	90.9

Data from Table 7 reveals that a majority of the participants received some level of institutional support, although the degree of support was not particularly significant. Only Item 24 which stated that “I knew the people whom I should contact to have appropriate support.” has the highest percentage of participants’ agreement (90.9%) and 0% of participants’ disagreement. More than 80% of participants agreed that they were given opportunities to establish a relationship with other teachers (Item 21). Conversely, mentees reported that they did not receive significant institutional support in relation to having collaborative time with peer teachers, taking part in extracurricular activities, and being invited to workshops, conferences, and small talks to share teaching experiences (Item 20,22,23). The percentage of agreement regarding these items was not high, ranging from 50% to 77.3%.

Regarding the level of teachers’ satisfaction with the types of assistance that they received in the program, Table 8 indicates that EFL novice teachers expressed a high level of satisfaction with all four types of support. The participants expressed the highest level of satisfaction towards instructional support, with a mean score of 4.45, and standard deviations of .956. Similarly, participants reported high levels of satisfaction, with both categories having the same mean score of 4.32, and standard deviation of .646 and .716, respectively. Institutional support had the lowest level of satisfaction compared with the other three types, yet its mean score was still above the scale 3.0 (M=3.82, SD=.907).

Table 8 Descriptive Statistics of Teachers’ Satisfaction

Types of support	N	Min	Max	Mean	SD
Novice teachers’ satisfaction with physical support	22	3.00	5.00	4.32	.646
Teachers’ satisfaction with emotional support	22	3.00	5.00	4.32	.716
Novice teachers’ satisfaction with instructional support	22	3.00	5.00	4.45	.596
Novice teachers’ satisfaction with institutional support	22	2.00	5.00	3.82	.907

## Results from the interviews

The qualitative data from the interviews provides additional information about the degree of support and teachers’ satisfaction levels with the support they received in the program.

Regarding physical support, the participants' responses were quite parallel to the surveyed results from the questionnaires. When the researcher investigated the degree of support regarding physical assistance, six out of six interviewees reported that they were well supported in terms of resources, materials, teaching tools, and logistic issues. One teacher expressed:

*"During the program, I was well supported in terms of written materials which are available in the center as well as teaching software from other teachers. Also, the classrooms are well equipped with technological devices such as projectors, TVs, and CD players."*

Another teacher added:

*"My mentor introduced me to the textbooks and materials that I should use. Additionally, there is a library in the center where I can read and borrow the books, teaching tools, and technological devices that I need to use for my teaching.."*

In terms of teachers' satisfaction with physical support, the results were very consistent with quantitative data from the questionnaire. 50% of questioned teachers were completely satisfied. 50% were satisfied and suggested improvements. One mentee said:

*"I feel really content with physical assistance. I was supported very well in terms of logistical issues. I was carefully instructed to borrow teaching tools and supplementary books regarding the places, means, and the people who were responsible for this aspect."*

Nevertheless, when being asked about the facility of the classrooms, two out of six teachers shared opinions about the size of the room. A teacher said:

*"Because the number of students exceeds the capacity of the classrooms, students find it difficult to move around, making group work impossible."*

Regarding emotional assistance, most of the mentees shared that they were greatly supported to overcome their emotional challenges. Four out of six participants reported receiving substantial emotional support from their mentors and coordinator.

*"I struggled with plenty of psychological issues in the classrooms. The pressure mainly came from my failure in teaching performance, my fear of the mentor's expectations, and the quality of the lesson plans. My mentor and I have daily meetings to share lesson plans, teaching ideas, and how to link activities in the plan. I really appreciate this."*

The majority of participants showed very high satisfaction with emotional assistance. Particularly, five out of six teachers reported that they felt completely satisfied and one teacher said that the support in terms of psychology was quite satisfactory. One teacher, who was strongly content with emotional assistance, noted:

*"Everyone in the program is very considerate. I always felt that I am welcomed in the center as well as in this program."*

According to a mentee, her mentor did not provide significant support for emotional challenges. Nevertheless, she was able to overcome these obstacles with the help of her coordinator's motivation. She responded:

*"I expected to be supported more to overcome my psychological issues. However, my mentor did not provide me with much support in this aspect. My mentor and I usually contacted to mainly discuss teaching ideas, but he did not give me many encouraging messages."*

In terms of instructional assistance, the results showed that 100% of participants agreed that they received a high

level of support. The primary source of aid was provided by the mentors. Additionally, most of the interviewees acknowledged that, in terms of instructional strategies, they struggled with plenty of challenges when they started to teach in real classrooms. One teacher remarked:

*“There was a huge difference between teaching theories and reality when I started to teach which was very shocking.”*

The majority of educators noted significant enhancements in their ability to create lesson plans, facilitate instructional activities, and execute teaching techniques. Their capacity to anticipate and resolve unforeseen situations in the classroom was also improved. A teacher notified:

*“My mentor supported me gradually in how to apply theories to reality. I was instructed to move from a beginner with no teaching experience to a teacher that can design an effective lesson plan. My mentor gave me lots of feedback which was useful and practical.”*

The participants feel highly satisfied with the instructional assistance. A mentee noted:

*“I feel very content about the support in relation to teaching strategies, academic knowledge and teaching skills. I learn a lot from several theoretical lessons and the informal talk for sharing teaching knowledge held from the mentoring program. In addition, I also appreciated the help of my mentor. I improved significantly thanks to my mentor’s instruction and feedback.”*

Regarding institutional assistance that was investigated in the interviews, 100% of the participants agreed that they were supported quite considerably in terms of establishing relationships and improving interaction and connection among mentees, their mentors, and the program coordinator. To be more precise, four out of six teachers appreciated the weekly meetings among mentees that were regularly organized by the program coordinator. They had opportunities to share knowledge about the teaching techniques that they learned and the psychological problems they faced with. Two mentees emphasized their high appreciation for the regular workshops which were held by experienced teachers in order to give them effective teaching ideas and strategies. A mentee noted:

*“After each theoretical session taught by the center’s skilled teachers, other mentees and I would normally have a casual conversation with them to share our understanding of teaching techniques.”*

A teacher appreciated the friendly and close-knit environment in the program. She said:

*“All of us were always invited to conferences, workshops, professional development programs, and even special events such as the center’s founding ceremony and year-end party. We felt that we were treated as members of a family.”*

Regarding teachers’ satisfaction with institutional support, the results from the interview show that they were quite satisfied with it. Four out of six participants reported that they were quite content about institutional support while the other two participants showed strong satisfaction with this type of support. A mentee, who expressed high satisfaction with institutional support, notified:

*“I felt satisfied with this support. For example, on my first day participating in the program, there was a program coordinator who took me around the center and introduced me to every member of the departments. I had the feeling of being welcomed.”*

## Discussion

The current research examined the execution of a mentorship initiative for EFL inexperienced instructors at a language center. The study specifically examined the nature of support provided to novice teachers within the program, as well as their level of satisfaction with the support they were given. The findings of this study indicate that there exist both similarities and differences when compared to the previous related studies and the conceptual framework of beginning teacher support as proposed by Boogren (2012).

The study's results indicate that the mentoring program offered all four categories of support, namely physical, emotional, instructional, and institutional support. The level of support provided in relation to these aspects was extensive and greatly valued by the majority of novice teachers. This discovery aligns with the results reported in previous studies conducted by Lipton and Wellman (2001), Boogren (2012). The researchers placed particular emphasis on the provision of specialized assistance pertaining to pedagogical concerns. This perspective aligns with the current research results, which indicate that instructional support was the most frequently provided type of support. The present investigation corroborates the perspective put forth by Paula & Gr̄infelde (2018) that emphasizes the significance of instructional strategies, including classroom management and effective implementation of teaching activities within the classroom setting.

Additionally, the results of the current investigation indicate that emotional support was provided in a robust and explicit manner by mentors and the program coordinator, and was deemed to be of great importance for ongoing maintenance beyond the program's duration. This discovery aligns with the research conducted by Abu Bakar (2016), which revealed a significant correlation between mentoring programs and emotional and psychological support. Nora and Crisp (2007) further substantiated this perspective. The provision of emotional support was also valued by the individuals. The researchers conducted an investigation into the effects of mentoring programs on mentees' emotional well-being. They found that mentors who actively listened provided encouragement, and offered ongoing support after the program had a positive impact on the mentees' emotions.

In comparison to prior research on the implementation of mentoring programs, the present study diverges in its emphasis. A notable trend among previous studies is their concentration on instructional support, including but not limited to lesson planning, feedback provision, and mentorship responsibilities. The study did not prioritize other facets such as psychological assistance, physical assistance, and institutional support. There is a paucity of research that has examined all forms of support concurrently. Nevertheless, it is my firm conviction that novice educators require comprehensive support beyond matters pertaining to instruction. According to Boogren's (2012) findings, there is evidence to suggest that despite possessing effective instructional strategies and teaching abilities, a number of teachers tend to exit the profession. Insufficient support in other aspects can be a contributing factor to this issue. The present research is centered on examining four fundamental categories of assistance provided to novice educators, with the aim of determining which one requires augmentation or enhancement to fulfill the requirements and anticipations of mentors. This has the potential to mitigate attrition



and preserve the source of proficient educators.

## Conclusion

The study was conducted to seek answers to two questions (1) To what extent have EFL novice teachers been supported during the mentoring program? and (2) To what extent are novice teachers satisfied with the support they received during the mentoring program?

The study was carried out with the involvement of 22 EFL novice teachers who have worked as new teachers of English in a foreign language center in the Mekong Delta and volunteered to participate in a mentoring program for new teachers. To address the research inquiries, this study utilized two data collection instruments, including questionnaires and interviews. Data analysis and interpretation were conducted with the aid of SPSS 20.0 software and interview protocols. The study's primary outcomes are succinctly outlined as follows.

Regarding the extent of support provided to novice teachers, the questionnaire data indicates that a majority of them received highly significant support in terms of physical, emotional, and instructional aspects whilst the extent of institutional support that they were provided was not as much as teachers' expectation. In terms of physical support, novice teachers agreed that they were quite fully supported with logistical issues including teaching materials, teaching tools, technological devices and detailed instructions for using them. A majority of teachers reported that they were significantly provided with emotional support. The mentees regularly engaged in close communication with their mentors, who demonstrated exceptional listening skills and provided constructive feedback to enhance their pedagogical practices. The data also revealed that instructional support was given to mentees to the highest extent. Mentees highly appreciated the support in terms of instructional areas such as giving constructive feedback, discussing teaching ideas, and lesson plans, practicing reflective teaching, dealing with unexpected situations in the classrooms, and the like. Regarding institutional support, The participants reached a consensus that the level of assistance provided was considered substantial. They appreciated institutional assistance in terms of expanding relationships with colleagues, having assistance from other teachers, and taking part in PD activities such as conferences, workshops, and short-term training programs.

Regarding novice teachers' satisfaction with the types of support they were offered in the program, the data from the questionnaire indicated that the majority of novice teachers were highly satisfied with four types of support during the mentoring program. More precisely, instructional support was deemed the most satisfactory, while institutional support was identified as the least satisfactory form of support. The data indicated that EFL novice teachers expressed high levels of satisfaction with four specific types of support provided to them through the mentoring program. The study participants put forth recommendations for enhancing the level of support in the program, with a view to improving overall satisfaction. The adequacy of classroom infrastructure, including the dimensions of the learning spaces and the availability of technological equipment, warrants careful

consideration. The majority of the participants expressed a greater degree of concentration toward the subject matter of the lesson plan.

### **Recommendations for the future mentoring activities**

In light of the major findings from this present study, several implications can be suggested as follows with the purpose of improving the quality of mentoring activities and meeting the participants' expectations towards mentoring programs for novice teachers.

The research findings suggest that mentoring program coordinators should prioritize providing institutional support to a greater degree. The significance of instructional and emotional support in facilitating the entry of novice teachers into the teaching profession is widely acknowledged. Nevertheless, institutional support assumes a pivotal role in enabling them to contemplate their prospects for advancement and progress on a larger scale, thereby contributing to the reduction of teacher attrition rates. Mentees can find their place in a new environment and develop personal identity. Program designers may facilitate weekly meetings to encourage sharing and learning among mentees. This can provide opportunities for mentees to expand their professional network and gain insights from their peers, which can enhance their emotional and instructional support. It is strongly advised that novice educators be afforded occasions to engage in collaborative endeavors with peers who instruct comparable grade levels and share analogous pedagogical interests. Collaborative activities such as joint work sessions, lesson plan development, pedagogical discourse, and the exchange of scholarly findings can be undertaken by educators.

The research findings indicate that there is a strong expectation for instructional support to be provided to the greatest degree possible. It is recommended that future mentoring activities prioritize instructional issues, such as the utilization of effective instructional strategies in the classroom. The mentoring process should aim to facilitate the mentee's current skills in these strategies and guide them toward achieving a higher level of expertise. During this phase, mentors play a crucial role in directly enhancing the practice of their mentees. The process of mentor selection should be conducted with great care to ensure alignment with the specific needs of the mentees. An effective mentor has the ability to provide both efficacious instructional guidance and emotional encouragement.

During the mentoring process, it is imperative for a program coordinator to possess a comprehensive understanding of the pivotal role that co-teaching and feedback provision play in augmenting the performance of mentees. It is recommended that the duration of the program be extended in order to facilitate the effective participation of mentees in co-teaching activities. The phase of theoretical revision ought to be suitably structured to ensure that protégés are afforded sufficient time to implement their acquired knowledge in practical settings, enabling them to navigate unforeseen circumstances and adapt their pedagogical approach accordingly. Additionally, mentors take vital roles during the co-teaching stage as they directly instruct and contribute to forming teaching styles for their mentees. Therefore, it is advisable that program leaders should be cautious

when pairing mentors and mentees. They are recommended to have similar teaching interests and fields.

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## An Analysis of Vietnamese Learners' Errors in English Speaking

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**Abstract:** This paper reports on an error analysis that examined the errors produced by Vietnamese EFL learners in speaking. The research design was decided to support a clear framework for collecting, analyzing, discussing, and interpreting data to examine possible influences of the mother tongue on English grammatical errors. 30 natural conversations and 20 follow-up interviews were employed as data collection instruments. The questions for the conversations covered topics related to the participants' interests and backgrounds to create a comfort zone for them. The follow-up interviews allowed the authors to unpack the error sources. The findings reveal that learners' errors belong to three main types: lexical, syntactical, and phonological aspects. These errors are caused by at least six sources: learners' lack of English knowledge, insufficient practice and lack of exposure to English-speaking environments, the direct translation of L1 grammar rules, imitation based on supposed linguistic similarities, learning-for-exam pressure, and less advantaged geographical residency and English learning conditions. On the one hand, these errors and their sources can explain learners' incompetencies. On the other hand, this paper argues that some of these sources are utilized as speaking strategies that learners initiate to sustain communication. Errors, in this sense, are embedded with the active agency rather than being viewed as mere linguistic gaps created by learners' incompetencies. As such, L1 interference is sometimes positive and contributes to learners' L2 learning processes.

**Keywords:** Error analysis, learners' errors, grammatical errors, L1 interference, Vietnamese EFL learners

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### Introduction

#### An overview of research on EFL learners' errors

Accomplishing fluency in speaking English requires English as a foreign language (EFL) learners to have communicative competence which includes the knowledge of the language and the capacity to utilize the knowledge of actual communication. To become influential in discourse competence, a learner needs to participate in a variety of speaking activities such as role-plays, debates, information gaps, acting from a script, discussions, problem-solving activities, decision-making activities, quizzes, gapped dialogues, questionnaires,

and story-telling. Some learners sometimes make mistakes and at other times, errors. While mistakes are mostly caused by learners' carelessness or forgetfulness of grammar knowledge, it is difficult to avoid errors even when they speak English with others under the influences of their first language (L1). Exploring the types of errors and their causes under the influences of L1 always deserves space for empirical research in different contexts.

Research on the influences or interference of L1 on the target language (L2) errors can be classified into several streams. For example, a popular strand that focuses on grammatical errors in English writing under the influences or interference of L1 (Kazazoğlu, 2020; Maros et al., 2007; Qasem, 2020; Watcharapunyawong & Usaha, 2013). These studies have collectively pointed out the interference of L1 on several types of errors in English writing that include tenses, word choice, articles, prepositions, modals and auxiliaries, forms of verbs, plural and singular nouns, sentence structures, sentence fragments, pronouns, transitional devices, subject-verb agreement, run-on sentences, parallel structures, and comparatives. Some errors in writing may also include the utilization of grammatical rules and vocabulary choices (Brown, 2000; Corder, 1967; Ellis, 1997). These researchers have collectively categorized errors into 10 types: omission of a subject (verb, object), complement, incorrect verb construction (serial verb construction), the plural form of nouns, compound/ complex sentence structure, word order, "there" structure, fragment, run-on sentence, and word-by-word translation.

The second strand of research focuses on errors in speaking (Bui, 2016; Subanduwo, 2017). The findings of the second stream point out that mistakes in pronouncing English consonants are made under the interference of L1 consonants that do not have equivalent ways of pronouncing. The third strand explores the interference of L1 on some particular forms of errors in English such as word order (Al-Khresheh, 2010), usage of prepositions (Gvarishvili, 2013), word choice in writing (Erkaya, 2012), learners' acquisition of English syntax and lexis (Islam, 2020), or comparing English grammatical errors across countries (Eng et al., 2020).

Research on errors produced under the effects of L1 and their causes in the Vietnamese context is also burgeoning and is divided into some streams of writing, pronunciation, and word usage. For example, Vu (2017) finds that Vietnamese EFL learners tend to transfer L2 into L1, causing errors of either overproduction or underproduction in word choice, articles, prepositions, pronouns, and possessive cases. Similarly, Linh and Vien (2020) explore the causes of Vietnamese high school EFL students' errors in word choice, plural nouns, tenses, prepositions, articles, subject and verb agreement, word order, and relative clauses. These researchers find that these errors are caused by the students' language transfer, lack of grammatical knowledge, carelessness, and lack of frequent practice. Bui (2016) examines the difficulties among Vietnamese EFL learners in pronouncing the consonants /θ/ và /ð/ as these two sounds do not exist in Vietnamese. They pronounce them as either /t/ or /tʰ/ instead. Bui (2022) investigates Vietnamese EFL learners' misuse of cohesive devices in writing and discovers that these learners often use references, conjunctions, and lexical items incorrectly. Nhut (2020) analyzes the errors in tenses, subject and verb agreement, plurality, and word order produced by Vietnamese EFL learners by comparing the grammar of Vietnamese and English languages. His study argues that these errors are caused by the interference of students' knowledge of Vietnamese grammar in their use of English grammar in writing.

The findings of these studies are important in forming an understanding of different types of errors made by EFL learners in different contexts. However, the research corpus on English speaking errors produced by Vietnamese learners is not very colorful. Many current studies have concentrated on particular aspects of errors and analyzed the causes in isolation. Instead, the authors of this paper took quite a different stance by analyzing the systemic effects of the causes of errors.

## **The study and its significance**

The study reported in this paper is situated in the growing corpus of research on EFL learners' errors. This study raises two main research questions:

- (1) What errors are commonly produced by Vietnamese EFL learners?
- (2) What causes the errors?

The answers to these two questions allowed the researchers to draft some recommendations for teaching and further research. On the one hand, this paper is congruent with the diverse strands of current research. It continually explores grammatical errors among Vietnamese EFL students to validate the findings produced in the body of previous research. The findings of this study also add more nuance to the body of research on Vietnamese EFL learners' errors in English speaking given that English has recently been considered one of the instrumental languages for Vietnam's deeper integration into the world's market (Nguyen, 2021), but this country was ranked in the last position in the league of 60 countries with moderate proficiency (English Proficiency Index, 2022). It does so by analyzing the errors in spoken English among Vietnamese EFL university students and the reasons caused by L1 interference in English speaking. On the other hand, the authors argue that learners' errors should be identified, categorized, and analyzed for examining the causes of errors and to discover the measures to decrease errors. L1 interference L1 is one of the main causes of impacts on L2 speakers to output errors. The investigation of the influences of L1 interference may support pedagogical implications on second language learning and teaching in EFL/ESL context (Corder, 1967). It is important to examine errors in L2 speaking with a concentration on the interplay of errors and L1 interference.

This paper begins with the literature section that reviews the common perceptions of mistakes and errors before discussing the interference of L1 on L2 errors. The literature review then conceptualizes ways to explore errors by using the theoretical lens of error analysis which is used to analyze the empirical material collected in this study. The findings are discussed before the conclusion and recommendations for teaching practices and further research is outlined at the end of the paper.

## **Literature Review**

### **Mistakes and errors**

Many people get confused about the identity of mistakes and errors when speaking English. Ellis (1997) points out that an error is an outcome of lacking knowledge (technical sense). It reflects the gap in learners' knowledge

in which they are not able to notice the correct grammar or not when speaking. A mistake reflects the process of failures as a consequence of competing plans, memory limitation, and lack of automaticity. Importantly, Nababan (1993) emphasizes that a learner may make grammar mistakes when speaking with others due to tiredness or lack of concentration. Learners may make the same errors in communicating, and those errors are not repaired soon because the basic factor of the errors is not finished systematically by the target language learners. They need a teacher to correct them. In a nutshell, a mistake shows learners' misuse of the language while an error reflects their lack of knowledge of particular linguistic aspects in operation.

The boundary between these two concepts seems to be agile. For instance, a learner may have learned about the usage of relative clauses in speaking, but this person has not had a chance to practice it in real situations for a long time. He or she may forget all about this grammar point and cause a mistake in communication. Is this mistake also an error as this person needs a fluent speaker or teacher to explain that grammar point again? Another example is a student may make a mistake in using the transitional device "therefore" in speaking, but he or she may refute that he or she does not know how to use it. He or she may say that it is caused by his or her forgetfulness of the meaning of the word. Is this mistake also claimed to be an error?

The purpose of this study is not to distinguish mistakes from errors. As the boundary between the two is thin, the authors conceptualize misuses of certain linguistic aspects which are caused by either learners' lack of knowledge, carelessness, forgetfulness, or even tiredness as the causes of errors. The ultimate objective of this study, which we would like to repeat here, is to identify, categorize, and analyze the common types of grammatical errors produced by Vietnamese EFL learners and look for possible causes of these errors.

### **L1 interference in L2 errors**

According to Subandowo (2017), L1 interference can be caused by language transfer which indicates the extent learners use their syntactical, semantic, and phonetic knowledge of their L1 to produce L2. This type of cross-linguistic interference emerges during the learning processes of L2 under the influences of the learners' socio-linguistic backgrounds and levels of L2 proficiency. A review of related literature (Al-Khresheh, 2010; Bui, 2016; Islam, 2020; Subandowo, 2017) allows the researchers to conceptualize L1 interference in L2 production in several ways that are mostly caused by learners' lack of grammatical knowledge. First, L1 interference can emerge from learners' incorrect L1 transfer into L2 due to their misconceptions of linguistic similarities in terms of grammar. Another cause of errors can result from learners' direct but inappropriate translation from L1 to L2 (which can be seen as a sub-form of linguistic transfer). Some sounds that do not exist in L1 can be somehow imitated in L2 production and lead to pronunciation errors. The same scenario may happen to learners' misuse of some words and phrases that cannot be used equivalently in English. Further, through our teaching experiences, we also suspect overreliance on technological devices and applications such as Google Translate, online dictionaries, or some English learning online platforms. What else can cause errors were also investigated in this study.



In addition, aging is reported to have a comparable impact on L1 and L2 individuals' verbal proficiency, lexicon judgment, and explanations (Clahsen & Reifegerste, 2017; Reifegerste, Elin, & Clahsen, 2019). While there are currently a few studies on L2 morphological analysis in aging, there is still a lack of studies on L2 sentence-level analysis in aging, despite previous research with L1 speakers indicating that the progressions of standard structural and syntactic evaluating may vary (Kemper, 1988; Kemtes & Kemper, 1997; Light & Capps, 1986; Obler et al., 1991; Yoon et al., 2015). Reifegerste et al. (2020) state that when compared to younger speakers, older individuals are more prone to allure errors, especially if they have limited working memory abilities. In our study, because all the participants were almost the same age, we take into account their duration of learning English. Some had been studying since their 3<sup>rd</sup> grade while others began studying this foreign language until they were in the 6<sup>th</sup> grade. We suppose that time can be a factor that interferes with learners' linguistic transfer from L1 to L2 in the sense that the longer and younger they start to learn English, the less likely they conduct ineffective linguistic transfer, and vice versa.

To understand how L1 impacts the production of errors in L2, we need to examine the instruction of language concepts that specify how L1 influences the acquisition of L2 and the cause of students' errors. The errors that emerge as a result of the interference are caused by the two linguistic backgrounds (Islam, 2020; Nunan, 2001). The greater the degree to which the equivalent of the two languages, the fewer errors learners produce, indicating a beneficial transfer. Conversely, when the level of resemblance is low, the result is negative transference, L2 learners apply the rules that they're familiar with in their primary language, with a significant probability of errors. (Ellis, 1997; Kazazoğlu, 2020). In this sense, there are significant differences between Vietnamese and English. Vietnamese belongs to the Mon-Khmer stock without any genetic traits related to Chinese although Vietnam was dominated by China for 1,000 years (Nguyen, 2017) while English belongs to the Germanic language group (Comrie, 2021).

Sorace and Filiaci (2006) present an interface hypothesis that asserts that language features involving a relationship between syntax and pragmatics sectors are particularly susceptible to insufficient acquisition in L2 end-states. Numerous studies have shown that advanced and near-native L2 speakers with various L1 origins can fail to operate target-like in areas demanding pragmatic theory interface. (Antonova-Unlu & Wei, 2020; Jensen et al., 2020). According to Gvarishvili (2013), the convincing proof and undeniable indications of L1 syntactic and lexical contribute to the development and application of English syntax and lexis reinforce the hypothesis that interlanguage errors or deviation L2 language characteristics through backgrounds are decisively L1 focused, regardless of linguistic variables within English itself. Additionally, as stated by Ellis (2008), novel insights could interfere with previous past experiences, restricting fresh understanding.

### **Error analysis framework**

As mentioned before, many scholars have attempted to identify the popular errors made by learners of writing and speaking English as a second language or the foreign language. Having better comprehension of errors will assist teachers to recognize the difficulties in learning the language of students. Ellis (2008) defines errors as

problematic due to the difficulty in grammaticality or acceptability. Specifically, correct grammar in an utterance, but it seems unacceptable in pragmatic meaning. Additionally, relating to the learner's errors, there are two major approaches to the study of learner's errors which are a contrastive analysis and error analysis (Harmer, 2001).

The contrastive analysis describes as a linguistic which is related to the correlation of two or more languages to ascertain both differences and similarities between them (Sullivan, 1984). This framework compares and contrasts the linguistic structures of the source and target languages to predict and identify types of errors that can be used to classify the levels of learners. The effort of contrastive analysis in the language instructing is the portrayal of the grammatical errors which occupied the differences between L1 and L2 grammar. In relevance to the sources of errors, Sadeghi (2009) argues that learners' errors can be caused by the interference of L1. This also means that there are both negative and positive sides of linguistic transfer between L1 and L2. The negative transfer happens in the difference between L1 and L2 grammar, while the positive transfer synchronizes if they are analogous. Another aspect of errors is that they are the consequence of the effect of L1 on the learning process. Learners intend to affect by the habit of their native language (Corder, 1967).

On the other hand, error analysis infers that learners' errors seem not to be impacted by the native language due to the irrelevance between errors and the native language structures (Khansir, 2012). This framework, which can be dated back to 1967, emphasizes the importance of analyzing grammatical errors. Accordingly, there are two main sources of errors: interlingual transfer and intralingual transfer (Gass et al., 2013). The consequence of the language transfer of analogous rules from learners' native language to the target language is called interlingual transfer. In contrast, the mutual involvement of objects in the target language is called intralingual transfer (Schmitt, 2000), or it could be named overgeneralization, which means that learners generally acquire grammar rules, but they are not able to realize some exceptional rules in grammar, causing errors. To analyze grammatical errors, this paper follows the 6 steps described by Gass et al. (2013) in realizing, identifying, and categorizing grammatical errors. These steps include collecting corpora, identifying errors, classifying, quantifying, analyzing error sources, and remediating. The step of remediating is not included in this report as it is not the focus of the study. However, we are aware that error analysis is not successful to support a complete picture of a learner's language. First, it is important for teachers to realize the vital role of examining the entirety of the learner's L2 production. Second, error analysis can be described "as a partial and preliminary source of information at an initial stage of investigation" (Ellis, 2008, p. 61). It can serve as one of the indicators for us to identify, classify, and potentially remediate learners' errors. Improving one's L2 takes time.

## **Research methods**

### **Participants and research context**

30 students at a private university were invited to voluntarily participate in this study. All of them were 18 years old and were studying English in their first year. Half of them were females. 15 of them were taking a pre-

intermediate course, and the other 15 were studying in an intermediate course. At this university, all students must take from 1 to 6 English preparation courses, depending on their achievements on the placement test. The pre-intermediate course is at level 4, and the intermediate is at level 5. All the levels cover common topics in general and academic English courses that are taught in the integration of the four skills and grammar. The authors wrote a research participant recruitment notice that called for the voluntary participation of students in these two courses. Then a random sampling technique was employed to select 30 students out of the list of 55. We limited the number to 30 so that we could handle the analyses of the conversations and interviews within 4 weeks before we were fully engaged in our personal teaching and administrative workloads.

As learners' duration and educational background may influence their English-speaking competence, the authors classified them into several groups that are presented in the following table.

Table 1. Participants' biodata

Number of participants	Gender	Duration of English learning (years)	Current courses
5	Female	8	Pre-intermediate
3	Male	8	Pre-intermediate
3	Female	11	Pre-intermediate
4	Male	11	Pre-intermediate
5	Female	8	Intermediate
3	Male	8	Intermediate
2	Female	11	Intermediate
5	Male	11	Intermediate
Total: 30			

### Research instruments and procedures

The authors used 4-6 conversational questions to converse in English with 30 Vietnamese students studying English general courses at a private university in Vietnam. Each conversation lasted for approximately 5-7 minutes. The purpose of using these questions was to allow for natural conversations to happen. Each conversation was recorded and given a code for the authors' own identification of each participant during data analysis. 20 semi-structured interviews of around 15 minutes each with 20 participants were conducted after they had partaken in the conversations with the authors and agreed to join the interviews. The interviewers (who were also the authors) mostly asked the participants why they had used pieces of language (that contained both grammatical errors and correct uses of the language to distract their attention from errors and mistakes). The purpose of the interviews was to enable the authors to explore the error sources and examined to what extent the participants' L1 influenced L2. The language used in the interviews was Vietnamese. The extracted quotes were then translated into English to use in this paper.

The research design was decided to support a clear framework for collecting, analyzing, discussing, and interpreting data to solve the research purposes (Creswell & Clark, 2011). The descriptive method was selected as a data collection instrument due to the relation to participants' interests and backgrounds, so it creates a comfort zone for the participants to talk about events in the past. The questions that were related to their social

lives and interests could encourage them to talk comfortably and easily.

### Data analysis

The data set consisted of 30 conversations and 20 interviews. Each of the authors listened to the conversations several times to note down the errors. Then the conversations were cross-checked by the author for the same purpose of identifying the errors. The errors were categorized into the syntactical, lexical, and pronunciation aspects. In each aspect, the sub-types of errors were identified. The authors paid attention to the types of errors that previous research has mentioned (see the overview and literature review sections of this paper) to guide our identification of the errors, but we also let ourselves open to new types of errors that might emerge from the conversations. In other words, the review of the errors referred to in previous research acted as a guiding torch for the authors to follow only.

The interviews were analyzed in the same procedures as the conversations. Themes were generated in accordance with the linguistic aspects and sub-types of errors to identify the error sources and analyze the causes of the errors. The themes of these sources and causes were put into each of the linguistic aspects for the authors to understand how the errors were produced. All are presented in Table 2 in the following section.

### Results

The researchers identified the errors by listening to the recorded audio files several times and cross-checking with each other. The errors were counted in the number of times produced by the participants and placed in Table 2. The errors identified in this study were classified into 3 main categories: lexical, syntactical, and pronunciation aspects. By analyzing the themes that emerged from the interviews, the researchers put the themes in another column.

Table 2. Types, frequencies, and sources of grammatical errors

Linguistic aspects	Types of errors	Frequencies (counted from the conversations)	Explanations for the error sources (coded from the interviews)
Lexical	Word choice	16	Word-by-word direct translation from Vietnamese, inequivalent expressions between the two languages, lack of English vocabulary
	Sensemaking of the utterance	12	
	Tenses	21 (mostly related to the simple present, perfect, and simple past tenses)	Inequivalent tenses between the two languages, lack of English grammar knowledge, direct translation from Vietnamese

Syntactical	Word and phrase formations	12	Word-by-word direct translation, lack of knowledge about English vocabulary
	Articles	11	Lack of knowledge, inequivalent forms of articles between the two languages
	Prepositions	10	Lack of knowledge, inequivalent forms of prepositions between the two languages
	Possessive cases	8 (uses of the “of” plus nouns)	Lack of knowledge, direct translation from Vietnamese
	Word order	7	Direct translation from Vietnamese
	Relative clauses	8	Lack of knowledge about relative clauses, direct translation from Vietnamese
	Modals and auxiliaries	9	Inequivalent forms of modals and auxiliaries between the two languages, lack of knowledge, direct translation from Vietnamese
	Gerunds and infinitives	7	Lack of knowledge, inequivalent verb forms between the two languages
	Plural and singular nouns	12 (missing an “s” for plural nouns)	Inequivalent forms of plurality and singularity between the two languages
	Subject and verb agreement	18	Vietnamese does not have subject-verb agreement forms
	Question forms	3 (the participants seldom made questions during the conversations)	Vietnamese does not have the special verb or auxiliary inversion in questions
	Sentence fragments in speaking	2	Lack of knowledge, direct translation from Vietnamese
	Pronouns	9	Vietnamese does not have objects as pronouns, but it has a wider range of pronouns than those in English
	Transitional devices and conjunctions in speaking	4	Direct translation from Vietnamese
Comparatives and superlatives	3	Inequivalent forms of comparatives and superlatives between the two languages, lack of knowledge, direct translation	
Pronunciation of	22 (/æ/, /ʌ/, /i:/,	Vietnamese does not have these sounds,	

Phonetic and phonological	and specific consonants and vowels	/u:/, /ɔ:/, /ɑ:/, “-ed” ending sounds, “s” ending sounds in plurality, /z/, /ŋ/, /p/, /tʃ/, /dʒ/, /θ/, and /ð/	12	lack of knowledge, imitation of the pronunciation of Vietnamese
	Syllable and sentence stress			Lack of knowledge, imitation of the pronunciation of Vietnamese
	Accents and intonations			

The themes presented in Table 2 were withdrawn from the follow-up interviews in which the researchers asked the participants about their usage of some linguistic aspects. All were conducted in Vietnamese to encourage the participants to freely and comfortably express their comments and ideas. The authors found that gender had almost no impact on the participants’ production of errors.

In terms of the lexical aspects, 10 participants expressed that as they wanted to sustain and develop the conversations, they quickly chose the words directly translated from Vietnamese. For example, a student said:

*Ah, that one was... I wanted to tell you that “I like to eat salad roll – gỏi cuốn” [spring rolls]. You know, salad is gỏi, and roll is “cuốn”. Is my English bad?*

This student knew separate words in English, and she thought combining these words would make sense as Vietnamese is a monosyllabic language. A combination of two or three words would be lexically equal to one word in English. Another student showed a similar translation:

*Why is English so difficult? Do you think I was wrong when I said “My brother is a cooker person at a restaurant downtown?” [“người nấu ăn”: chef]*

Some acknowledged that they did not know some words to continue the conversations, and they had to either stop or switch to another topic to maintain them. For example, some students said:

*I didn’t know how to say “ruộng lúa” [paddy fields, rice fields] in English so that I could talk about the beauty of my village or “vỡ mộng” [feel disillusioned, disappointed] in English. I will try to learn more words!*

*How do you say “xôi” [sticky rice] in English? I wanted to talk about it for my everyday breakfast.*

Other students used English words in the conversations incorrectly because they did not know the words in English. They tended to make up the phrases by combining specific words they knew in English to say. Some examples include “*go do the teeth*” [“đi làm răng”: go to the dentist, fix the teeth], “*fake people lie*” [“người giả dối”: dishonest people], “*sing songs throat*” [“hát vọng cổ”: sing traditional Vietnamese operas], or “*work doctor*” [“làm bác sĩ”: work as a doctor, is a doctor]. Some even stated that they felt that they were making “something wrong in speaking”, but they seldom received high school teachers’ correction. It is also worth noting here that the students who experienced a shorter period of learning English (8 years) than the other group

(11 years) produced more errors, and many of them came from villages.

Such examples show that these lexical errors are found to be related to their errors in using English grammar and pronunciation. Regarding the causes of the syntactical errors, many students tended to use direct translation from Vietnamese grammar to English because they lacked L2 grammar competency but wanted to develop communication. Some encountered difficulties resulting from the grammar discrepancies between the two languages. Some students did not know the past forms of some irregular verbs and/or did not conjugate them in the simple past tense appropriately. Some students complained:

*OK, it was wrong, huh [subject-verb agreement]? Vietnamese is much simpler. Tôi đi học [I go to school], and chị ấy đi học [she goes to school]. We (Vietnamese people) simply say “đi” plus a subject. In English, you (English-speaking people/learners) must use “s” for verbs that go with “she” or “he”! How can I know all?*

*English is so difficult and complex. When do I have to use –ed? When do I have to use “went” for “go”? Vietnamese is simpler. We just put the “đã” in front of the verb, and that’s it!*

In Vietnamese, there is no subject-verb agreement or changes of pronouns as subjects into objects as in English. When some students with a shorter period of learning English used these grammatical points, they tended to imitate the ways they spoke Vietnamese to convey their ideas in English. Some used direct translation, e.g.:

*“How I can talk about my passion for food?” It’s wrong, teacher? In Vietnamese, we (Vietnamese speakers) say “Làm sao em có thể nói về niềm đam mê đồ ăn chứ?”. There you see, “làm sao” is “how”, em is “I”, “có thể” is “can” and so on. Why do we (English-speaking people) have to invert the “can” in front of the “I”? I never understand it, but I must learn it because it is English, which is not the same as Vietnamese!*

*Vietnamese has “hơn” (comparative word) for all comparatives and “nhất” for superlatives. That’s all for it. English is more complex. I don’t remember what adjectives go with what form. I just put “than” in them because it means “hơn”, right?*

*“Cái mà” is which and “người mà” is “who”. Ah, now I know why I got them wrong. These words sound very clumsy in Vietnamese, showing that you don’t know what to say or you are clumsy in choosing the right words to speak. Why don’t we just cut the sentence into two instead?*

*English modal verbs are extremely hard, and I never know how to use all of them correctly. What is the difference between “can” and “may”, teacher? They all mean “có thể” in Vietnamese, right?*

These extracts show that the students did not possess proper knowledge of English grammar, and they were more likely to use direct translation to cope with the development and sustainment of the conversations. Some appeared to be able to identify the instances of their wrong usage, and these seemed to be mistakes rather than errors. However, when putting them into real communication, these mistakes were used as errors that contained the students’ unawareness of the usages. This also means that they had little authentic practice or exposure to English uses on a frequent basis. Some further stated that these errors were caused by their concentration on the grammar and reading skills for the national high school graduation exams they had taken before they entered university.

Most of the students did not have problems with the English diphthongs and some vowels. The vowels they mispronounced included the low /æ/ (as /a/), mid /ʌ/ (as /ou/ or /ə/), and long ones /i:/, /u:/, /ɔ:/, /ɑ:/. The long vowel sounds were changed into the short vowel sounds accordingly. In terms of consonants, many students mispronounced some particular sounds in English that do not exist in Vietnamese as indicated in Table 2. They had problems with the postalveolar affricates and fricatives, dental fricatives, bilabial stops, and velar stops. These phonetic errors were constant within individual speakers rather than happening as rare occurrences. The common strategies they adopted to deal with these “very difficulties” (in one participant’s words) were to either omit them, replace them with another sound, or add an extra schwa /ə/. For example, the word “teeth” was pronounced as /tit<sup>h</sup>ə/, “she watches TV all the time” as /si wat tivi on də t<sup>h</sup>am/, “students” as /tju dənt/, “sing” as /sin/, or “school” as /kun/. Most mispronounced and/or did not pronounce the ending sound /s/, /z/, and /iz/ in the plurality of nouns and subject-verb agreement in the simple present tense. A similar error was found with the ed-endings as /t/, /d/, and /id/. They either omitted or replaced them with /id/ inappropriately. For example, “walked” was mispronounced as /wə kid/, “concentrated” as /kon son trei/, or “finished” as /fi niʃ/. Some participants said:

*I don’t know when to pronounce /id/, /d/, or /t/. Why /t/ with –ed verbs? Never know!*

*Some sounds are weird! They are pronounced like you put your tongue out of your mouth. How can you hold your breath? I put it in and make it more like the sounds we have in our Vietnamese language.*

*Long sounds? No, we don’t have them in Vietnamese, do we? In English, they sound funny!*

The interviews allowed the researchers to realize that the students who had studied English extra classes at foreign language centers were less likely to make pronunciation errors than those who had not. The longer the students had studied extra classes outside their high school ones were more likely to pronounce better and have more correct word and sentence stresses and accents. The other students tended to put the wrong stresses on words with more than 2 syllables. Some used the tones “đầu sắc” (rising tone) and “đầu huyền” (falling tone) that are available in Vietnamese to make word stresses in English. For example, “university” was pronounced as /diu ni v3: si ti/ or “architect” as /á ki tèk/. Others did not use any word stress, making many sounds flat, e.g. “international” as /in t3: na sən nou/ to “be safe” (in one of the participants’ words). Some expressed their choice of putting stresses as follows:

*We must learn by heart (word stresses) because every word has a different way of stressing. Sometimes, it is at the beginning but at other times, it’s on the second syllable. Giving a word empty stress guarantees that I am correct!*

*English words are stressed like the way we speak Vietnamese. Vietnamese has several tones, and I think they are workable for English words.*

*My teachers at high school never taught me to speak out loud. What we did was doing pronunciation exercises on paper!*

Insufficient practice and knowledge of word stresses, accents, and intonation made some participants unable to have proper pronunciation. The linguistic transfer was employed as one of the strategies for them to use in speaking with others. The authors also noticed that the less duration the students were exposed to frequent practice, the less likely they were to speak with a correct accent. The students with 8 years studying English at



high school without going to extra classes spoke with a heavy foreign accent while those studying the same duration but having taken or taking extra classes tended to speak more fluently and with more acceptable accents. The same applied to those studying English for 11 years. This fact somehow shows that extra classes outside high school and university classes focus more on communicative abilities. Investment in those classes, in some ways, yielded the students some positive impacts as their exposure to English practice was more intense. Those in high school and college might be too academic or focused on tests. However, the purpose of this study was not to explore these factors and influences, so the authors decided to skip them.

## Discussion

According to the results of this study, the discussion could be shown into two separate parts: a discussion of common grammatical errors and the effects of L1 interference in L2-speaking English. As Brown (2000) claims, L1 interference is a significant source of errors among L2 learners. Similarly, the results of this study accord with Brown's opinion. By using the error analysis approaches, the researchers were able to find answers to the two research questions that focused on what types of errors and their causes are among Vietnamese EFL university students. Table 2 summarizes the popular types of errors and their causes that readers may like to refer back to. The results are now discussed in relation to the previous research corpus in the same field and topic. The points discussed in this section contribute new understandings to the current knowledge of errors in L2 speaking and L2 errors in general.

First, the errors identified in this study are similar to those found in the previous research in other and in Vietnamese contexts. They can be generally classified into three main categories: lexical, syntactical, and phonetic and phonological aspects. Like what some previous studies that have focused on writing and others on speaking have found, this study shows some similar errors in grammar, pronunciation, and vocabulary under the effects of L1 (Al-Khresheh, 2010; Bui, 2016; Bui, 2022; Brown, 2000; Corder, 1967; Ellis, 1997; Eng et al., 2020; Erkaya, 2012; Gvarishvili, 2013; Kazazoglu, 2020; Maros et al., 2007; Nhut, 2020; Qasem, 2020; Subanduwo, 2017; Watcharapunyawong & Usaha, 2013; Vu, 2017). What makes this study a bit different from the findings of past research is that the errors in these three linguistic aspects are interrelated. For example, the errors in the past tense are related to the errors in the pronunciation of the regular verbs with the -ed endings. Learners' mispronunciations of the plural "s" for nouns and the "s" in verb conjugation in the present tense are influenced by their lack of English grammar knowledge. The errors in sentence sense-making are related to several aspects of the learners' syntactical errors. Errors in speaking never stand alone as separate entities that exist in learners' lack of knowledge or incompetence. Rather, they exist within a system of learners' incompetencies.

The second point of discussion that can be seen as novel compared to the previous research is the authors' analysis of the source errors. While the previous studies have often discussed separate sources of errors, this study argues that these sources, like the interrelated system of errors, are interrelated. There are two sub-points

of discussion here. First, the sources of errors in speaking contain learners' lack of knowledge, insufficient practice of and exposure to the English-speaking environment, and attempts to sustain communication by using direct translation from L1 to L2 and imitating the supposed linguistic similarities between L1 and L2. Second, this finding points out that learners, albeit making errors consciously or subconsciously, are active agents in sustaining their communication. In this sense, errors are not the passive representation of learners' lack of knowledge, but they show their subjectivity and agency in managing their own speaking strategies in dealing with their grammatical gaps. This finding has a significant implication for teaching practices in which teachers can view learners' errors as one of the initiatives to improve learners' knowledge, rather than seeing them as points of disappointment or hopelessness. Learning, as such, is a growth process instead of a finish line for each lesson.

Third, this study explored various sources of errors that are similar to and different from previous research. For example, Khumpee and Yodkhamlue (2017) argue that different grammatical rules in English. EFL errors result from word-by-word translation strategy or thinking in the mother tongue language. Likewise, the review of the related literature in this paper has shown that the sources of errors are caused by learners' linguistic transfer from L1 to L2 while the two languages can have a lot of grammatical differences. The authors of this paper agree with this idea, but the empirical material (the analysis results of the conversations and follow-up interviews) in it specifies six concrete sources rather than generalizations of linguistic transfer. In particular, these sources include learners' lack of knowledge, imitation of L1 grammar, the direct translation of grammar rules, inequivalent grammatical aspects between L1 and L2, learning-for-exam pressure, and less advantaged geographical residency and English-learning conditions. Among these six sources, learners' imitation of L1 grammar rules and use of direct translation can be seen as both the sources of errors and strategies to confront their lack of knowledge and realization of the grammatical inequivalence between L1 and L2. In this sense, learners' awareness of the sources of errors can become their strategies for communication. Errors are not always bad!

## Conclusion

This study was contextualized within a growing body of research on the interference of L1 on the production of errors in L2 and Vietnam's attempt to improve its citizens' English-speaking capacity for global integration. On the one hand, this study is a timely response to partly explaining the reasons for Vietnam's lagging behind other countries in the English Proficiency Index. On the other hand, by setting out the research inquiries focusing on exploring the types of errors in L2 speaking and their causes, this study unpacked the interrelation of errors. Through the error analysis framework, the findings of this study can be highlighted as follows:

- There are three popular types of errors produced by the effects of L1 interference in L2 that are classified into the lexical, syntactical, and phonological aspects. These errors include word choice, sentence sense-making, tenses, word and phrase formations, articles, prepositions, relative clauses,

possessive cases, word order, modals and auxiliaries, gerunds and infinitives, plural and singular nouns, subject-verb conjugation, question forms, sentence fragments, pronouns, transitions, conjunctions, comparatives and superlatives, pronunciation of some consonants and vowels, syllable and sentence stresses, accent, and intonation.

- There are six interrelated sources of errors which include learners' lack of English knowledge, insufficient practice and lack of exposure to English-speaking environments, direct translation of L1 grammar rules, imitation based on supposed linguistic similarities, learning-for-exam pressure, and less advantaged geographical residency and English learning opportunities.
- The interrelation of errors enables learners to find spaces to develop ways and strategies to compensate for their gaps in English competencies. These ways and strategies are embedded with learners' active agency in sustaining communication. Some sources of errors turn out to be their strategies for this compensation.

These contributions allow the researchers to conclude that L1 interference in L2 production and communication is not always negative. It shows specific indicators of learners' proficiency levels and teachers' pedagogical interventions. While errors are normally conceptualized as linguistic gaps, L1 interference can somehow create learning spaces for learners to reduce these gaps.

## Recommendations

As discussed earlier, grammatical errors in speaking can be interrelated. This issue requires further empirical research using both a quantitative and qualitative approach to explore the interrelations so that more understandings can be formed for effective teaching practices. Errors and mistakes should always be remedied. The scope of this exploratory study simply focused on investigating the types of errors and their causes without engaging the methods to correct them. Therefore, by referring to the list of errors and causes in Table 2, teachers can be prepared to draft tools and techniques to help Vietnamese EFL learners to correct their errors in speaking. In line with this recommendation, future research can be extended to other contexts of EFL so that we can have a more holistic view of errors in speaking.

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## High School Students' Attitudes Towards Learning Genetics and Belief in Genetic Determinism

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**Abstract:** Students in high school tend to find genetics difficult to learn because it requires some crosslinked knowledge about subjects like genes, proteins, cells, tissues as well as organs and systems. It also becomes more difficult to connect and explain concepts such as the gene expression at the level of the cell to conceptualize the effect of the gene at the level of the organism. On the other hand, despite the fact that molecular genetics has progressed rapidly, its reflection in textbooks or even the qualifications of teachers in relation to the latest findings in genetics, have not responded to this pace. Here we present a survey study of Albanian high school students (grades 10-12, ages 15-19) on their attitude study genetics and their beliefs towards genetic determinisms. A number of 274 students participated in the survey, from 8 different public and private schools in the country. The response rate was higher than 90% for each group, 58.4% of the respondents were females, 32.6 0% were males and 4.1% did not answer. The mean age of the respondents was 16.8 ( $\pm$  1.8) years. Students found genetics interesting, and relevant but also a difficult topic in biology (respectively: 36.5%; 33.2%: 39.2%). Their responses showed positive attitudes towards gene technology and acceptance of the use of gene editing (51.4%). Students' perception of the utility of genetics did not differ among them; female and male students had significantly different responses along attitude factors, however liking genetics was the only factor without gender difference. Our study suggests that in general students liked to study genetics and they had mostly favorable attitude towards gene technology. They are not completely convinced of genetic determinism; this is also made possible by updated books. A complete study combining the textbooks, the knowledge of the teachers, and their approaches are needed.

**Keywords:** Education, Survey, Genetic determinism, Genetics, Students

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## Introduction

The relationship between determinism, knowledge, attitudes and beliefs about genetics is unclear. Most of the studies have focused on aspects of genetics or genomics use. In the last two decades, however, research in genetics has evolved into genomics and our understanding of genes and genomes and how they relate to development, phenotypic traits, cell physiology, among other features, has radically changed (Meyer et al., 2012 ;El-Hani et al., 2007 ).

We are living in an exciting time regarding the way the genome of different organisms is being explored, including the human genome. This way of scientific research, thanks to advanced technology, has increased the need for understanding genetics and its terminology.

The steps which the science of genetics is enriching this literacy are much faster than the material that is reflected in the textbooks. In our country, only in the last 10 years, new texts have begun to be implemented that reflect some of the achievements in this science.

On the other hand, in the high school level, age group 15-19 years old, several types of schools operate in our country. Public secondary schools, where the textbooks are suggested and are uniform, private secondary schools, where the textbooks are optional according to the programs that these schools offer, and professional schools of a technical nature, which use the same texts as public schools but with a reduced program.

At the same time, teachers have a role in teaching the science of biology in general and genetics in particular. The teacher uses different emphases in teaching genetics (Aivelo et al., 2019). The engagement of students in extracurricular topics depends entirely on the teacher's training.

The teachers admitted that in the textbooks high school students have scientific concepts about biological determinism, genetic determinism, and environment determinism. This programme combines the doctrine that: "human and nonhuman animal behavior and mental activity are largely (or completely) controlled by the genetic constitution of the individual and that responses to environmental influences are for the most part innately determined. the concept that psychological and behavioral characteristics are entirely the result of constitutional and biological factors. Environmental conditions serve only as occasions for the manifestation of such characteristics. the view that psychological and behavioral characteristics are largely or completely the result of environmental conditions. Biological factors are considered to be of minor importance, exerting little if any influence" (Meyer et al. 2012).

The questions that arise, for these issues that may have remained un-reflected in the textbooks, are motivated by seeing the level of students who come to study Biological Sciences in the Faculty of Natural Sciences. For this reason, we undertook the first study of this kind in our country, to understand how these achievements in the



science of genetics have been reflected in the perception and attitude.

Here We present a survey study of Albanian upper secondary school students (grades 10–12, ages 15–19) on their attitudes towards studying genetics and the use of gene technology, and belief in genetic determinism.

## **Method**

### **Questionnaire**

We collected questionnaire data from the students during the school year 2023–2024, time of the active practical part of our master students, when they are permanent resident in different schools and collaborate with teachers to present the questionnaire to the students during the school day throughout the school year. They choose to collect the questionnaire during the second semester after the students had finished the topics related to cells and heredity as well as gene concepts and biotechnology. To study the students' attitudes and beliefs, we composed a survey based on (Aivelo & Anna Uitto 2021), with modification. We combined 18 questions to measure students' attitudes towards learning Genetics science and their perception for genetic determinism. We include one short exam to see how they understand the correlation between genotype and phenotype.

### **Data collection and study group**

The population of interest included upper secondary school students (grades 10–12, ages 15–19). The questions were organized into two sections; the first section included questions on the students' demographic and type of school, and the second section asked students about their perception, attitude, and beliefs in genetics determinism.

The questionnaire was made available to the students by their teacher during an extracurricular lesson after finishing the chapters on the cell and inheritance. This way the survey ensured us a high participation of more than 90%. Participants were from private high schools (98 students); public high schools (128 students), and professional high schools (18 students). A total number of 274 students participated in the survey, from 8 different public and private schools in the country.

### *Statistical Analysis*

The data preprocessing step and statistical analysis were performed in SPSS 26.0. The data is first explored using frequencies, descriptive statistics, and graphical visualizations. Chi-square test is used to test the relationships between general features of the respondents and several selected nominal variables in the questionnaire. Spearman Correlation is used to estimate the correlation between ordinal variables and the chi-square goodness-of-fit test is used to determine whether the distribution of cases in a single categorical variable was equal across categories.

## Results

### General information about study group

The results showed that a number of 274 students participated in the survey, from 8 different public and private schools in the country. The response rate was higher than 90% for each group, 58.4% of the respondents were females, 32.6 0% were males and 4.1% did not answer. The mean age of the respondents was 16.8 ( $\pm$  1.8) years (Figure 1)

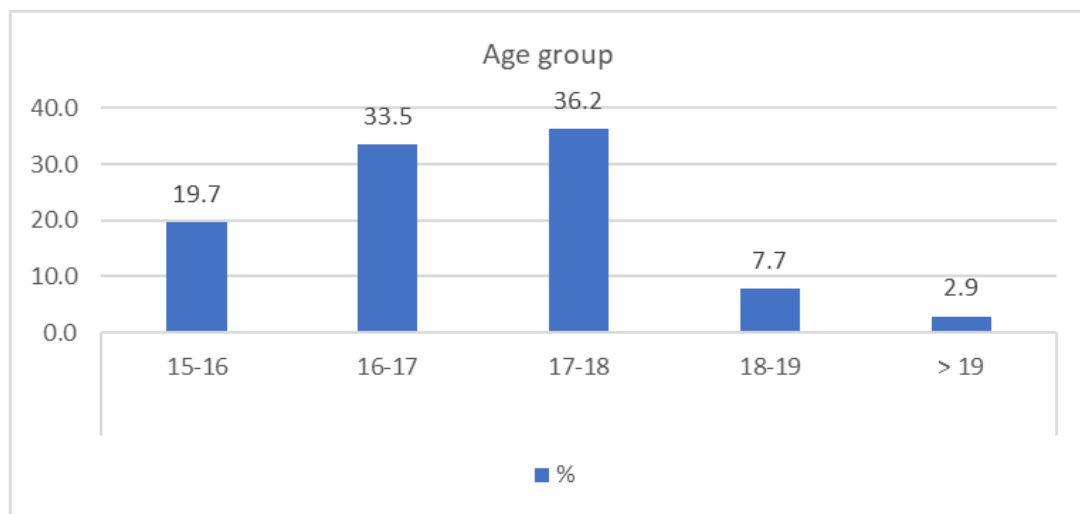


Figure 1. Distribution of participants according age group

According to the type of school and other demographic data, our sampling consists of 57.6 % public schools, 35.8% private schools and 6.7% professional schools. Most of the participants study in schools in Tirana (90.8%) and only 9.1 % in the districts (Table 1). The distribution of the questionnaire in all the districts of Albania was difficult at this time of the study, but this is a goal for the future extension of this survey.

Table 1. Demographic data about study group

Variables		N	Frequency %
Type of school	Public	158	57.6
	Private	98	35.8
	Professional	18	6.7
Gender	F	160	58.4
	M	86	31.6
Residency	Tirana	249	90.8
	Other	25	9.1
	districts		

### Perceptions about genetics

Students found genetics interesting, and relevant but also a difficult topic in biology (Table 2).

Table 2. Considerations of perceptions about genetics

Statement	Strongly disagree (%) N	Disagree (%) N	Agree (%) N	Strongly agree (%) N
Genetics is a difficult area of biology	(10.2)28	(20.0)55	(37.2)102	(32.4)89
It is impossible for me to achieve good results in the study of genetics.	(8.7)24	(48.2)132	(16.4)45	(26.6)73
I think I excel at genetics	(12.0)33	(19.7)54	(40.8)112	(27.3)75
Many things in genetics are difficult	(9.9)27	(12.4)34	(46.7)128	(31.0)85
It can also solve difficult genetic exercises	(12.4)34	(16.4)45	(41.9)115	(29.1)80
Studying genetics is boring	(60.2)165	(31.0)85	(4.4)12	(4.4)12
We usually have interesting exercises in genetics	(3.6)10	(6.5)18	(64.2)176	(25.5)70
Genetics is one of my favorite subjects in biology	(3.3)9	(8.0)22	(28.4)78	(60.2)165

### Attitude and beliefs about genetic determinisms

Their responses showed positive attitudes towards gene technology and acceptance of the use of gene editing (51.4%). Students' perception of the utility of genetics did not differ among them; female and male students had significantly different responses along attitude factors, Female had a more positive perception about the gene editing technologies [ $X^2(2) = 8.943, p = 0.011$ ]. However liking genetics was the only factor without gender difference. About 74.0% of students belief in genetic determinism and and this was positively correlated with

public high school student which study different textbook and course materials (Spearman Correlation  $\rho=0.348$ ,  $p<0.001$ ). Our study suggests that in general students liked to study genetics and they had mostly favorable attitude towards gene technology (see Table 3).

Regarding the short exam if genes are equated with trait there is no clear distinction between genotype and phenotype, and hence little need to consider a mechanism by which a gene could be expressed in the phenotype. This everyday perspective provided a plausible explanation of the difficulties and misconceptions found.

Table 3. Considerations of attitude and beliefs about genetics

Statement	Number	Frequency
I need knowledge on genetics in my future studies	97	35.5
Genetic knowledge is required skill in everyday life	106	38.6
Understanding genetics is increasingly important	104	37.6
Editing the human genome is ethically acceptable if it allows for the cure of genetic diseases	144	52.7
Genetically modified plants help reduce world hunger	20	7.5
Stem cell research done on human embryos should be illegal	12	4.3
It is acceptable for scientists to develop pathogens by genetic modification if this leads to new cures for diseases	57	20.4
I think genes determine all human traits	144	52
Human intelligence is determined by genes	203	74
	94	34.4

## Discussion

Considering that recently in the education system in Albania, some textbooks have been tested in secondary schools and only in recent years a general textbook in the subject of biology has been stabilized, we thought to evaluate how are the perceptions and attitudes of students in genetics. At the same time, with the flow of new information from scientific research in the field of genetics, which has progressed rapidly, the opinion of young people about skills in genetics as an enabling tool for education in general is not known. It is already evident that these findings have not been reflected with the same growth in educational texts, but also in the construction

of the curriculum or extracurricular hours. Before this study, a working group from our institution undertook a national competition with a contemporary theme in genetics. This was not part of our study, but the perceptions in general were that at the secondary level there are large gaps in knowledge and lack of reflection of innovations.

In our study, 274 high school students, from 8 different schools, mainly in Tirana, participated. What prevailed was the liking that young people have for the subject of genetics, listing the need to learn and be skilled in genetics as a necessary skill for the future. Almost 80% found studying genetics interesting (rated agree and strongly agree) and they believe that can excel in genetics. Around 86% of students have knowledge and see genetics as their favorite field in biology. Similar results about the perception of knowledge in genetics reported in several studies (Tornabene et.al., 2020; Aivelo et al., 2021). There were no significant differences in this likability between genders, nor differences between schools.

Reasons behind gender differences are not often discussed in the research of genetics education. As found in many studies gender differences were evident in some factors: male students had more positive attitudes towards gene technology (Mielby et al., 2013; Olofsson et al., 2006; Sturgis et al., 2010) and higher self-concept in learning genetics (Fonseca et al., 2012). In our study male belief in genetic determinism comparing to females, did not find gender differences at all. In general, educational arrangements can affect students' attitudes and beliefs in science education more than gender (Osborne et al., 2003).

Genetic determinism is the belief that genetic contributions to phenotypes are exclusively or at least much more important than the contributions of other factors such as epigenetic and environmental ones, even in the case of complex traits such as behaviors and personality (Mills et.al., 2008; Smith et al., 2010).

52% of participants believe in genetics determinism highlighting that all humans' traits are prone of genes, and 52.7% admitted that editing the human genome is ethically acceptable. 74% of the participants believe in the study of human genomes as a prediction of human diseases, and only 34.4% believes that human intelligence is determined by genes. Those are some confused results to be discussed and only a few studies have similar frequencies (Aivelo et al., 2021; Lanie et al. 2004; Mills et.al., 2008), meanwhile they shown lower consideration about genetically modified plants as a solution for sufficiency. It suggests that biotechnology is not well understood. In terms of equating genes to traits, there is no clear distinction between genotype and phenotype, and therefore there is little need to consider a mechanism by which a gene may be expressed in phenotype. This everyday perspective provided a plausible explanation of the difficulties and misunderstandings found (Lewis et al. 2004).

## **Conclusion**

Our study suggests that in general students liked to study genetics and they had mostly favorable attitude

towards gene technology. They are not completely convinced of genetic determinism; this is also made possible by updated books. A complete study combining the textbooks, the knowledge of the teachers, and their approaches are needed.

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## Bibliometric Review on TVET and Industry Collaboration


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**Abstract:** TVET is an education and training process with a strong emphasis on industry practises that strives to generate competent workers in particular fields. Cooperation with industry in TVET has the potential to improve the quality and relevance of TVET programmes and equip students with the practical skills and knowledge demanded by employers. Thus, there is a need for a complete bibliometric study of research linked to collaboration between TVET and industry, despite the fact that the number of studies in this field continues to increase. The bibliometric analysis in this research which was extracted from Web of Science database is analyze using VOSviewer. The research conducted a descriptive analysis of the publication number trends, the top authors and leading journals in this field. Next, the researcher also analyzed the co authorship based on authors and countries, research trends, citation and keywords analysis as well as co citation analysis. The article found that most of the articles in this field are published by authors from developed countries where the majority is from the United States. Other than that, the recent research hotspot were also identified indicating the future direction of the research in this field.

**Keywords:** Bibliometric, TVET, Engineering, Industry, Collaboration

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## Introduction

Technical and Vocational Education and Training (TVET) is an education and training process that places significant emphasis on industry practises, with the primary objective of developing a proficient workforce in specialised areas. Collaboration among industries in TVET has the potential to improve the quality and applicability of TVET curricula, as well as provide learners with the hands-on competencies and expertise that are sought after by employers (Oviawe, Uwameiye & Uddin, 2017).

Technical and Vocational Education and Training (TVET) institutions have a significant and extensive historical background in Malaysia. Since its early stages of development, the nation has prioritised technical and vocational education. The enhanced emphasis on Technical and Vocational Education and Training (TVET) in the present day is manifested in the amplified significance and prominence of TVET in the 11th and 12th Malaysian Plans (Nalathambi et al., 2023). In recent times, the Malaysian government has persistently allocated resources towards Technical and Vocational Education and Training (TVET), with a specific emphasis on enhancing the calibre of instruction and fostering greater cooperation with the industry. The concept of industry partnership in Technical and Vocational Education and Training (TVET) pertains to the cooperation between TVET institutions and the industry sector with the aim of enhancing the calibre and pertinence of TVET curricula, and providing students with the pragmatic competencies that are essential for meeting the demands of employers. UNESCO places emphasis on enhancing training systems and consistently underscores the necessity of establishing stronger connections between training programmes and the labour market (Marope, Chakroun & Holmes, 2015). The establishment of partnerships with industry is crucial for Technical and Vocational Education and Training (TVET) institutions (Oviawe, 2018) to maintain their relevance and generate graduates who possess the necessary skills to fulfil industry requirements. The significance of the interplay among multiple stakeholders cannot be overstated in the endeavour to effectively design and execute an education and training framework that yields a proficient labour force.

Collaboration refers to the process of interaction between two or more parties, each with a designated role, aimed at successfully planning and implementing a management system that facilitates joint decision-making in the interest of organisational and national development (Ladkin & Bertramini, 2022). Collaboration is a strategic alliance that leverages the knowledge and expertise of an educational and training institution in conjunction with industry. The aforementioned statement indicates that collaboration entails the establishment of a cooperative network between educational and training institutions and the industry (Zeng, Xie & Tam, 2010), with the aim of fostering a harmonious ecosystem in the realm of employment and training.

The collaboration between the industry sector and Technical Vocational Education and Training (TVET) institutions is aimed at improving the quality and pertinence of vocational education and training programmes. The process entails a symbiotic relationship characterised by intimate collaboration, effective communication, and reciprocal assistance between the aforementioned entities to reconcile the differences between academic

establishments and the demands of the labour market (Raihan, 2014).

Numerous scholarly investigations assert that fostering collaboration between educational institutions and industry-based training is crucial and highly necessary in order to attain the goal of generating a proficient workforce. There are studies identified that industrial attachment is the most significant linkage, with challenges like lack of initiative and poor industry response (Raihan, 2014). Industry linkage is not the only aspects in the collaboration between industry and TVET institutions that could benefit both parties as well as students. Therefore, it is imperative to consider strategic collaboration between educational and training institutions and the industry as a crucial approach to augment a proficient workforce that aligns with the industry's requirements. Furthermore, the expeditious advancement of technology has necessitated collaboration between educational and training establishments and industry to impart knowledge and expertise on cutting-edge technologies, thereby facilitating the creation of a proficient and high-caliber workforce. In order to attain the status of a high-income generating country, it is imperative that all stakeholders, including the government, institutions, and industry, engage in effective strategic collaboration. This will enable the workforce to contribute to the economic growth of the nation.

## **Methodology**

### **Research Objectives**

This article aims to examine the trends and studies related to TVET and Industry collaboration by using a bibliometric mapping method. This method utilized publications retrieved from Web of Science database and analyze the trends, status of the publications in terms of its citation, authors, sources of publications (journals), institutions, countries and keywords used by the author in their publications. Bibliometric techniques employ science mapping on bibliographic data sourced from publication databases such as Web of Science, with the aim of identifying the comparative impact of publications and their contribution to the formation of knowledge clusters, such as major themes, within a network. By doing so, individuals can offer valuable perspectives on the development of the field, including its intellectual lineage, as well as the nascent areas of inquiry. This method is widely used to analyzed and explore a large amount of articles or data in particular field (Dothu et al., 2021).

### **Data Collection**

In May 2023, the Web of Science database yielded a total of 1442 publications. The Web of Science database was selected based on its extensive collection of articles pertaining to the field in comparison to other databases. In addition, it is noteworthy that Web of Science is a dependable repository of scholarly literature, wherein a significant proportion of the articles encompassed within this database have undergone rigorous evaluation by specialists within the relevant domain. Birkle (2020) asserts that the database in question is not only widely utilised but also holds a position of authority in the field of research publications and citations. The Web of Science is comprised of a diverse array of specialized indexes, which are categorized based on the nature of the

indexed content or thematically emphasized (Pranckutė, 2021). Table 1 shows the inclusion and exclusion criteria of this article.

Table 1. Inclusion and exclusion criteria

Criteria
<b>Inclusion Criteria</b>
Keywords search was based on all field
Documents written in english language
Documents published within 2010 to 2023
Documents types only limited to article, proceedings and review article
<b>Exclusion Criteria</b>
Date of publication before 2010
Documents published in non-english languages

The process of identifying the articles in this study refers to the Preferred Reporting System for Systematic Reviews and Meta-Analyses (Prisma) (Moher et al., 2010). Figure 1 shows the PRISMA research protocol for this study.

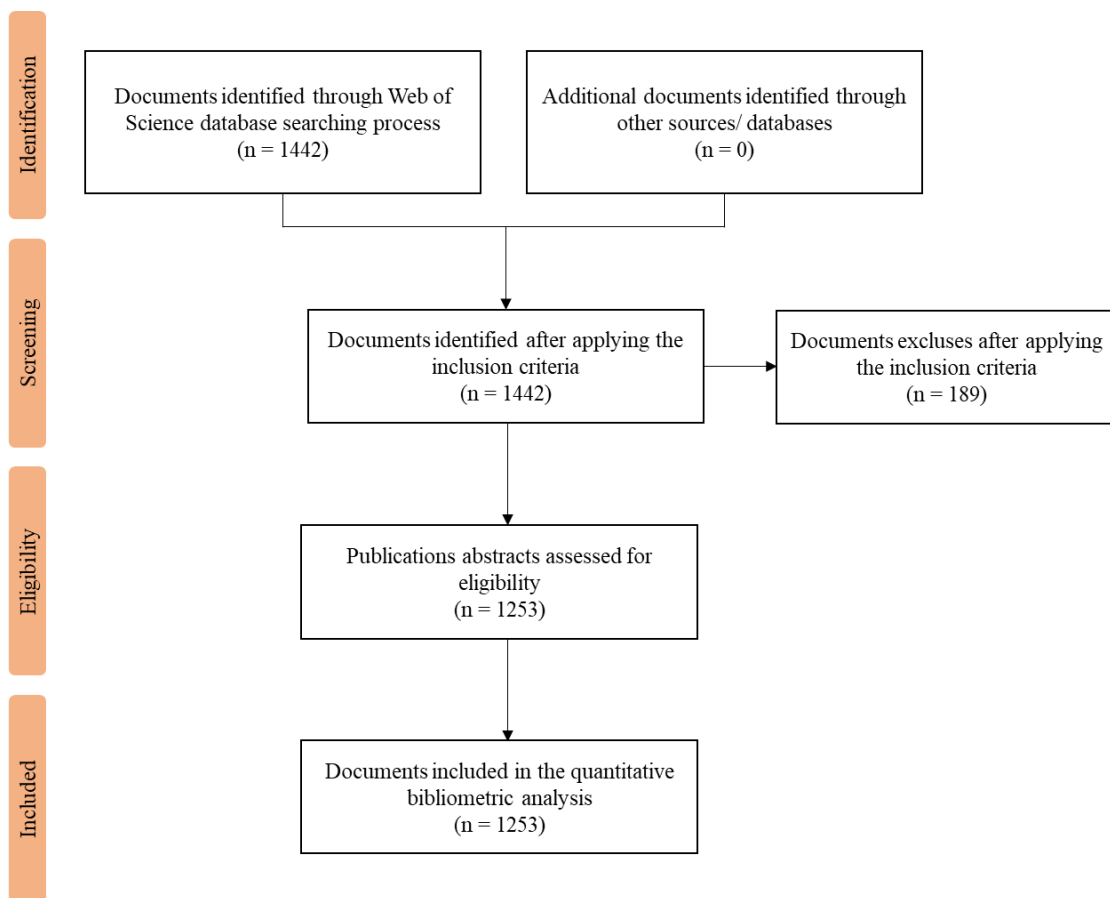


Figure 1. PRISMA research protocol

The data related to the publications was obtained in May of 2023, with the application of inclusion criteria to ensure the relevance of the acquired publications. The study's inclusion criteria are based on the year of publication (2010 to 2023), document type (including articles, proceeding papers, and review articles), and language (English). To obtain relevant publications related to this study, appropriate keywords were employed through the implementation of Boolean search commands to efficiently search for relevant literature. The publications were identified using the following keywords: (tv<sup>et</sup> OR tve OR vocational OR training ) AND industry AND institution AND collaboration.

### **Data Analysis**

The study starts with the search of the Web of Science database, followed by the application of inclusion criteria to procure relevant publications. Upon identification of relevant publications, the authors proceeded to extract data based on various categories, including but not limited to authors, year of publication, citation count, affiliation, country of origin, and number of publications. Among the chosen publications, 70% consist of articles, 23.4% are proceedings papers, and 6.6% are review articles. The data related to publications obtained from the Web of Science database is then exported to Tab Delimited file. The process of extracting fundamental data related to publication and citation trends, highly cited articles, top publishing journals, institutions, and countries was conducted using Microsoft Excel. VOSViewer was employed by the author for conducting bibliometric analysis. VOSViewer is a software tool designed to facilitate the creation and visualisation of bibliometric maps, as described by Van Eck and Waltman (2010). Van Eck and Waltman (2017) state that VOSViewer has been designed to facilitate the examination of clustering outcomes at a higher level of aggregation. Therefore, this software is deemed appropriate for application in this study.

## **Results**

### **Publication and Citation Trends**

Based on the search process conducted at the early stages of this study, a total of 1253 publications were identified in the selected database. Figure 2 shows the publication and citation trends based on the 1253 publications identified through the Web of Science database.

Research related to collaborations between industry and TVET institutions originated in the 1990s and gained momentum from 2010 onwards. The graphical representation reveals a notable rise in the quantity of publications within this particular domain, spanning from 2018 to 2022, with a cumulative count of 176 articles. 60% of the total publications is produced between 2010 and 2023 comprise the aforementioned total number of publications. Regarding the quantity of citations, there has been a steady rise in the number of citations over time. The Web of Science database documented 39,383 citations in May 2023, which were attributed to 37,256 articles.

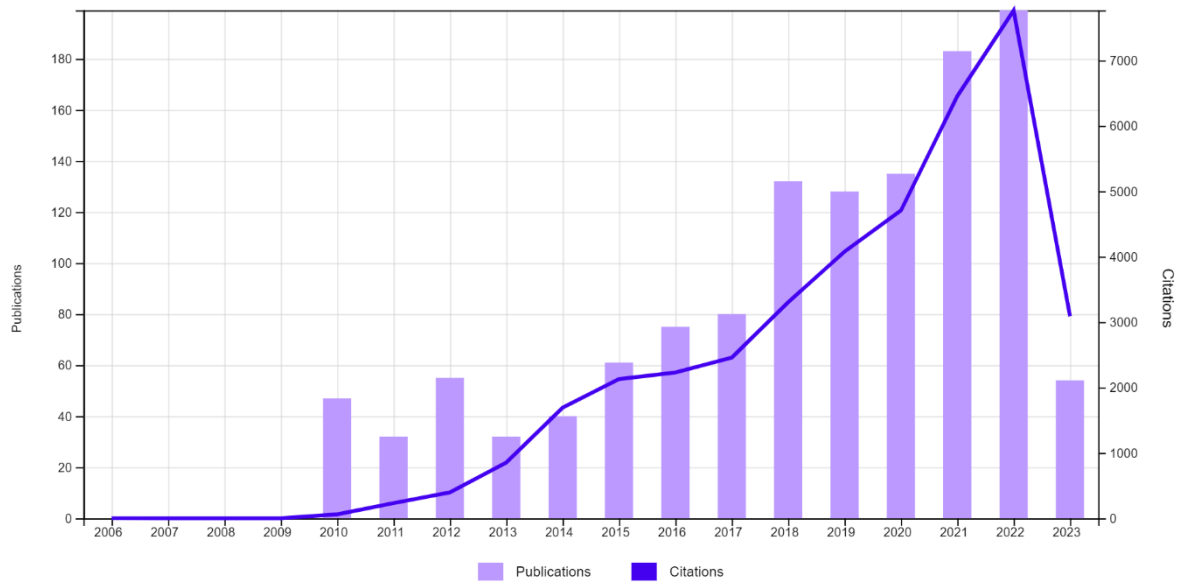


Figure 2. Publication and citation trends

### Highly Cited Articles

Based on the identified publications, the top articles in this field with highest citation is presented in table 2.

Table 2. Top 5 highly cited articles

Author(s)	Document Title	Source	Total Citation
Oliveira and Martins (2010)	Understanding e-business adoption across industries in European countries	Industrial management & data systems	283
Perkmann et al. (2021)	Academic engagement: A review of the literature 2011-2019	Research policy	100
Ansari, Erol and Sihni (2018)	Rethinking human-machine learning in industry 4.0: how does the paradigm shift treat the role of human learning	Procedia manufacturing	65
Thune (2010)	The training of “triple helix workers”? Doctoral students in university–industry–government collaborations	Minerva	61
Povey et al. (2016)	Engaging parents in schools and building parent-school partnerships: The role of school and parent organisation leadership	International Journal of Educational Research	30

The authors have identified 5 most frequently cited articles in this field and listed the name of authors, document title, sources or the articles and number of citation for each articles. Based on table 2, Oliveira and Martins (2010) article entitled Understanding e-business adoption across industries in European countries is at the first place with 283 total citation (20.21 citation per year). The next most cited articles is by Perkmann et al. (2021) with an articles entitled Academic engagement: A review of the literature 2011-2019 with a total of 100 citation (33.33 citation per year) and followed by Ansari, Erol and Sihm (2018) article entitled Rethinking human-machine learning in industry 4.0: how does the paradigm shift treat the role of human learning with a total of 65 citation (10.83 citation per year). In general, the top 2 most cited articles have more than 100 citation until May 2023.

### Most Prominent Journal

In this study, the authors have identified the most prominent journal with high numbers of publications related to the field. Table 3 shows the most prominent journals in this field.

Table 3. Top 6 most prominent journals

Sources	Numbers of Articles	% of 1,253
Iceri Proceedings	20	1.597%
Edulearn Proceedings	16	1.278%
Sustainability	14	1.118%
Lecture Notes In Computer Science	13	1.038%
Inted Proceedings	11	0.879%
Journal Of Technical Education And Training	9	0.719%

According to the results of data extraction, it is identified that there is only 5 journals or sources published more than 10 publications. The highest numbers of publications is from ICERI Proceedings with a total number of 20 articles followed by EduLearn Proceedings with a total number of 16 articles. The next journal or sources with the highest number of publications in this field is Sustainability which is a multidisciplinary journal with a total number or 14 articles. From the top 6 journals, there are one journal from Malaysia, which is Journal of Technical Education and Training at number 6. This journal is indexed both in Scopus and Web of Science (Emerging Science Citation Index). Overall, total number of publications in the top 6 most prominent journals is 83 articles.

### Top Institutions

As for institutions, there are various institutions that have published articles related to industry and TVET

institutions collaborations. However, the author only focused on the top 6 most productive institutions in this field based on Table 4.

Table 4. Top 6 most productive institutions

Institutions	Numbers of Articles	% of 1,253
University Of California System	102	8.147%
Udice French Research Universities	97	7.748%
University Of London	91	7.268%
University Of Melbourne	87	6.949%
Centre National De La Recherche Scientifique Cnrs	83	6.629%
University Of Oxford	72	5.751%

Based on table 4, University of California System is at the top place with 102 articles under their affiliation (8.147% out of total publications). The most productive institutions is followed by Udice French Research Universities with a total of 97 articles (7.748% out of total publications) and University of London with a total of 91 articles (7.268% out of total publications). Based on the findings, it can be seen that France contributes to 2 of the most productive institutions (Udice French Research Universities and Centre National De La Recherche Scientifique Cnrs) as well as England (University Of London and University Of Oxford).

### Top Publishing Countries

The top 6 most productive countries in this field is as shown in Table 5.

Table 5. Top 6 most productive countries

Countries	Numbers of Articles	% of 1,253
USA	334	26.677%
Australia	315	25.160%
England	260	20.767%
Peoples Republic of China	219	17.492%
Germany	203	16.214%
Italy	158	12.620%

Based on table 5, the most productive country with highest publications relevance to this field is United States of America (USA) with 334 articles (26.677%). This finding is parallel to the findings of most productive institutions where the top productive institutions identified in this study is University Of California System located in USA. The next productive country is Australia with a total number of 315 articles (25.160%) which is

also parallel to the findings of the most productive institutions where University Of Melbourne is at the top 4 institutions with 86 numbers of publication only by itself. This is followed by England with 260 articles (20.767%), Peoples Republic of China (PRC) with 219 articles (17.492%), Germany with 203 articles (16.214%) and Italy with 158 articles (12.620%). Based on the data extracted, Malaysia is at 36th place with a total of 42 articles (3.462%). Thus, this shows that this field is not yet widely explored in Malaysia and there is a need to further study on the implementation of industry and TVET institutions in Malaysia towards improving out TVET graduates quality and employability.

### Co-authorship Analysis

To create a link between researchers or authors of the articles related to industry and TVET institutions collaboration, a co-authorship network analysis is conducted using VOSviewer software. The concept of co-authorship network analysis pertains to the evaluation of the interaction that occurs among multiple scientists within a social setting, enabling the exchange of ideas and accomplishment of objectives in relation to a common aim (Sampaio, Fonseca & Zicker, 2016). In this study, the author identifies the co-authorship analysis of countries and organization. For co-authorship network analysis based on countries, the author have set the minimum numbers of documents of a country to 5 and minimum numbers of citations of an author is set to 5. Figure 3 shows the visualization network of the country co-authorship produce by VOSViewer.

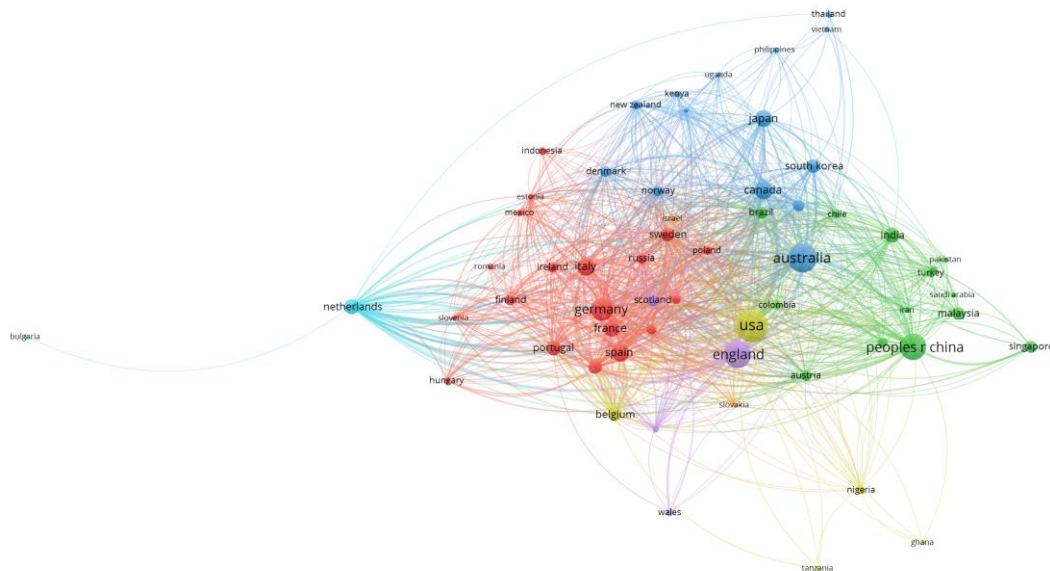


Figure 3. The visualization network of the country co-authorship

Based on the analysis, there are 60 countries/regions that meet the requirements. All the countries included in the analysis are divided into 7 clusters. The first cluster (n = 19) in red colour shows Germany (101 publications and 334 TLS) as the largest node followed by Spain (64 publications and 250 TLS), Italy (61 publications and 263 TLS) and France (51 publications and 273 TLS). The second cluster represented by green colour shows



collaboration between People's Republic of China (137 publications and 225 TLS), India (49 publications and 94 TLS), Malaysia (33 publications and 42 TLS) and Singapore (28 publications and 34 TLS). Australia (162 publications and 322 TLS), Canada (66 publications and 226 TLS), Japan (57 publications and 122 TLS) and South Korea (36 publications and 82 TLS) belongs in the third cluster represented by blue cluster. USA (198 publications and 389 TLS), Belgium (32 publications and 183 TLS), Nigeria (14 publications and 31 TLS), Tanzania (5 publications and 7 TLS) and Ghana (5 publications and 5 TLS) belongs to the yellow cluster. England (145 publications and 449 TLS), Scotland (28 publications and 154 TLS), Wales (12 publications and 21 TLS) and Luxemburg (8 publications and 79 TLS) is in the purple cluster. Netherlands (47 publications and 273 TLS) and Bulgaria (5 publications and 1 TLS) is in the ocean blue cluster and Israel (7 publications and 63 TLS) and Slovakia (6 publications and 40 TLS) belongs to the orange cluster. As shown in the visualization map, Australia, USA, England, Germany and People's Republic of China is the largest nodes indicating the productivity of the country parallel to the previous findings related to the most productive countries. Therefore, these countries can be said to be the leading countries in this field of research.

The next co-authorship analysis conducted by the author is the co-authorship organization analysis. Figure 4 shows the visualization network of the organization co-authorship.

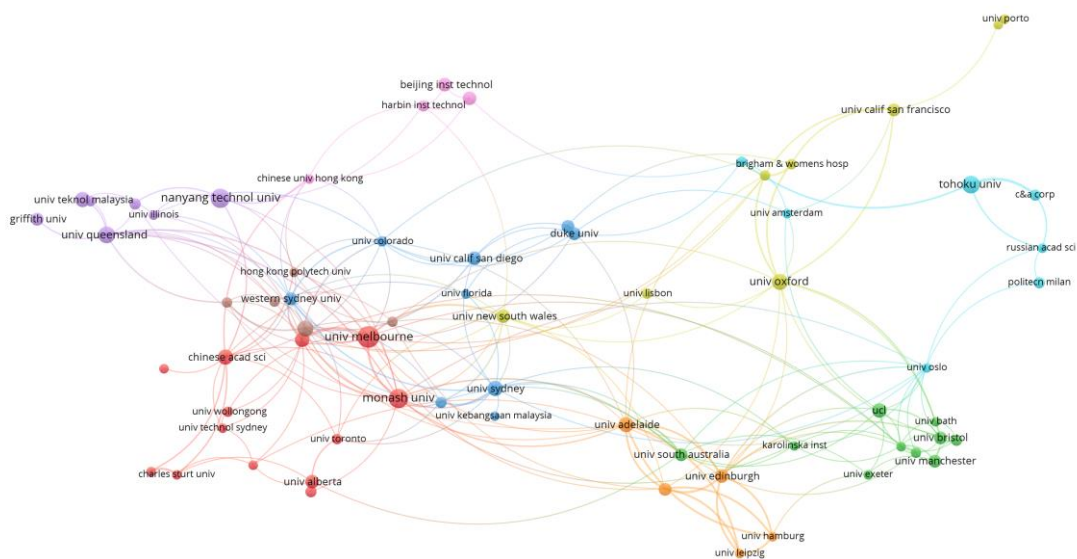


Figure 4. The visualization network of the organization co-authorship

Based on the analysis, there are 73 out of 2153 organizations that meet the requirements. The author sets the threshold in the analysis to be minimum number of documents of an organization and minimum number of citations of an organization to 5 as the minimum numbers. Based on the analysis, there are 9 clusters formed which indicates the collaborations between the organizations. The first cluster which is the red cluster is comprised of 13 organizations lead by the University of Melbourne (23 publication and 27 TLS) and Monash University (19 publication and 26 TLS). The green cluster is lead by University College London 11 publication

and 9 TLS), University of Bristol (8 publication and 11 TLS) and University of South Australia (8 publication and 11 TLS). University of California San Diego (10 publication and 6 TLS) and Duke University (8 publication and 8 TLS) is represented by the blue cluster. Oxford University (13 publication and 18 TLS) and University of California San Francisco (8 publication and 8 TLS) can be seen in the yellow cluster. Next, cyan clusters consists of Tohoku University (16 publication and 12 TLS) and University of Tokyo (6 publication and 6 TLS). The University of Adelaide (12 publication and 29 TLS), University of Edinburgh (10 publication and 27 TLS) and University of Liverpool (8 publication and 21 TLS) shows a collaboration between them based on the orange cluster. University of Western Australia (13 publication and 16 TLS) and Curtin University (6 publication and 9 TLS) appears in the purple cluster as one of the organization most productive in this field. The lavender cluster consists of Nanyang Technological University (18 publication and 11 TLS), University of Queensland (14 publication and 16 TLS) and Universiti Teknologi Malaysia (12 publication and 4 TLS). The last cluster which is the violet cluster consist of Beijing Institute of Technology (10 publication and 2 TLS) and The National Institute of Advanced Industrial Science and Technology (9 publication and 5 TLS). This indicates that the most productive organizations based on the sizes of the nodes is Nanyang Technological University, University of Melbourne and Monash University. These three organizations also have a strong collaboration between them as seen in the link between them in the visualization map.

### Keyword Analysis

In order to help us identify the hot topics and potential topics to be explored in the future, co-occurrence analysis is conducted in this study (Ding & Yang, 2020). Co-occurrence analysis is conducted using VOSViewer and the network visualization map is shown in figure 5.

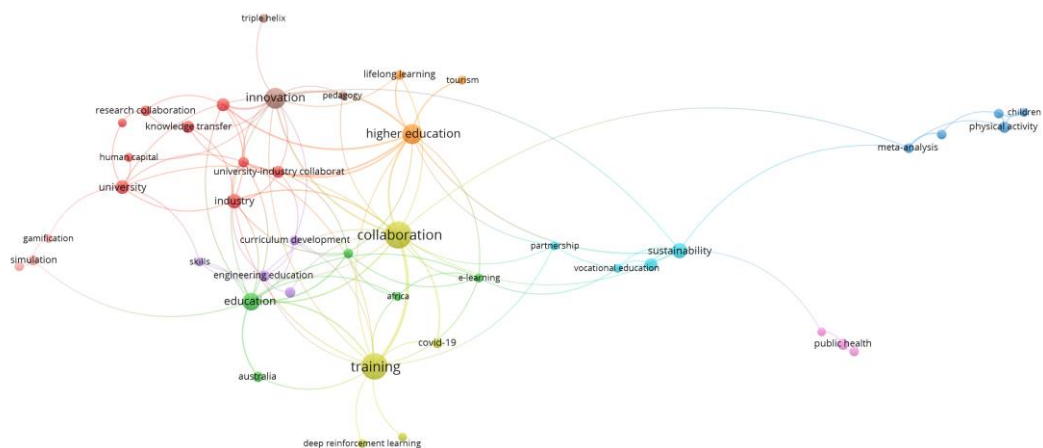


Figure 5. Co-keyword network visualization

Table 6. Most frequently used keywords

Authors' Keyword	Occurrences	Total Link Strength
Collaboration	44	39
Training	41	33
Higher Education	24	28
Innovation	25	27
Education	18	17
Entrepreneurship	10	15
Industry	12	12
Research	7	12
Sustainability	14	10
Engineering	6	8

Based on the analysis, there are 56 keywords that meet the requirements (out of 3549). The threshold set for the minimum number of occurrence of a keyword is 5. The most frequently used keywords in this field are collaboration (green cluster), higher education (purple cluster), innovation (red cluster), education (yellow cluster), Industry 4.0 (violet cluster). These results suggest that collaboration, higher education, innovation, education and industry 4.0 are the keywords frequently examined by the researcher in this field. Table 6 shows the most frequently used keywords related to industry and TVET institutions collaboration. As seen in table 6, collaboration is the most frequently used keywords with 44 occurrences (39 TLS) followed by training (41 Occ, 33 TLS). Other frequently used keywords are higher education (24 Occ, 28 TLS), innovation (25 Occ, 27 TLS), education (18 Occ, 17 TLS) and entrepreneurship (10 Occ, 15 TLS).

## Discussion and Conclusion

This article examines the trends and studies related to TVET and Industry collaboration from 2010 up to 2023 by using a bibliometric analysis. There were a total of 1442 publications identified based on the search process conducted using the Web of Science database and only 1253 publications were included in the study. Based on the findings, there seems to be an increase in the number of publications starting from 2010 and there is a sharp increase starting from 2018 until present year. 2022 records the highest numbers of publication in this field which indicates an increasing interest in the studies related to industry and TVET institutions collaborations. The partnership between industry and Technical and Vocational Education and Training (TVET) is a pivotal factor that can enhance the employability of TVET graduates and address the challenge of graduates lacking the requisite competencies that the industry demands. The symbiotic relationship between educational institutions and industries is crucial in the production of skilled workers. Educational institutions are responsible for producing skilled graduates, while industries require skilled workers to meet their operational demands (Mustafa, Hussain & Zulkifli, 2022). In addition to this, the phenomenon of globalisation and the rapid progress in technology and communication have been altering the configuration of the labour market on a global scale, thereby transforming the skill prerequisites for extant and forthcoming occupations (Naziz, 2019). Hence, a collaborative approach is imperative to mutually benefit the involved parties and address the fundamental challenges associated with the aforementioned situations.

The research findings suggest that there is potential for further investigation in emerging research areas such as sustainability, entrepreneurship, and innovation. These are the emerging keywords associated with this particular field. The concept of sustainability has garnered significant attention in Malaysia, particularly in recent times. Othman and Omar (2012) have examined the concept of sustainable partnership between university and industry collaboration. The authors have identified the primary objective of such collaboration, which is to establish a successful and sustainable partnership that can provide highly skilled and competent workforce to meet the industrial requirements. In addition, a separate scholarly investigation delved into sustainable collaboration, with particular emphasis on the influence of governance and institutions (Niesten et al., 2017). Therefore, the keyword sustainable could be the next important aspects to be discussed in this field by future researchers.

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## Appraising the Past: The Evaluative Language in Historical Texts

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**Abstract:** In the area of foreign language, learners may face challenges in interpreting the writer's voice in historical texts. Such problem may stem from their lack of understanding of generic properties of historical genre in interpersonal function of language use (Martin & Rose, 2008) and could be addressed through effective reading instruction. Driven by this concern, this study focuses on one of the critical stages of Feez's (1998) teaching-learning cycle, 'modelling and deconstruction of text' to examine how the linguistic means for evaluating historical phenomena utilized in order to give meanings to the past. Appraisal theory (Martin & White, 2005) is also applied in this study to investigate how different evaluative strategies operate in historical genre. Two historical texts about Indonesian war are selected as the sample to highlight the features of evaluative language. The strategies involve using linguistic resources to respond to events emotionally, judge past behavior within a moral framework and assess the weight and causal force of past events.

**Keywords:** Appraisal theory, historical texts, text deconstruction

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### Introduction

In the field of foreign language education, historical texts are commonly introduced as one of genre in English textbooks of secondary schools (Lanjwani et al. 2023; Suryatiningsih, 2020). Learning historical texts is worthwhile for educational and linguistic rationale. In educational context, learning the historical content is aimed at generating, developing the spirit of nationalism and patriotism (Hardiana, 2017), and maintaining harmony or cohesiveness of community's progression (Purwanta et al., 2020). The process of learning historical texts will not only involve learning content but also develop learners' literacy on specialized discipline (Wrigglesworth & Mckeever, 2010). Literacy skills in historical texts comprises the cognitive abilities in reasoning, explanations, and interpreting moral values about the events. In linguistic rationale, historical discipline is built with reading and writing activities that entails close readings, reading across texts to examine intertextual links, and constructing meaning by comparing or contrasting a series of texts (Leinhardt et al., 1994). Briefly, history is a language-based discipline (Achugar & Stainton, 2010). In other words, history as a

disciplinary knowledge is not introduced in isolation from language. Learning historical texts requires an understanding of linguistic features of texts produced within the discipline. Please use 10-point font size. Please margin the text to the justified. Manuscripts should be 1.5 times spaced. Footnotes and endnotes are not accepted. All relevant information should be included in main text. Do not indent paragraphs; leave a 1.5 times space of one line between consecutive paragraphs. A paragraph should have at least 3 sentences.

However, learners may find difficulty in the recognition of how the past is represented or perceived in the text. The representation of the past in the historical texts deals with the interpretation of the writer's voice that can be analyzed through the linguistic features of historical genre in interpersonal function of language use (Martin & Rose, 2008). The interpersonal function of language use represents the way the writer or historian uses language to express their perspectives on the historical events in order to influence readers. In educational context, the ways the writer represent the past tend to infuse learners' empathy, feeling, and appreciation for the inner situation of historical actors or heroes, especially in the battle stories. Therefore, learners' negative perception on history e.g. that history is a boring subject associated with memorizing dates, names of heroes, events, and does not have a good effect on learners' daily lives, can be avoided.

A number of previous studies have been conducted on the interpersonal function of language use in secondary English textbooks (see Achsan & Barati, 2015; Magfiroh et al., 2021; Teo & Zu, 2018; Zudianto, 2015). They have focused on the comparison of conversation texts found in two secondary English textbooks to find the realization of mood and tenor in interpersonal function of language use (Achsan & Barati, 2015), the attitudes devices of the characters in narrative texts (Magfiroh et al., 2021), the investigation on how verbal texts and visual images are co-deployed in textbooks to instantiate the curriculum goal of affect and attitude education (Teo & Zu, 2018), and the representation of multi-ethnicity in the form of dialogs or monologs in the textbooks (Zudianto, 2015). Most of the studies cited above suggest the need to research the attitudinal devices in secondary textbooks. And yet, among these studies, investigating the writer's textual voice as the realization of interpersonal function of language use in historical texts for pedagogical practices has received scanty attention. To fill this void, the present study is intended to demonstrate the deconstruction of the writer's voice depicted in the historical texts in secondary school English language textbook. This study applies appraisal theory in linguistic domain and focusses on 'modelling and deconstructing the text' as one stage of teaching-learning cycle in pedagogical practice.

### **Appraisal theory**

Grounded in Hallidayan Systemic Functional Linguistics (SFL) theory, this study employs Appraisal theory (Martin & White, 2005) focussing on interpersonal resources that are concerned with negotiating social relation, like, how the writer shares his/her voice, feelings, and perspectives. Appraisal theory deals with evaluative language that has semantic resource used to negotiate emotions, judgments and valuations, alongside resource for amplifying and engaging with the evaluations on events and issues in historical texts. The key functions of appraisal system in language are to express the writer's or historian's opinions that reflect the value system of

those writers or historians and their community; to construct and maintain relations between the writers or historians and readers; and to organize the discourse of historical texts. Appraisal theory comprises three central semantic systems: attitude, engagement, and graduation. Attitude concerns feelings, that is, the emotional reactions negotiated in a text. Attitude comprises with affect, judgment, and appreciation. Engagement is how values are sourced by playing voices around opinions and reader aligned. It is divided into monogloss and heterogloss. Graduation refers to the grading of attitudinal values whereby feelings are amplified or hedged in the discourse (Martin & White, 2005). The sub-systems of appraisal theory can be seen in the following figure.

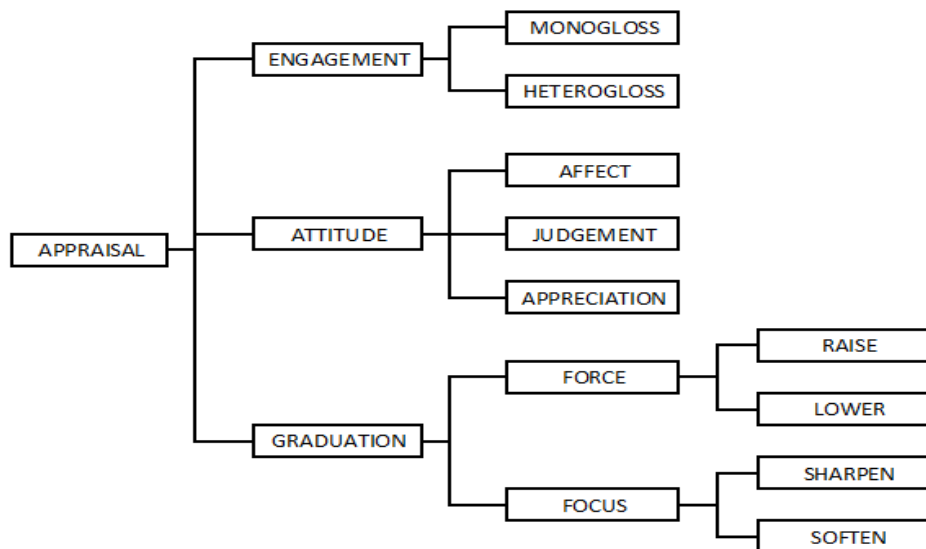


Figure 1. Appraisal Resources (Martin & White, 2005, p.38)

### Teaching-learning cycle

Teaching-learning cycle was firstly developed as the basis of genre pedagogy for organizing and sequencing the elements in the syllabus (Feez, 1998). Genre-based approach became influential when it was drawn upon Halliday's (1994) systemic functional linguistics and is defined as 'staged' and goal oriented social processes'' (Christie, 1998; Dewerianka, 1996; Martin, 1989). Drawing upon Feez's (1998) prominent teaching-learning cycle, the genre of history can introduced in a sequence of different phases of teaching and learning in the classroom interaction. The teaching-learning cycle involves five major stages: (1) building the context: teachers teach the purpose of the genre (historical texts) and the contexts in which the genre is commonly used; (2) modelling and deconstructing the text: teachers demonstrate how to analyze the salient linguistic features of historical texts that indicate the writers' voice and learner build the knowledge of those specific linguistic features; (3) joint construction of the text: teachers guide learners as facilitator to work with peers or compose their own texts; (4) independent construction of the text: teachers allow learners to do independent work if they have succeeded at their previous learning activities; (5) linking related texts: teachers relate the historical texts to other texts and contexts. It is possible for the teachers to encourage learners to elicit their reflection, critiques, or to interpret inherent values in historical texts.



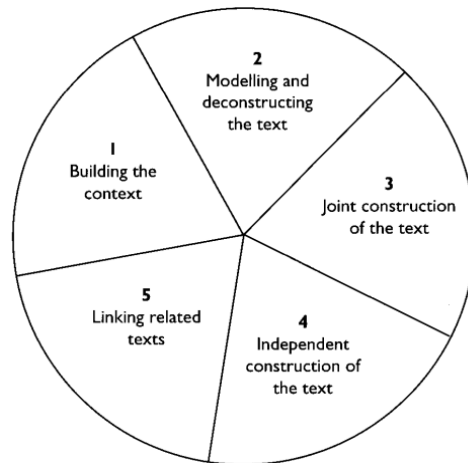


Figure 2. Teaching-learning circle (Feez, 1998, p. 28)

**Method**

*Applicable linguistics framework and pedagogical practice for analyzing historical texts*

The language appraisal framework (Martin & White, 2005) was used to examine linguistic resources in the historical texts of the English textbook at secondary schooling. The language appraisal parameters to analyze the historical texts are affect (emotion), judgment (social evaluation of the characters and their behavior), and appreciation (aesthetic evaluation of things). These parameters are used to evaluate positive and negative attitudes, opinions, or reaction conveyed by the writers or historians in historical texts. For pedagogical practice, the interpersonal function in appraisal framework is linked with the stage two of genre-based pedagogy, following Feez’s teaching-learning cycle.

*Textbook as the source of data*

In this study, we use English foreign language textbook endorsed by the Indonesian Ministry of Education and Culture, entitled *Bahasa Inggris for SMA/MA/SMK/MAK Kelas X*. (English Language for Senior High School, Grade 10). It written by Utami Widiati, Zuliati Rohmah, and Furaidah, published in 2017. English as compulsory subject at secondary schools and teachers should use this book as endorsed by the government. The data for textual analysis were taken from this textbook because (1) they met the criteria set by Indonesian Board of National Education Standard, (2) they were written by Indonesian teachers who have experienced in teaching at secondary schools, (3) the historical texts are specifically appear at this book since one theme of syllabus dealing with the recount texts – the text which retell events or experiences in the past. The historical texts selected were about Indonesian war: Bandung Sea of Fire and The Battle of Surabaya.

*Analytical procedures*

The learning activities in the deconstruction phase occur as follow:

- Learners are introduced to model texts representing the target genre e.g. a historical recount.
- This model serves to build historical knowledge relevant to the unit.
- Questions are posed in relation to the purpose of unit of work, e.g. to appraise the action of figures described in historical text.
- Teachers appraise the events or action of figures by coding the linguistic features.
- Through a range of activities and activities and teacher input, there is analysis of and critical reflection on the texts.
- The use of lexis and grammar and the rhetorical effects may be explored by students.

## Results

In this part, we focus on the deconstruction of the extract of historical texts, which typically occur at the stage “modelling and deconstructing the text” in the teaching-learning cycle. The following chart can be used as the guidance when the learners do close reading on the historical texts.

<b>Goals</b>	<b>Actions</b>	<b>Knowledge</b>
What is the purpose of the text?	Identify the function of the text by reading the first paragraph as it gives introduction to the whole text.	Social purpose of the text
What is the text about? Who are the main actors in the text?	Identify participants (nouns), processes (verbs), circumstances (adverbs and prepositional phrases)	Main events, key actors, and context of the events
How is information organized in the text?	Identify the cause-effect and chronological patterns in the text. Identify connectors	The development of arguments in historical text.
What is the perspective of the writer? (the voice of the writer)	Identify modality, personal pronouns, mood (declarative, interrogative, imperative), and evaluative vocabularies.	The voice of the writer on the issues presented

Adapted from Achugar and Stainton (2010)

### *Analysis: Text Deconstruction*

The sample of analysis text deconstruction can be seen as follows.

Text 1: Bandung Sea of Fire

Bandung Sea of Fire

The Bandung Sea of Fire was a historical moment for Indonesian independence [+appreciation]. It was the intentional burning [+affect] [+ graduation] of much of the southern side of Bandung during the Indonesia national revolution. The event came to be known as Bandung Sea of Fire or Bandung Lautan Api [+ affect] [+graduation]. Hundreds of Indonesian nationalists were singing Halo – Halo Bandung to show that they were proud of what they have done [+judgment].

The British commander gave an ultimatum to the Indonesian troops to leave Bandung [-judgment]. The troops responded differently [+ judgment]. They mobilized people [+judgment] to burn the southern part of Bandung as they left on March, 24 1946 [engagement]. Houses and buildings was burned deliberately created a horrified scene [-affect] [+graduation].

In March 1946, a member of Indonesia militia, Mohammad Toha, during the evacuations smuggled dynamite leaved by Japanese and Dutch troops [engagement]. The dynamite was smuggled into the Dutch military headquarters in Dayeuh Kolot region [+judgment]. Toha detonated the dynamite in warehouse [+judgment: capacity]. He killed himself with several Japanese and Dutch troops [+judgment: tenacity]. The explosion of the dynamite created a small lake in the area [-appreciation] [+graduation]. The name of Mohammad Toha then used for the main street in Dayeuh Kolot [+appreciation].

The Bandung Sea of Fire showed us that Indonesia combatants were very loyal to the country [+judgment: tenacity]. They did not want to leave anything for the colonial and British army [+ judgment]. The event was a great example of how Indonesian would sacrifice everything to reach their goal [+appreciation][engagement].

As seen in the first paragraph, the text organization provides the orientation (what, who, where) to the readers. The first line of the paragraph, the writer of this text shows his positive appreciation towards the battle happened in Bandung as the starting point to gain the Indonesian independence. The salient clause of *a historical moment for Indonesian independence* is underlined and inserted coding at the end of this clause. The coding [+appreciation] is as the parameter of appraisal framework. It indicates positive reaction of the writer towards the events. The lexical phrase *intentional burning* is categorized as positive affect or feeling because the action is deliberately intended by the Indonesian troops. Graduation refers to up-scaling or down-scaling of the thing or event. In this text, graduation is realized in *intentional* that means gradable according to intensity. The voice of the writer shows the pride or positive affect which is realized in *Bandung Sea of Fire*. This lexical choice is also categorized into positive graduation as fire is described as wide as the sea. The last line of this first paragraph ends with the writer's positive judgment towards the behavior of the Indonesian troops as it is realized in *they were proud of what they have done*. Positive judgment relates to social esteem that have to do with social values or norms (Martin & White, 2005).

In the second and the third paragraphs, this historical text provides the series of events. The writer begins with

negative judgment towards the British commander as realized in *The British commander gave an ultimatum to the Indonesian troops to leave Bandung*. This event is categorized as the cause for the following event. Cause-and-effect plays important role in meaning making of historical discourse (Coffin, 2006). The effect is that positive judgment conveyed by the writer toward the Indonesian troops as it is realized in *The troops responded differently*. It means that Indonesian troops did not obey the British commander ultimatum and it is regarded by the writer as the brave behavior of Indonesian troops. As the consequence, the following actions of Indonesian troops in the series of events are categorized as positive judgments by the writer. The positive judgments are realized in *They mobilized people to burn the southern part of Bandung as they left on March, 24 1946* and *Houses and buildings was burned deliberately*. Since the writer provides the date of the troops mobilized people to burn the southern part of Bandung, it means that the writer represents proposition as highly warrantable. The date information is categorized as proclaim under the parameter of engagement [Martin & White, 2005]. Negative affect shows scary and sadness feeling of the writer as realized in *horrified scene*. Even though it is categorized as negative affect, horrified scene is deliberately created by the troops to fight enemies and defend for the country. It is, therefore, categorized as positive graduation, up-scaling the scene.

The third paragraph indicates complication or climax. The writer begins with the date information that functions to acknowledge external voice in order to convince the readers. This lies under the appraisal framework of engagement. The writer engages the external voice as an evidence to support the occurrence of the most important event in this historical text. The writer allocates this whole paragraph to the heroic actions of Mohammad Toha, who smuggled and detonated the dynamite, and killed himself. The coding of positive judgments on the figure's behavior is noted for the following clauses: *The dynamite was smuggled into the Dutch military headquarters in Dayeuh Kolot region; Toha detonated the dynamite in warehouse; He killed himself with several Japanese and Dutch troops*. The explosion effect is as large as *small lake* and evaluated by the writer as negative appreciation while the up-scaling of explosion is categorized the positive graduation. As the gratitude expression from society, the writer writes the positive appreciation to the name and the area where the battle occurred. as it is realized in *The name of Mohammad Toha then used for the main street in Dayeuh Kolot*.

The last paragraph has re-orientation in which the writer provides comments about the events that are told in the text. The writer gives positive judgment to Indonesia heroes as realized in *Indonesia combatants were very loyal to the country. They did not want to leave anything for the colonial and British army*. Positive appreciation is also described in the clause: *The event was a great example of how Indonesian would sacrifice everything to reach their goal*. The positive judgment towards the hero's behavior and positive appreciation towards the events encourage the learners to develop the spirit of nationalism, patriotism and historical awareness.

The text 2 shows the typical historical text on the theme of battle providing the dates of events, the figures, and name of places, and cause effect of the sequential events. In terms of appraisal analysis, the first line of the first paragraph indicates proclaim under the semantic resource of engagement, in which the writer represents the date as the highly warrantable proposition. The textual voice of the date information has well-founded and generally

reliable in society. Then, the writer gives positive judgment towards Indonesians who refused to surrender their weaponry to British army. This shows patriotism to defend Indonesian territory and show that they are not afraid to face the bloody battle. The positive judgment is also given to Bung Tomo as realized in the clause *Bung Tomo is the well-known revolutionary leader who played a very important role in this battle.*

Text 2: The Battle of Surabaya

The Battle of Surabaya
<p><u>On 10 November, Indonesia celebrates Hari Pahlawan or Heroes Day in remembrance of the Battle of Surabaya which started on that very date in the year 1945</u> [engagement: proclaim]. The bloody battle took place because <u>Indonesians refused to surrender their weaponry to British army</u> [+judgment]. British Army at that time was part of the Allied Forces. The defiant <u>Bung Tomo is the well-known revolutionary leader who played a very important role in this battle</u> [+judgment].</p>
<p><u>It all started because of a misunderstanding between British troops in Jakarta and those in Surabaya, under the command of Brigadier A.W.W.S. Mallaby. Brigadier Mallaby already had an agreement with Governor of East Java Mr. Surya. The agreement stated that British would not ask Indonesian troops and militia to surrender their weapons</u> [engagement]. However, a British plane from Jakarta dropped leaflets all over Surabaya. The leaflet told Indonesians to do otherwise on <u>27 October 1945</u>. This action <u>angered</u> the Indonesian troops and militia leaders because <u>they felt betrayed</u> [-affect]</p>
<p><u>On 30 October 1945, Brigadier Mallaby was killed</u> as he was approaching the British troops' post <u>near Jembatan Merah or Red Bridge, Surabaya</u> [engagement: proclaim]. <u>There were many reports</u> about the death, but <u>it was widely believed that</u> the Brigadier was murdered by Indonesian militia [engagement: attribute]. Looking at this situation, <u>Lieutenant General Sir Philip Christison brought in reinforcements to siege the city</u> [-affect], [-judgment].</p>
<p><u>In the early morning of 10 November 1945, British troops began to advance into Surabaya with cover from both naval and air bombardment. Although the Indonesians defended the city heroically, the city was conquered within 3 days and the whole battle lasted for 3 weeks. In total, between 6,000 and 16,000 Indonesians died while casualties on the British side were about 600 to 2000</u> [engagement: proclaim]</p>
<p>Battle of Surabaya caused Indonesia to <u>lose weaponry which hampered the country's independence struggle</u> [-affect]. However, the battle provoked Indonesian and international mass to rally for the country's independence which made this battle <u>especially important for Indonesian national revolution</u> [+appreciation].</p>

The second paragraph describes the causes of the battle which refer to warrantable propositions They are categorized proclaim under the engagement resource. The date of event also strengthen the writer's proposition. The effect of the causal propositions trigger Indonesian negative emotion that are realized in the clause *This action angered the Indonesian troops and militia leaders because they felt betrayed.* The writer's voice is coded

into negative affect.

Again, at the beginning of the third paragraph, the date of the event represents the reliable writer's proposition as it is realized in the clause *On 30 October 1945, Brigadier Mallaby was killed as he was approaching the British troops' post near Jembatan Merah or Red Bridge, Surabaya*. This clause is categorized proclaim in engagement resource. However, the following clause indicates the subjectivity of external voice: *There were many reports and it was widely believed that ...* Therefore, these clauses are categorized as attribution under the engagement resource. Based on these propositions, the effect of Brigadier Mallaby killing leads to the *reinforcements to siege the city by Lieutenant General Sir Philip Christison*. The meaning of this clause surely gives negative affects and negative judgment toward British troops.

The fourth paragraph condenses with well-founded propositions like the dates of naval and air bombardment, the duration of battle, the numbers of dead troops. The clauses containing these propositions are categorized as proclaim under the semantic resource of engagement.

In the last paragraph, the writer's voice shows negative affect due to the lost of weaponry which hindered Indonesian's independence struggle. However, the writer also states positive appreciation that this battle became the world's attention to provoke Indonesia to immediately gain independence. The writer's voice in the last paragraph indicates his/her concern to enhance the spirit of nationalism, patriotism, and awareness to the heroes struggle for the country in the past.

The evaluative strategies operate in historical genres involve using linguistic resources to respond to events emotionally, judge past behavior within a moral framework and assess the weight and causal force of past events. The implementation of modelling and deconstructing text through appraisal framework should consider learners' language proficiency, motivation, and text quality. Some suggestions are given as follows:

- More guided practice activities in building the context of texts and in modelling and deconstructing of texts can be provided for elementary or low foreign language learner proficiency.
- Based on learners' language needs, teachers can emphasize targeted lexico-grammatical features when they model and deconstruct text.
- Teachers can select a wide range of in-class reading topics to meet the diverse interests of learners, including authentic text.
- Learners who prefer collaborative group work can be given more opportunities to jointly construct texts with their teachers and peer.

## Conclusion

In this paper, we adopted instructional discourse on modelling and deconstruction of texts by employing the appraisal theory to investigate the writers' voice. Two samples of historical texts about Indonesian wars are used

to highlight the linguistic features of evaluative meanings. These samples of historical texts can be used as the model for the learners and teachers can use them in their practice. The demonstration of text deconstruction inform learners and teachers the importance of the second stage of teaching-learning cycle which is based on genre pedagogy.

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## Factors Influencing the Use of Donation-Based Crowdfunding Platforms in Indonesia and The Development Strategies

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**Abstract:** The use of donation-based crowdfunding platforms in Indonesia is still not optimal, despite the country being known as one of the most generous in the world. This study discusses the factors that influence the use of donation platforms in Indonesia, namely perceived ease of use, perceived usefulness, platform trust, subjective norm, and gamification. Perceived ease of use and perceived usefulness are of concern because the public is still hindered by administration and platform use. Platform trust is an important factor because of concerns over violations that occur on the platform, reflected in reputation and information quality. Subjective norm are related to communities that have started using donation platforms with a potential significant number of donations. Another challenge of using donation platforms is low user engagement and retention, which can be improved through gamification. The results of this study 11 of 13 hypotheses accepted show that the perceived ease of use, perceived usefulness, and platform trust have a positive effect on behavioral intention, and behavioral intention has a significant effect on crowdfunding implementation. Meanwhile, the subjective norm does not directly affect behavioral intention, but mediated by the perceived usefulness. Gamification does not have a significant effect on behavioral intention, but has a significant effect on crowdfunding implementation, meaning that gamification will be useful for increasing retention rather than attracting users to adopt. The results of this study are processed with the VIKOR method to determine the priority scale of alternative strategies that can be developed to improve the performance of the donation platform. This study can be a guide for donation platform developers to increase the use of donation-based crowdfunding platforms in Indonesia.

**Keywords:** donation-based crowdfunding platform, perceived ease of use, perceived usefulness, technology acceptance model, platform trust, reputation, information quality, gamification, Indonesia.

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## Introduction

Indonesia has been named the most generous country in the world in 2020 by the Charities Aid Foundation (CAF) (World Giving Index, 2021). The WGI report shows that Indonesia has managed to maintain its position in the midst of a pandemic compared to other countries whose position has fallen due to the implementation of the regional restriction policy. Indonesia occupies the top two rankings of the three categories or indicators used by the WGI, namely donating to foreigners, donating money, and volunteering. On the other hand, internet penetration in Indonesia reached 76.3% as of July 2022 (Internet World Stats, 2022). Along with the penetration of the internet in Indonesia, it has made it possible for innovations to be realized in service providers such as the financial technology industry, which were previously done offline, now can be done online, including the practice of crowdfunding. Because the Internet continues to change our lives, the practice of donations, which is a type of crowdfunding, is also adapted to developing technologies (Hoefer, 2012). This is proven by the existence of a well-known donation site in Indonesia. Based on a usage ranking assessment, the IDN Research Institute (2019) states that donation platforms in Indonesia consist of Dompot Dhuafa, Ayo Peduli, Kitabisa, WeCare, Gandeng Tangan, Wujudkan, and Peduli. With the penetration of technology such as the internet and Indonesia being crowned as a generous country, it is hoped that it can support the creation of greater market potential in Indonesia, especially in the use of the donation platform.

The donation platform is a form of digital crowdfunding innovation that uses a web platform or application and utilizes an electronic payment platform to make transactions easier and faster. Djimesah et al. (2022) and Zhang et al. (2020) stated that crowdfunding-based platforms have advantages such as convenience, speed, transparency, and a wider reach compared to conventional systems. However, in Indonesia, the majority of donations have not maximized the use of digital media (Philanthropy Outlook, 2022). The results of the Philanthropy Outlook report (2022) show that the majority or 76.6% of philanthropic organizations in Indonesia use non-digital media to raise donations. The majority of digital channels used by fundraisers are social media and websites rather than the donation platform itself. This is motivated by deductions for platform operational costs, there is a collection period, and the general public is more inclined to support charitable campaigns than transformative ones. On the other hand, there is a potential increase from the donor side, research entitled GoPay Digital Donation Outlook 2020 states that digital donations have increased for generations Z, millennials and X, especially during the Covid-19 pandemic with the most significant increase in generation Z. The Covid-19 pandemic what has happened has changed the way people make donations from conventional to digital (Kopernik & Gopay, 2020). Another phenomenon, Databoks (2021) reveals that the majority of people choose online donations during Ramadan, where only 37% of respondents decide to donate offline because they are not used to it, are hampered by administration, and are limited by money transfer options. Low levels of acceptance of information technology can lead to low levels of use (Dehghan et al., 2012).

Another problem encountered was the occurrence of violations committed by one of the leading philanthropic foundations in Indonesia due to deductions from donations greater than the stipulated stipulation, namely 10%.

Another challenge in using the donation platform is low user participation and low user engagement (Golrang & Safari, 2021). According to Golrang & Safari (2021) increasing user participation can be done with gamification. Gamification is expected to encourage users to participate and engage in donation campaigns aimed at increasing potential opportunities to fund charitable projects. For gamification on the donation platform in Indonesia, currently not much has been implemented, some of which are still in the form of a Minimum Viable Product (MVP), therefore it is important to determine whether gamification has an effect on the use of the donation platform and how to determine the right dimensions or gamification elements before going any further. On the other hand, there are potential opportunities regarding various kinds of communities in Indonesia that can encourage a larger amount of donations than individual projects.

This study aims to explore the factors that influence the use of the donation platform so that it can serve as a basis for formulating a development strategy for the donation platform.

## Literature Review

### Donation-Based Crowdfunding Platform

The donation platform is the result of financial technology innovation in the form of crowdfunding. Crowdfunding is described as a collective effort by people or communities who build networks and pool their money together to invest and support efforts initiated by people or organizations and usually carried out via the internet (Ordanini et al., 2011). Crowdfunding can be classified into four categories, namely lending-based crowdfunding, equity-based crowdfunding, donation-based crowdfunding, and reward-based crowdfunding. However, it should be noted that donation-based crowdfunding is the only type of crowdfunding that does not involve a real or concrete return on investment (Behl & Dutta, 2020). Emerging from the social media wave, crowdfunding is open to anyone who wants to raise money or make a donation. Charitable organizations are catching on to the trend by building crowdfunding sites to host donation-based projects (Zhang et al., 2020). The benefits of the donation platform include being a valuable financial resource, charity projects on the internet, forms of community efforts, and social development. This platform is considered a valuable financial resource and is used to raise funds by individuals to support many charitable projects on the internet (Golrang & Safari, 2021). Donation platforms can help those in need apart from government efforts (Zhang et al., 2020). Donation platforms have the potential to enhance social development, especially in developing countries (Wash, 2013). Most crowdfunding agencies use various strategies to increase the amount of donations, either by focusing on the frequency of donations or by collecting larger amounts (Moritz & Block, 2016).

Donation behavior is a field of research to understand donors and strategize how to convince more to give (Zhang et al., 2020). From an operational point of view, all types of crowdfunding involve platforms, project makers, and supporters (Messeni Petruzzelli et al., 2019). Any entity wishing to establish an action, the project maker must observe certain rules relating to objectives, campaign design, principles of financial support, and legal issues. The majority of crowdfunding platforms have clear financial goals that they want to achieve within

a set time limit. In order to fully present their project to the crowd, they must offer precise and reliable information regarding the project and its results. Throughout the campaign, the platform usually maintains supporter participation and will then redirect those donations to the project creator. Internet-based platforms play an important role in the emergence of the crowdfunding phenomenon because fundraising activities are no longer limited to the geographical area where the project creator operates, but become available worldwide to any individual who can access the crowdfunding platform (Agrawal et al., 2015).

Financial technology innovation in the form of donation-based crowdfunding has begun to develop as evidenced by the presence and growth of well-known donation platforms in Indonesia. The growth of the internet population fueled digital philanthropy which underwent extraordinary transformations over the years (Hsieh, & Liou, 2020). Indonesia has been named the most generous country in the world in 2020 by the Charities Aid Foundation (CAF) (World Giving Index, 2021). Since donating money can be seen as a sacrifice, what motivates such altruistic actions is often the belief that it will eventually be rewarded in the future (C.-J. Liu & Hao, 2017). This can reflect that the Indonesian people have a high altruistic attitude.

### **Innovation, Easiness, and Usability**

A donation-based crowdfunding platform is a form of digital crowdfunding innovation. However, from a fundraising perspective in Indonesia, the majority of donations have not maximized the use of digital media. Based on the Philanthropy Outlook Report (2022) it shows that the majority or 76.6% of philanthropic organizations in Indonesia use non-digital media to raise donations, on the other hand the digital channels used by the majority of fundraisers are social media and websites rather than donation platforms.

From the side of the donor there is an increase in potential. Research titled GoPay Digital Donation Outlook 2020 states that digital donations have increased in generations Z, millennials and X, especially during the Covid-19 pandemic. The Covid-19 pandemic that occurred has changed the way people make donations from conventional to digital (Kopernik & Gopay, 2020). Another phenomenon, Databoks (2021) reveals that the majority of people choose online donations during Ramadan, where only 37% of respondents decide to donate offline. There are still many people who have not chosen a donation platform due to deductions for platform operating costs, collection periods, the general public who are more inclined to support charitable campaigns than transformative ones, are unfamiliar, are hampered by administration, and are limited by money choices (Philanthropic Outlook, 2022). The low level of acceptance of information technology causes a low level of use, if potential users of this technology show resistance to it, the desired goals cannot be achieved (Dehghan et al., 2012).

The Technology Acceptance Model (TAM) was created by Davis in 1989 to understand the relationship between attitudes, behavior of IT consumers and also to determine the factors that affect Acceptance of IT by users of information systems and to clarify and predict user behavior (Klopping & McKinney, 2004). The technology acceptance model is derived from the Theory of Reasoned Action (TRA) (Fishbein-Ajzen). Logical

operations theory which is a general model reveals that attitudes determine social behavior and attitudes are a function of beliefs about the consequences of behavior and evaluating the results. In the technology acceptance model, the application of logic operation theory is carried out to model the acceptance of information systems by users. Perceived Ease of use PEOU and Perceived Usefulness (PU) have been considered as the two basic structures of TAM in influencing information technology acceptance in recent decades. Perceived Ease of use (PEOU) refers to the level of customer confidence that BI services are easy to use (Davis, 1989). PEOU is claimed by Venkatesh and Davis (1996) that identify causes of PEOU is very important from a theoretical point of view to decide on adoption and use. Substantial evidence is that people who experience PEOU are more likely to use the system (Davis, 1989). Perceived Usefulness (PU) refers to how a person believes using a particular device will improve his performance (Davis, 1989). Users will use the service if they believe the service can benefit them. According to the Technology Acceptance model, the perceived usefulness of a system by users is influenced by the fact that the system is easy to use. This model also assumes that perceived ease of use and perceived usefulness have a direct impact on people's attitudes towards using the information system. Based on the literature review conducted, the Technology Acceptance Model influences the intention to use e-commerce platforms (Aparicio et al., 2021), e-banking (Dehghan et al., 2012; Ly & Ly 2022), healthcare (Dhagarra et al., 2020), and crowdfunding (Djimesah et al., 2022).

### **Trust, Reputation, Information Quality**

In contrast to the traditional conceptualization of trust which is based on building long-term human relations, the trust of internet users depends on the authenticity of digital content and the transaction processes carried out on a site (Grabosky, 2001). Three attributes are the main elements of trust in the online context, namely integrity, skill, and benevolence (Lee & Turban, 2001). Trust is an emotional state in which individuals are inspired to believe in others through satisfying behavior (Singh & Sinha, 2020). Trust supports the ecosystem in building positive long-term client relationships and is essential for technology adoption (Partel et al., 2019). Practically speaking, trust is a prerequisite for interactions carried out in uncertain environments (Ba & Paulov, 2002). In such situations, beliefs about the service provider as well as usability and ease of use become important. If service providers fail to convey trust, consumers are unlikely to engage in transactions. Ensuring trust, by creating a positive attitude towards service providers, is likely to improve user fear of service provider opportunism. Several studies have shown that trust is essential for building customer relationships and increasing system security (Li'ebana-Cabanillas et al., 2018). For consumers, online trust assurance helps mitigate vulnerabilities such as security and privacy breaches associated with online transactions (Kim & Peterson, 2017).

Reputation can be defined as an assessment of the potential desires of an entity where the evaluation is carried out by a group of external people in the context of evaluations carried out by previous buyers (Standifird, 2001). Reputation also influences the likelihood that a potential customer will make a purchase. Internet fraud causes consumers to be more careful, seeking information about vendors and taking them into account in purchasing decisions (Karahanna et al., 2013). User trust in the crowdfunding platform as a social information system,

concerns trust from donors and the authenticity of project campaign content (Zhang et al., 2020). The trust of e-commerce users in future transaction results is shaped by their past experiences. Such experiences that help reduce uncertainty in decision making can be summarized as website familiarity in terms of knowledge and understanding of the purpose of the site, how it works, and how to use it (Gefen, 2000; Kim et al., 2008). Similar to online consumers disclosing personal information, crowdfunding users enter personal and financial information into website databases to complete donation transactions. When crowdfunding sites demonstrate efforts to protect users from security and privacy compromises, user trust increases (Kim et al., 2008). This study defines perceived security as the user's perception of the efforts of crowdfunding sites to maintain the confidentiality of collected personal information and safeguard it in every way. Just as e-commerce sites need to provide accurate information about products and transactions, crowdfunding sites must provide reliable and sufficient information about projects and the donation process so that users can make informed decisions (Xu, 2018). Quality information also supports fundraising efforts by helping legitimize donation projects (Gerber et al., 2012). When users see the efforts made by crowdfunding sites to ensure that information is always complete and up-to-date, their trust tends to increase (Kim et al., 2008). On the other hand, the quality of the information can keep participants feeling engaged and their behavior active. Crowdfunding platforms need to survive and succeed with quality information as their main foundation (Bi et al., 2018). Studies also confirm that information quality leads to ethical practices on digital platforms. Based on the literature review conducted, reputation and trust have an influence on the intention to use the e-commerce platform (Aparicio et al., 2021), trust affects the intention to use the healthcare platform (Dhaggara et al., 2020). On crowdfunding platforms, reputation has an influence on platform trust which is mediated by privacy protection, perceived security and information quality which then platform trust affects crowdfunding readiness. Behl & Duta (2020) also stated that the quality of information affects the intention to use and behavior of crowdfunding.

### **Subjective Norm**

The belief that there is a social interest in doing or not doing certain actions has been put forward by Ashraf (2018). This concept refers to social restrictions that affect individuals, such as family, friends, neighbors, and colleagues. If a person expects others to behave similarly, those social expectations tend to be followed by the individual, which means a person's perception that most people who are important to him think he should or should not perform the behavior. Therefore, individuals will be more likely to engage in activities on a donation platform if they believe that the behavior is desirable in a social context. The reason for the direct effect of subjective norms on intention is that people may choose to perform a behavior, even if they themselves dislike the behavior or its consequences, if they believe one or more important references think they should do it, and they agree. motivated enough to comply with the reference (Venkatesh & Davis, 2000).

In an empirical comparison of TAM and TRA, Davis et al. (1989) found that subjective norms had no significant influence on intention beyond perceived usefulness and ease of use, and they omitted them from the original TAM, but they acknowledged the need for additional research to investigate the conditions and mechanisms governing the impact of social influence on use behavior. Davis finds that subjective norms have a

significant influence on intention in mandatory settings but not in voluntary settings referring to the causal mechanism underlying this effect as compliance. As Hartwick & Barki (1994) found, even when users perceive use of the system as organizationally mandated, usage intentions vary because some users are unwilling to comply with the mandate. But subjective norms can influence intentions indirectly through perceived usefulness. Internalization (Kelman, 1958) refers to the process by which, when a person perceives that an important referent thinks he or she should use a system, he incorporates the referent's beliefs into his own belief structure. Internalization is equivalent to what Deutsch and Gerard (1955) call informational social influence which is defined as the influence to receive information from others as evidence about reality. In the case of internalization, subjective norms have an indirect effect on intention through perceived usefulness, as opposed to a direct adherence effect on intention. Accordingly, TAM2 theorizes that the direct effect of subjective norms on intention for mandatory use contexts will be strong prior to implementation and during initial use, but will weaken over time as increased direct experience with the system provides an evolving basis for intention toward continued use.

### Gamification

User engagement is often measured as a static process and rarely measured and tested as a time series construct, this points to an important part of gamification research, namely continuous engagement (Ramadan, 2018). Gamification is the application of game domain elements to change human behavior in a non-game environment (Camerer, 2003). Gamification can generate engaging experiences, thus enhancing the way customers interact with their company or brand (Robson et al., 2016). Therefore, understanding how customer engagement in online transaction processes can be enhanced is an important factor in creating a successful digital strategy (Insley & Nunan, 2014). Palmer et al. (2012) distil hundreds of current principles of game mechanics, behavioral economics theory, and user experience design thinking into four specific dimensions of gamification. The following is an explanation of the gamification dimensions and elements:

Table 1. Gamification Dimensions and Elements (Palmer et al., 2012)

Gamification Dimensions	Definition	Gamification Elements
Progress paths	Narrative guides and challenges that change as the user progresses	Challenge, task
Feedback and rewards	Quick indication of success, whether virtual or real	Badge, achievement, level, rewards, voice feedback, point
Social connection	Support and competition structures that make winning possible	Leaderboard, community, moment
Interface and user experience	Aesthetic design and platform considerations that enhance fun and appearance	Avatar, design improvement

A series of similar hypotheses have also been proposed in the literature regarding the relationship between crowdfunding and gamification. Donation-based crowdfunding, which is at the heart of aid operations, does not offer compensation to donors, making it difficult to attract more people or consistently defend the interests of donors (Kuti & Madarász, 2014). Burtch et al. (2018) discuss how providing a points mechanism can help achieve community involvement in donation platforms. The situation becomes more complex in disaster relief operations because it involves many stakeholders and financial assistance needs to be achieved quickly, which can be done with the continuous involvement of donors (Zagefka & James, 2015). The use of gamification has also been used to generate fun in crowdfunding platforms (Hantke, Appel, & Schuller, 2018). Gamification can increase users' intrinsic and extrinsic motivation, increase user participation and enjoyment, play a positive role in changing user behavior in the fields of health, education, brand marketing, and many more (Yin, 2022). Crowdfunding platforms and channels use game mechanics to achieve the desired result. Over the years, gamification has been increasingly applied in multidisciplinary fields including commerce, environment and ecological behavior, cartography, machine learning, software development, innovation, health and medical issues, politics, education, tourism, finance and funding, energy, mobility and transportation (Golrang & Safari, 2021). Gamification is widely applied to crowdfunding platforms, including for donation-based crowdfunding (Gofundme), gift-based crowdfunding (Kickstarter), peer-to-peer or loan-based crowdfunding (LendingClub), and equity-based crowdfunding (FundersClub) (Burtch et al., 2018). Some prime examples include Razoo-like gamification approaches to fundraising, which has raised \$200 million for charity. Similar practices have also been adopted by Rallyup.com and Challengely, which have successfully engaged customers for a common goal (Neeli, 2015). As gamification has been successfully implemented on the platforms mentioned, it is hoped that gamification can influence the use of crowdfunding platforms as research has also been conducted by Behl & Dutta (2020), Zhang et al. (2020), and Golrang & Safari. (2021). According to Golrang & Safari. (2021), the use of gamification elements in the donation platform affects the sustainable use of the platform and increases user engagement.

## **Methodology**

### **Data Collection Methods**

To test the research model, survey observations were conducted and collected in the form of a questionnaire with a list of measurement items that were mostly adapted from existing studies. This study uses the Partial Least Square Structural Equation Modeling (PLS-SEM) technique in evaluating the proposed research model with SmartPLS 3.0 software. Compared to covariance-based structural equation modeling (SEM), SEM based on Partial Least Square (PLS) is able to handle formative latent variables in addition to reflective variables (Zhang et al., 2020). The advantages of PLS-SEM have been discussed by Peng & Lai (2012), especially in the context of predicting the validity of exogenous variables. Unlike traditional regression methods, SEM offers a simulation environment to understand the relationship and dependence of several independent constructs with dependent constructs (Urbach & Ahlemann, 2010). Hair et al., (2006) have discussed the advantages of SEM in differentiating the nature of independent and dependent variables and, more specifically, exogenous and



endogenous latent variables. Preacher & Hayes (2008) compared the use of covariance-based SEM and PLS-based SEM and proposed guidelines for using certain types of SEM in certain circumstances. This study fulfills most of the criteria set by Preacher & Hayes (2008) because this study is exploratory in nature and the theoretical framework is not borrowed from existing frameworks. The use of PLS-SEM is also recommended because it offers easy understanding of the results even with reduced sample sizes and limited residual distributions, along with handling problems such as factor uncertainty (Fornell & Bookstein, 1982). This study followed guidelines such as those provided by Peng and Lai (2012) and adopted a two-step approach to estimating the model. The first step is to examine the reliability and validity of the measurement model, then proceed with analyzing the structural model.

Data was collected in Indonesia with respondents from diverse geographical backgrounds. According to Kock & Handaya (2018) based on the theory of the inverse square root method with a significance level of 5% and a minimum path coefficient of 0.2, the minimum number of respondents is 155 respondents. Links to online questionnaires were posted on various social media platforms to reach respondents, in addition to that, filling out the questionnaire directly with respondents without going through social media. Respondents must have used donation platforms in Indonesia such as Kitabisa, Benihbaik, Wecare, ACT, Dompot Dhuafa, Rumah Zakat, Lindungihutan. Each item is measured on a five-point Likert scale to ensure higher variability between survey responses (Dubey et al., 2019), where 1 indicates Strongly Disagree and 5 indicates Strongly Agree. The use of a 5-point scale has been established as a good scale for samples larger than 100 (Leung, 2011). The study received a total of 187 respondent responses. The theoretical framework used in this study is the result of a systematic process that begins with studying existing scales and understanding their suitability and application in the context of this research and involves exploring constructs and defining them operationally in the research context.

### Conceptual Model Design

Table 2. Explanation of the Conceptual Model

Variable	Concept	Source
Perceived Usefulness	The degree to which a person believes that using a particular system will improve his job performance	(Davis et al., 1992)
Perceived Ease of Use	The extent to which a person believes that using a particular system will be free of effort, freedom from difficulty or great effort	(Davis et al., 1992)
Gamification	Use of game design elements in non-game contexts to motivate and increase user activity and retention	(Deterding et al., 2011; Behl & Dutta, 2020)

Subjective Norm	A person's perception that most people who are important to him think he should or should not engage in the intended behavior	(Venkatesh & Davis, 2000)
Website Reputation	The consumer's impression of an Internet store is based on public opinion and the extent to which shoppers believe the organization is honest and cares about its customers	(Jarvenpaa et al., 2000)
Platform Trust	User trust in the platform as an information system that concerns donor trust and the authenticity of project content	(Zhang et al., 2020)
Information Quality	User's general perception of the accuracy and completeness of site information relating to products and transactions	(Kim et al., 2008)
Perceived Security	User's perception that Internet vendors will comply with security requirements such as authentication and integrity	(Kim et al., 2008)
Behavioral Intention	The degree of evaluative effect that an individual associates with using the system	(Davis et al., 1992)
Crowdfunding	Behavioral responses to individual intentions to use crowdfunding	(Behl & Dutta, 2020; Deterding et al., 2012)

With the depiction of the conceptual model as follows:

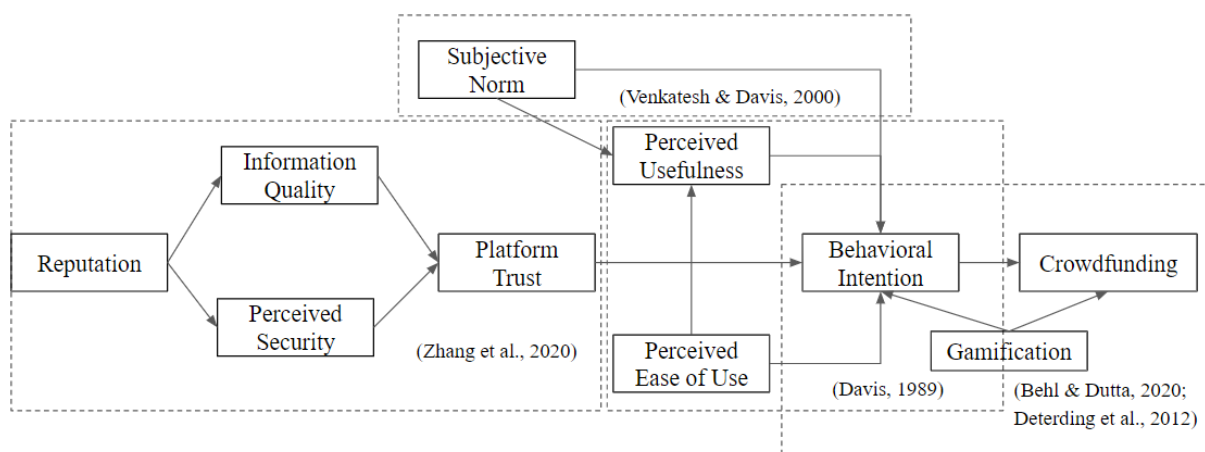


Figure 1. The Conceptual Model

The model is adopted from several financial technology literatures including donation platforms. Zhang et al.

(2020) explain how reputation affects Platform Trust which is mediated by Perceived Security and Information Quality on the use of the donation platform. Davis (1989) uses the Technology Acceptance Model in the form of two main components, namely Perceived Usefulness and Perceived Ease of Use to adopt the use of technology including financial technology. Gamification was adopted from Behl & Duta's research (2020) which proved that gamification can have a positive effect on Behavioral Intention and Crowdfunding. On the financial technology platform, Deterding et al. (2011) revealed that Gamification can influence usage involvement. In the conceptual model, all variables lead to Behavioral Intention and Crowdfunding with the aim of measuring the level of adoption and actual behavior in making donations. Through this conceptual model, the following research hypotheses were formulated:

Table 3. Research Hypothesis

Hypothesis	Definition	Source
H1	Reputation (R) has an influence on Perceived Security (PS)	(Zhang et al., 2020)
H2	Reputation (R) has an influence on Information Quality (IQ)	(Zhang et al., 2020; Behl & Dutta, 2020)
H3	Information Quality (IQ) has an influence on Platform Trust (PT)	(Zhang et al., 2020)
H4	Perceived Security (PS) has influence over Platform Trust (PT)	(Zhang et al., 2020)
H5	Platform Trust (PT) has influence on Behavioral Intention (BI)	(Zhang et al., 2020; Dhagarra et al., 2020; Aparicio et al., 2021; Sullivan & Kim; Ly & Ly 2022)
H6	Subjective Norm (SN) has an influence on Perceived Usefulness (PU)	(Venkatesh & Davis, 2020)
H7	Subjective Norm (SN) has an influence on Behavioral Intention (BI)	(Venkatesh & Davis, 2020; Ly & Ly 2022)
H8	Perceived Usefulness (PU) has an influence on Behavioral Intention (BI)	(Davis, 1989; Dehghan et al., 2012; Ly & Ly 2022; Djimesah et al., 2022)
H9	Perceived Ease of Use (PEOU) has an influence on Perceived Usefulness (PU)	(Davis, 1989; Dehghan et al., 2012; Ly & Ly 2022; Djimesah et al., 2022)
H10	Perceived Ease of Use (PEOU) has an influence on Behavioral Intention (BI)	(Davis, 1989; Dehghan et al., 2012; Ly & Ly 2022; Djimesah et al., 2022)
H11	Gamification (GM) has an influence on Behavioral Intention (BI)	(Behl & Dutta, 2020; Sullivan and Kim, 2018; Aparicio et al., 2021; Deterding et al., 2011)
H12	Gamification (GM) has an influence on Crowdfunding (CW)	(Behl & Dutta, 2020)
H13	Behavioral Intention (BI) has an influence on Crowdfunding (CW)	(Behl & Dutta, 2020)

### Questionnaire Design

The questionnaire in this study used measurement items derived from a literature review of the observed constructs with the references listed in the following table:

Table 4. Research Questionnaire

Variable	Measurement Items	Source
Reputation (R)	The donation platform I use has a good reputation The donation platform that I use is known by the public The donation platform I use has a reputation for being honest	(Zhang et al., 2020; Aparicio et al., 2021)
Platform Trust (PT)	A trustworthy donation platform A reliable donation platform The donation platform keeps promises The donation platform has my best interest in mind	(Zhang et al., 2020; Fang et al., 2014)
Information Quality (IQ)	Overall, I think the platform provides useful information Donation platforms provide reliable information The donation platform provided enough information when I tried to make a donation I am satisfied with the information provided by the donation platform	(Zhang et al., 2020)
Perceived Security (PS)	The donation platform implements security measures to protect donors I feel safe with the electronic payment system on the donation platform I am willing to use my payment card on the donation platform to make a donation	(Zhang et al., 2020)
Subjective Norm (SN)	People who influence my behavior think that I should use a donation platform The community I live in thinks I should use a donation platform The media influenced me to use the donation platform	(Venkantesh & Davis, 2000; Ly & Ly, 2022)
Perceived Ease of Use (PEOU)	My interaction with the system is clear and understandable I find the system easy to use Interacting with the system doesn't take much effort	(Davis, 1989; Ly & Ly, 2022)
Perceived Usefulness (PU)	Using a donation platform would be beneficial Using the donation platform will be more convenient for me Using the donation platform system will increase my efficiency	(Davis, 1989; Ly & Ly, 2022)
Behavioral Intention (BI)	Assuming I have access to a donation platform, I intend to participate in it I intend to participate in donations on the donation platform in the future I will use the donation platform to help others Participating in donations on the donation platform is something I will do	(Behl & Dutta, 2020)
Gamification (GM)	To what extent do you believe that game elements: Gives me a feeling of being directed Gave me useful feedback so I can adapt Encourages me to strive for achievements and goals Gives me a sense of social support	(Behl & Dutta, 2020)
Crowdfunding (CW)	I prefer to fund projects that are close to their funding goal (e.g. 80% of the money to be raised) I prefer to fund projects that involve a high monetary value	(Behl & Dutta, 2020)

Being involved in the creation process through funding a project is an honor in itself  
When I fund a project, my most important driver is excitement

**Profile of Respondents**

As a form of respondent eligibility, respondents who are included in this study will be limited to individuals who have used the donation platform. This is done to ensure that respondents have sufficient knowledge in using the donation platform and can provide an accurate view of the factors that influence the use of the donation platform. Respondents received in this study totaled 187. Following are the profiles of the respondents who participated in filling out the research questionnaire:

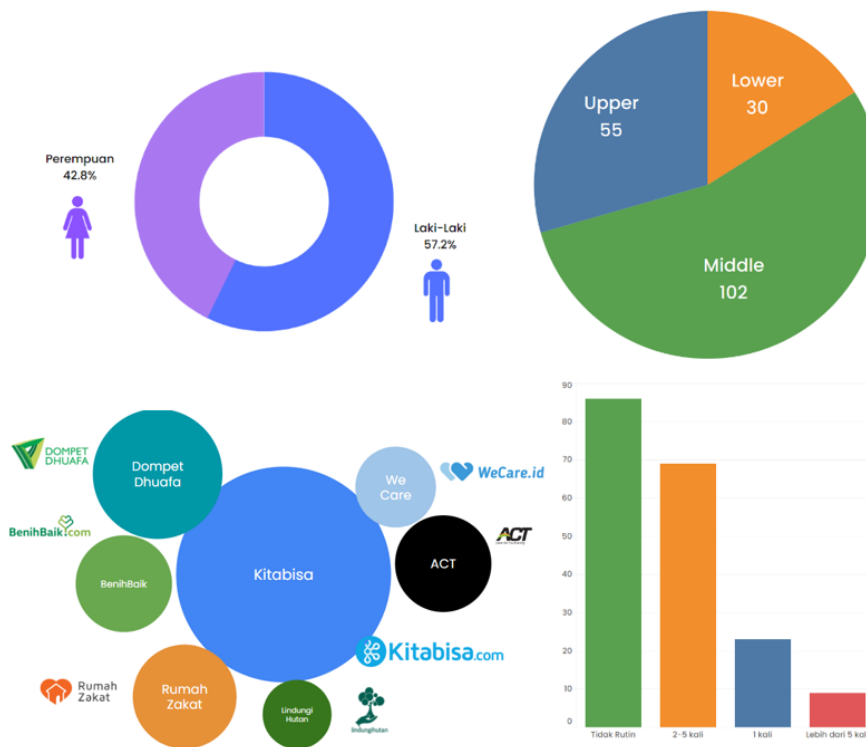


Figure 2. Profile of Respondents

Table 5. Profile of Respondents

Demographics	Classification	Total
Gender	Man	107
	Woman	80
Age	18-24 years	51
	25-30 years	50
	31-35 years	20
	36-40 years	21

	> 40 years	44
Work	Full time	98
	Part time	22
	Student / Student	29
	Entrepreneur/Business Owner	22
	Doesn't work	16
Residence	DKI Jakarta	67
	West Java	15
	Central Java	65
	East Java	19
	Banten	10
	Yogyakarta	11
	The Donation Platform used	Kitabisa
Dompot Dhuafa		49
ACT		20
Rumah Zakat		33
WeCare		16
LindungiHutan		11
BenihBaik		18
Social Economic Status		Upper
	Middle	102
	Lower	30
Frequency of use of the donation platform	1 time	23
	2-5 times	69
	More than 5 times	9
	Not a routine	86

### Strategy Recommendations

Assessment of recommendations for strategies/alternatives in developing the donation platform with the aim of increasing user adoption and involvement is carried out using the VlseKriterijumska Optimizacija I Kompromisno (VIKOR) method which begins with the selection and adjustment of relevant alternatives to the variables that influence the use of the donation platform through a literature review conducted by researchers to then be given to the expert for confirmation. Once confirmed, then the expert evaluates the weighting of the criteria and evaluates the alternatives with the aim of obtaining a Q Value of each alternative that can be used to determine the ranking of the alternatives to all the alternatives proposed.

Table 6. List of Experts

Expert	Role	Experience
A	Head of Research	3 years (Donation-Based Crowdfunding Platform)
B	Chief Operations Officer	3 years (Fintech Platform)
C	Product Manager	2 years (Donation-Based Crowdfunding Platform)

## Results and Discussion

This study used the Partial Least Square Structural Equation Modeling (PLS-SEM) technique in evaluating the proposed research model with SmartPLS 3 software. A two-stage analytical procedure by (Hair et al., 2019) was used to test the measurement and structural models. The study followed the guidelines by Peng & Lai (2012) who adopted a two-step approach to estimating the model. The first step is to examine the reliability and validity of the measurement model, followed by analyzing the structural model. The results of the test using SmartPLS 3 can be seen in the following figure:

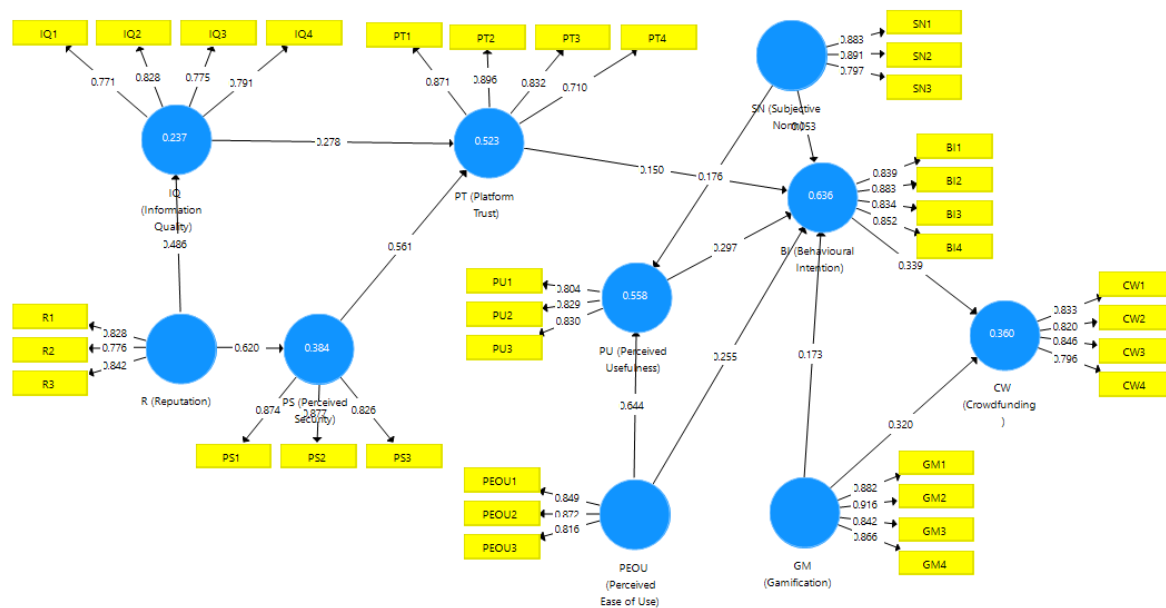


Figure 3. Path Model

## Measurement Models

This study assesses the latent construct measurement model to determine validity and reliability. For internal consistency reliability assessment, Cronbach's Alpha ( $\alpha$ ) must be greater than 0.7. Outer Loading should be 0.5 or higher, and ideally 0.7 or higher. Composite Reliability (CR) must be greater than 0.7 (Hair, 2019). Meanwhile, the Average Variance Extracted (AVE) must be greater than 0.5 in determining the construct level of convergent validity (Hair, 2019).

Table 7. Validity and Reliability Test

Construct/Variable	Item	Outer Loading	Composite Reliability (CR)	Cronbach's Alpha ( $\alpha$ )	AVE
Reputation (R)	R1	0.828	0.857	0.752	0.666
	R2	0.776			
	R3	0.842			
Information Quality (IQ)	IQ1	0.771	0.87	0.831	0.626
	IQ2	0.828			
	IQ3	0.775			
	IQ4	0.791			
Perceived Security (PS)	PS1	0.874	0.894	0.823	0.739
	PS2	0.828			
	PS3	0.776			
Platform Trust (PT)	PT1	0.871	0.898	0.847	0.689
	PT2	0.896			
	PT3	0.832			
	PT4	0.71			
Gamification (GM)	GM1	0.882	0.93	0.899	0.769
	GM2	0.882			
	GM3	0.916			
	GM4	0.842			
Subjective Norm (SN)	SN1	0.883	0.893	0.821	0.736
	SN2	0.883			
	SN3	0.891			
Perceived Ease of Use (PEOU)	PEOU1	0.849	0.716	0.801	0.716
	PEOU2	0.849			
	PEOU3	0.872			
Perceived Usefulness (PU)	PU1	0.804	0.861	0.759	0.674
	PU2	0.804			
	PU3	0.829			
Behavioral Intention (BI)	BI1	0.839	0.927	0.895	0.761
	BI2	0.839			
	BI3	0.883			
	BI4	0.834			
Crowdfunding (CW)	CW1	0.833	0.894	0.843	0.679
	CW2	0.833			
	CW3	0.82			
	CW4	0.846			

Outer Loading is the value generated by each indicator to measure each variable which shows a large correlation between the indicator and the latent variable. In this study all items with an Outer Loading value have a value above 0.7, which means that they meet the requirements and are ideal, where Outer Loadings must be 0.5 or higher, and ideally 0.7 or higher for all variables. Cronbach's Alpha ( $\alpha$ ) is a measure used in statistics to measure the reliability or consistency of a measurement scale or questionnaire. In simple terms, Cronbach's Alpha ( $\alpha$ ) provides information about the extent to which the items in the scale correlate with each other. If the items on the scale have a high correlation, then the Cronbach's Alpha ( $\alpha$ ) will be high, indicating good consistency in measurement. Conversely, if the items on the scale have a low correlation, then the Cronbach's Alpha ( $\alpha$ ) will be low, indicating a problem in measurement consistency. The value of Cronbach's Alpha ( $\alpha$ ) in this study has a value above 0.7 which means that all instruments used in the variables or constructs are said to be reliable. Composite Reliability (CR) for all constructs has a value above 0.7, this indicates an acceptable level of reliability for each construct. Likewise, the Average Variance Extracted (AVE) value is far above 0.5, which



means it supports convergent validity which reflects the items used are interrelated and describe the construct well. Based on the results of the data analysis above, it can be concluded that the measurement scale used in the study has good reliability and construct validity. The items in the scale have a strong relationship with the construct being measured, and meet the expected reliability and validity criteria.

Table 8. Discriminant Validity

	BI	CW	GM	IQ	PEOU	PS	PT	PU	R	SN
BI	0.852									
CW	0.55	0.824								
GM	0.66	0.544	0.877							
IQ	0.5	0.429	0.403	0.791						
PEOU	0.717	0.414	0.669	0.451	0.846					
PS	0.679	0.44	0.687	0.421	0.626	0.859				
PT	0.661	0.446	0.647	0.514	0.685	0.678	0.83			
PU	0.712	0.515	0.603	0.548	0.731	0.588	0.656	0.821		
R	0.639	0.368	0.515	0.486	0.671	0.62	0.784	0.67	0.816	
SN	0.539	0.513	0.749	0.333	0.491	0.619	0.568	0.493	0.457	0.858

The table above given is the discriminant validity matrix, which describes the level of relationship between the variables involved in the study. The table shows that the discriminant validity in the diagonal cells is more significant than the corresponding row and column values, which means that a variable does not affect other variables more than the variable itself. The indicator must be loaded more strongly on the corresponding construct than the other constructs in the model and the AVE root must be greater than the correlation between constructs (Sullivan & Kim, 2018). Thus, it can be concluded that the variables involved in the study have good discriminant validity.

### Structural Models

In measuring the inner model, the T-Statistics must be greater than 1.96, while the p-value must be 0.05 to confirm the hypothesis (Hair, 2019). Finally, the qualitative data is interpreted to confirm the quantitative results. R Square has a value of 0.75, 0.5, or 0.25, which has a substantial, moderate, and weak category (Hair, 2019). The Path Coefficient has a value of -1 to +1 which indicates the direction of the variable's influence.

Table 9. R Square

Construct/Variable	R Square
Behavioral Intention (BI)	0.636
Crowdfunding (CW)	0.36
Information Quality (IQ)	0.237
Perceived Security (PS)	0.384

Platform Trust (PT)	0.523
Perceived Usefulness (PU)	0.558

The R Square value is used to measure how much the percentage of variability of each construct can be explained by the related variables. Based on these results, it can be concluded that the variability of these constructs can be explained to different degrees by the related variables. The variability of these constructs can provide an understanding of the extent to which these constructs can influence and explain the phenomenon under study.

Table 10. Hypothesis Testing

Hypothesis	Independent Variable	Dependent Variable	Path Coefficient	T-Statistic	P-Value
H1	Reputation (R)	→ Perceived Security (PS)	0.62	14	0.000
H2	Reputation (R)	→ Information Quality (IQ)	0.486	10.719	0.000
H3	Perceived Security (PS)	→ Platform Trust (PT)	0.278	5.691	0.000
H4	Information Quality (IQ)	→ Platform Trust (PT)	0.347	11.524	0.000
H5	Platform Trust (PT)	→ Behavioral Intention (BI)	0.15	2.13	0.034
H6	Subjective Norm (SN)	→ Perceived Usefulness (PU)	0.176	3.485	0.001
H7	Subjective Norm (SN)	→ Behavioral Intention (BI)	0.053	0.774	0.439
H8	Perceived Ease of Use (PEOU)	→ Perceived Usefulness (PU)	0.255	2.923	0.004
H9	Perceived Ease of Use (PEOU)	→ Behavioral Intention (BI)	0.644	13.429	0.000
H10	Perceived Usefulness (PU)	→ Behavioral Intention (BI)	0.297	3.516	0.001
H11	Gamification (GM)	→ Behavioral Intention (BI)	0.173	1.811	0.071
H12	Gamification (GM)	→ Crowdfunding (CW)	0.32	3.937	0.000
H13	Behavioral Intention (BI)	→ Crowdfunding (CW)	0.339	3.916	0.000

The significance test is based on bootstrapping, which is a nonparametric procedure based on a large number of subsamples taken randomly from the data with replacement (Hair, 2019). In path analysis, the Path Coefficient is a measure that describes how much the independent variable influences the dependent variable and the direction of the relationship. The T-Statistic is used to measure how big the difference or relationship is between two variables, while the P-Value is used to determine whether the difference or relationship is significant or just a mere coincidence which aims to provide information about the extent to which the results of this research test support or reject the hypothesis. zero.

As shown in the table, there are 11 out of 13 significant relationships. The insignificant relationship includes

Subjective Norm (SN) to Behavioral Intention (BI) which has a T-Statistic value  $<1.96$ , namely 0.774 and P-Value  $> 0.05$ , namely 0.439. Then also Gamification (GM) on Behavioral Intention (BI) which has a T-Statistic value  $<1.96$ , namely 1.811 and P-Value  $> 0.05$ , namely 0.071. Based on the results of this analysis, it can be concluded that the hypotheses proposed in this study are accepted except for hypothesis H7 which does not show a significant relationship between Subjective Norm (SN) and Behavioral Intention (BI) and H11 which does not show a significant relationship between Gamification (GM) and Behavioral Intention (BI). This shows that the presence of Subjective Norm (SN) and Gamification (GM) does not cause someone to have the desire to use the donation platform. On the other hand, the results of the analysis also indicate that independent variables such as Reputation (R), Perceived Security (PS), Information Quality (IQ), Platform Trust (PT), Perceived Ease of Use (PEOU), Perceived Usefulness, and significantly contributed to Behavioral Intention, Subjective Norm (SN) significantly contributed to Perceived Usefulness (PU), and Gamification (GM) significantly contributed to Crowdfunding (CW).

Subjective Norm (SN) do not affect Behavioral Intention (BI) but affect Perceived Usefulness (PU) meaning that even though individuals receive influence or opinions from people who are important to them, this does not necessarily make them more inclined to engage in donating behavior. on these platforms This study applies Subjective Norm on donation platforms which are currently still voluntary Davis et al 1989 found that subjective norms have a significant influence on intention in mandatory settings, but not in voluntary settings Even if users perceive use of the system as an organizational mandate or community, intentions to use may vary because some users do not want to adhere to those mandates. However, subjective norms can still influence intention indirectly through perceived usefulness. The process of internalization, in which individuals incorporate referential beliefs into their own belief structures, also plays a role. important In this case, subjective norms have an indirect influence on intention through perceived usefulness In TAM 2, the theory states that the direct effect of subjective norms on intentions will be strong before implementation and during initial use, but will weaken over time due to direct experience with systems provide an ever-evolving basis for usage intentions.

Gamification (GM) has no influence on Behavioral Intention (BI) but has an influence on Crowdfunding (CW) explaining that even though the presence of gamification does not cause potential users to adopt gamification, gamification itself can help increase user engagement/retention and increase the nominal amount in make a donation by adding a game element to the fundraising process. It is necessary to consider the right gamification elements/dimensions to increase retention compared to adoption such as achievement and social sharing rather than the use of points or rewards.

### **Strategy Recommendations**

Based on the research that has been done, what can be used as an assessment or alternative determination is knowing that Platform Trust (PT) has a significant influence on Behavioral Intention (BI), Subjective Norm (SN) which has a significant influence on Perceived Ease of Use (PEOU). but does not have a significant influence on Behavioral Intention (BI), Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) which

have a significant effect on Behavioral Intention (BI), and Gamification (GM) which have a significant influence on Crowdfunding (CW) but does not have a significant effect on Behavioral Intention (BI). After knowing the effect of these factors on the use of the donation platform, the selection of relevant alternative strategies was obtained from a literature review. Alternatives in developing a donation platform based on a literature review are as follows:

- (1) Perceived Ease of Use (PEOU) has an influence on Behavioral Intention (BI) and Perceived Usefulness (PU) has an influence on Behavioral Intention (BI):

Crowdfunding platforms should take advantage of mobile money technology along with using innovative ways to increase stakeholders' perceptions of its usefulness and encourage them to use it and promote projects (Djimesah et al., 2022). Crowdfunding platforms should consider how ready platform stakeholders are to adopt the technology and their readiness to use the tools that make system adoption complete (Okine et al., 2023). Fundraisers can go the extra mile to showcase their projects with images and videos, as well as testimonials from credible individuals or organizations. Fundraisers should ensure that they update information regularly and in a timely manner. The website can provide a support system that reminds recipients to keep donors informed of project progress. Individuals or organizations coordinating fundraising projects should pay close attention to the content they place on websites. The project details donated by the donor are highlighted in the description, and the information provided is accurate and complete (Zhang et al., 2020).

- (2) Platform Trust (PT) has influence on Behavioral Intention (BI):

Companies can improve their image of trust towards customers by providing consistent service quality, keeping promises, increasing the level of integrity, and being trustworthy (Aparicio et al., 2021). It is suggested that fundraisers starting crowdfunding projects can provide detailed project information and explain their actual situation (Wu et al., 2022). Charities orient their identity working towards the dimensions of self-identity for the attainment of the goals of cultivating loyal donors. The institutional context, in the sense that charities need to rebuild credibility in the face of increasing public distrust of charity work, competes for limited resources (Liu & Chen, 2021). Disclosure of personal fundraising information is beneficial to campaign performance, as it is more likely to gain the trust of donors. Detailed project descriptions (higher number of words) can improve the performance of crowdfunding campaigns. Fundraising efforts on social media are an important factor in project performance especially in the early stages of the campaign. Frequent updates on project progress are essential to improve campaign performance (X. Liu et al., 2022).

- (3) Subjective Norm (SN) has an influence on Behavioral Intention (BI):

Practical alternatives to mandating use based on social information should be developed and tested, such as increasing the credibility of social information sources to increase internalization or designing communication campaigns that increase the prestige associated with using the system to increase identification (Venkatesh & Davis, 2000).

- (4) Gamification (GM) has an influence on Crowdfunding (CW):

Crowdfunding sites may use multiple gamification categories including points, badges, leaderboards,

social sharing and/or a combination of these to ensure effective engagement (Burtch et al., 2018). Gamification is considered as one of the most appropriate techniques to create user engagement. It is the presence of gamification elements, such as points, badges, and dynamics, that produce a sensation of consumer satisfaction as a result (Behl & Dutta, 2020).

After selecting the relevant alternatives, the alternatives are then adjusted by the researchers to be given to experts to be confirmed and given an assessment using the VIKOR procedure. The criteria used for alternative assessments are RICE with the addition of Scalability/Innovation Potential. RICE which means Reach, Impact, Confidence, Effort is a priority model created by Sean McBride at Intercom as an approach to multi-dimensional problems (Ithia, 2019; Sandy, 2020). After conducting an assessment using VIKOR, the following are recommendations for research alternatives based on the ranking of the alternative-criteria values:

- 1) Presenting interesting stories and narratives about recipients of donations and individuals who have successfully helped through donations.
- 2) Partner with trusted experts and charitable organizations/organizations that have a good reputation in providing consistent donation management services and displaying certification to create credible testimonials.
- 3) Provides an option for automatic recurring donations, where users can set a schedule and the amount of donation they want to give on a regular basis to make it easier for users to contribute consistently and build an ongoing relationship with the donation project.
- 4) Build partnerships with government, social, non-profit organizations and companies that have a good reputation in the community for the use of donation platforms, CSR, and promotion of the use of donation platforms.
- 5) Improving the features of the description of donations, monitoring and reporting of donation projects with the quality of information that is accountable and transparent on a regular basis for users.
- 6) Provide effective search and personalization features on the donation platform so that users can adjust their preferences and interests.
- 7) Provide a verification and validation system for donors and recipients of donations.
- 8) Simplify administration processes and facilitate interactive tutorials and user guides to guide new users in adopting the platform.
- 9) Increasing integration with digital payment systems or other channels (retail shops) so that users have more flexible choices in making donations.
- 10) Provide a badge and achievement system for users as rewards and prestige.
- 11) Integrate social sharing features that enable users to share social projects and donation records on the donation platform to social media users.
- 12) Provide a space for users to provide ratings and reviews of the charitable projects they support to help other users make more informed donation decisions and provide feedback to recipient organizations.

## Discussion

Based on the hypothesis testing, this study found that most of the hypotheses which amounted to 11 out of 13 were accepted, except for hypotheses H7 and H11. The results of the study show that Reputation (R) which is mediated by Perceived Security (PS) and Information Quality (IQ) has a significant influence on Platform Trust (PT). Platform Trust (PT) has a significant influence on Behavioral Intention (BI), this represents that users who trust the donation platform are more likely to make donations on that platform and they also tend to consider the platform as their top choice when looking for a donation platform. Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) also have a significant influence on Behavioral Intention (BI), which means that if individuals believe that with the convenience offered by the donation platform, they can make a significant contribution to the goals or missions they want to support. and if individuals feel that using the donation platform is easy and simple, then they will feel more comfortable and confident in using the donation platform to make donations. However, the findings of this study indicate that Subjective Norm (SN) has no significant effect on Behavioral Intention (BI) but has a significant effect on Perceived Usefulness (PU). This could imply that although the influence of important people on individuals does not necessarily make them more inclined to donate on a donation platform, subjective norms can still influence intention indirectly through perceived usefulness. Subjective norms will have a significant effect on mandatory arrangements, but not on voluntary arrangements, on the donation platform the majority are on voluntary arrangements. Then, Gamification (GM) also does not have a significant effect on Behavioral Intention (BI) but has a significant effect on Crowdfunding (CW). This represents that the presence of gamification does not cause users to have a direct intention to use the donation platform, but users will feel happy in carrying out the donation mechanism if gamification is present on the donation platform where this can lead to increased user engagement or retention and the amount of donations. This knowledge is then used to design strategic recommendations and prioritize the right alternative strategy recommendations to increase the use of the donation platform in Indonesia.

## Conclusion

In conclusion, this study provides important insights for the development of donation platforms by identifying factors that influence user intentions and behavior to donate such as reputation, information quality, perceived security, subjective norms, platform trust, perceived usefulness, perceived ease of use, and gamification. The proposed strategy recommendations can help increase user adoption and engagement, thereby increasing the success of the donation platform in achieving their goals.

## Recommendations

This research has provided valuable insight into the factors influencing the use of donation platforms in Indonesia. However, there are some suggestions that can be given for this research. First, this study used a survey method with a limited number of respondents. Consider digging deeper through qualitative research with

in-depth interviews or case studies to gain a more comprehensive understanding of the use of the donation platform. Then to make a more significant contribution, this research can compare the factors that influence the use of donation platforms in Indonesia with other countries or conduct cross-cultural studies to understand the differences and similarities in the use of donation platforms in various contexts. In the conceptual model, this study focuses on the factors that influence Behavioral Intention (BI) and Crowdfunding (CW). It is important to look at the wider impact, such as the influence of these factors on user satisfaction, loyalty and the sustainability of the donation platform. In addition, future research may involve additional variables such as privacy protection in the context of donation platform trust. In the gamification section, it is necessary to carry out future research to analyze the dimensions or elements of the right gamification to further explore the gamification factors on the involvement of users of the donation platform. In designing alternative strategies, in future research it is hoped that in selecting alternative strategies it is best to use quantitative methodology in the process of selecting strategic recommendations that are relevant to the variables that influence the use of the donation platform for then the strategy recommendations are designed and validated together with experts to be selected as alternative strategies on research.

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## Adaptive Approaches of Primary School Teachers Facilitating Environmental Studies

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**Abstract:** This paper examines teachers' adaptive approaches with regard to Environmental Studies (EVS) within primary classrooms of government schools located in suburban Mumbai in India. 'Environmental Studies' (EVS), is a significant aspect of school curricula; integrating concepts and issues of science, social studies and environment education. While the effectiveness of curricular activities and materials for EVS in fostering student learning is often examined, teachers' implementation of these resources have received relatively inadequate attention in scholarly research. The local conditions in government schools, as well as the nature of reform curriculum and teacher training form the background to the complexities involved in adaptive teaching. We find that different adaptive methods are developed by some teachers over time in response to their documentation of local concerns and resources. We also find that the teachers' strong sense of professional agency is reflected in their explorations with curriculum-adaptation possibilities. Additionally, teachers' varying levels of trust in the design of existing textbook activities may affect their pedagogical decisions. We propose that delving into teachers' local knowledge provides insights into their perspectives and practices regarding student learning. Studying teachers' adaptive approaches is therefore imperative, and has critical implications for curriculum design and teacher professional development efforts.

**Keywords:** Environmental education, Teacher practice, Curriculum activities

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### Introduction

In accordance with the Education for Sustainable Development Goals (ESD) (UNESCO, 1992), the National Curriculum Framework (NCF) 2005 in India integrates the concepts and issues of science (physical, chemical and biological), social studies (history, geography, civics, society, culture) and environment education (protection and conservation) under the subject Environmental Studies (EVS) for primary grades as part of

formal school curriculum. The National Focus Group on Curriculum, Syllabus and Textbooks recommends EVS syllabus at the primary grade level, ‘to introduce ways of looking at the natural and social world in the form of activities, ways of data collection, and making sense out of them’ (NCERT 2006a). Due to the predominance of textbooks in the Indian educational system (Clarke, 2001; Sarangapani, 2003); EVS materials and pedagogy efforts in India struggled with synthesizing the syllabus intent, learner context and textbook use in classrooms (Chhokar and Chandrasekharan, 2006). To combat this dominance of prescriptive textbooks and to improve EVS teaching and learning, the National Curriculum Framework (NCF) 2005 introduced reforms. The reform-led EVS textbooks include a variety of teaching-learning methodologies under theme-based lessons, to involve children in relating to their immediate environment through a variety of activities, opportunities to ask questions and ways to explore answers themselves (Pingel, 2009). Studies are being conducted gradually to examine teachers' perspectives, beliefs, knowledge, and professional growth in relation to the NCF-2005 reforms; and the textbook serving as a key manifestation of this change has become an important element of these studies. But empirical studies on teachers' conduct of EVS textbook activities have been neglected (Nawani, 2010; Batra 2005). Although initiatives to improve EVS curricula are significant, it is understood that they will not have the desired effects unless they are combined with suitable modifications to teacher education curricula and teacher preparation (Ravindranath, 2007). One of the criticisms leveled at teacher education in India is that it does not reflect the needs and realities of the communities in which it operates, and that teacher education programs should be structured and modified in a way that enables their teacher graduates to respond dynamically to the new problems and challenges in the field of education (Chitra, 2019). It has also been found that conventional teaching techniques are used by trainers to provide teachers instruction on the reform pedagogy’s content (Clarke, 2003). Teachers in the in-service training modules do not actively participate in the learning process; they hardly ever raise questions or engage the trainers in debate or discussion. Most crucially, teachers' classroom experiences are not examined and validated in light of the new instructional methodology, notes Clarke (2003). Thus, teachers' abilities and experiences are not taken into account throughout training, which in turn translates into teachers' constrained perspectives of children as learners possessing unique experiences and abilities.

Curriculum adaptation is an ongoing process that changes the regular prescribed curriculum by modifying or adapting it in terms of the content or delivery of instruction to meet the learning requirements of students (McLaughlin, 1993). While the phenomenon of curriculum adaptation is ubiquitous, still it is poorly understood – “it remains unacknowledged; it is described as a complex clinical skill beyond the ken of most classroom teachers; it is regarded as a mysterious, unanalyzable feature idiosyncratic to every teacher and every classroom; or most frequently, buried in elaborate discussions on individualized instruction” (Hunt, 2016). Undoubtedly, adaptation is a crucial component of teaching. Individual students have unique features, schools are "very dynamic and fluid working settings" (Collie et al., 2018), and any school day is infused with "change, unpredictability, novelty, uncertainty, and transition" (Martin, 2017). Researchers across disciplines over the years have used various terminologies for adaptive teaching, such as teacher flexibility (Leikin and Dinur, 2007), improvisation (Lobman, 2005), modifications (Denton et al., 2007), adaptive teaching (Vogt and Rogalla, 2009), and so on. It's interesting to see that scholars operationalized the idea of adaptive teaching similarly,

despite differences in nomenclature. Their definitions frequently emphasized teachers' meeting the needs of students and included teachers' response to a stimulus (or stimuli) (Parsons et. al., 2017). In line with these definitions, adaptation is conceptualized for our study as marked by one or more of the following observations – when the teacher verbally announces an alteration to the textbook activity or instruction in response to an external stimulus; and/or makes a change in the activity or instruction based on student response. No curriculum is used uncritically or without adaptation, and adaptation is a key step in how teachers use curriculum materials (Ben-Peretz, 1990). However, studies to comprehend this process explicitly in the context of teacher implementation of activities within reform-inspired EVS education in India are limited. Considering this need, we focus on teacher adaptation approaches along with their reflections on their approaches. Evidence from both research and practice shows that teaching in reform-oriented ways requires teachers to adapt curriculum and instruction while teaching (Drake & Sherin, 2002). In order for curricula to serve as a tool for reform, teachers must be encouraged and supported to make modifications that uphold the reform-focused objectives of the curricular materials while catering to the requirements of their students and unique teaching environments. Given this complexity, we think it's essential to look at how teachers employ reform-based curriculum and, in particular, to identify configurations in the curricular modifications that teachers make.

## Method

Through this study we aim to study teacher views and practices of conducting EVS activities in government primary schools of Mumbai. Our study is guided by the following research question: How do primary school teachers view and adapt Environmental Studies (EVS) activities in government-run schools in suburban Mumbai? Teacher practices have been studied using both large scale studies (Schumm et al., 1994; Pettigrew et al., 2013; Zangori et al., 2013) and in-depth cases (Ramchand, 2021; Xiaodong, 2001; Sharma, 2008). Since there is a lack of studies in EVS teacher practice in the Indian context, we prefer in-depth inquiry to understand the complexity of the phenomenon situated within school settings. We used a combination of ethnography and a multi-case study approach. An ethnographic study is largely based on qualitative methodologies and places importance to the narratives of individuals involved in the concerned area of research (Brown et al., 2017). Multiple case studies are useful when there is limited prior information about a phenomenon, and it allows for inclusion of more instances thereby making it possible to make compelling interpretations (Zach, 2006). Since there is limited knowledge about teacher practices in relation to the context of this study, this research design is appropriate. The study was conducted with 15 teachers across 4 government-run schools. The State-board textbooks were being used by the participants. In the primary grades, the EVS teachers teach multiple subjects. Permission for school access was obtained and participant consent was ensured before beginning the study. The participant names are replaced by pseudonyms in the paper. Data collection was performed across 6 months. The researcher conducted interviews of teachers about their approaches towards conducting EVS activities and; observed, audio recorded and took notes of parts of the EVS sessions across the three grades. Average number of students per class ranged from 40 to 60.

## Results

We see a range of different approaches in teachers' implementation of textbook activities – such as eliminating, restricting and expanding sections of a task. We refer to the activities as – ‘observation’ task, ‘definitive’ task, and ‘inquiry task’ based on what the students are primarily expected to do in the task. These activities could not be chosen a priori by the researcher, as their selection by the teacher varied according to the chapter in progress.

Approaches to an observation task: (The activity required the students to identify which of the listed food items are usually served with larger spoons/ ladles and which ones are served with small spoons). Ameena, spent 5-10 minutes discussing different aspects of the meal context – “what did you all have for dinner last night?” After she gathered some responses, she asked the questions from the textbook activity. When she realized that her students were unable to appropriately mention the food item quantities, she photographed students' lunch box images and asked them to analyze the meals from the photos. Similarly, when Sheena realized that her students faced difficulties with the task, she drew her own lunch-plate on the blackboard and then asked students to prepare paper cut-outs representing their own meal plates from lunch or dinner time. She gave the students extra time to draw different types of food items and stick them onto paper plates. She even asked probing questions to help students share about the proportion of various food items on their plate. She incorporated students' spontaneous questions such as “why does my mother always serve less pickles, while I want lots of it?”. On the other hand, Amruta avoided this task from her lesson saying “this activity is not so important, you all would know the answers, it is very easy”. In the case of Devika, we see a minor adjustment. She followed the task as is from the textbook, but took help from a photo-illustration of a meal plate shown in the textbook and asked students to point at the meal item in correspondence to their answers. She spent around 5-7 minutes to complete the entire activity. Avni spent the first 15 minutes verbally explaining the background of why some types of food are served in small quantities and other types of food in large quantities. She then began asking questions from the task. She, unlike all other teachers, framed the activity around the purpose of doing the activity. The rest of the activity was done as per the textbook directions – by drawing a table for writing names of food items under respective headings – ‘large spoon’ or ‘very small spoon’.

In case of another activity from the chapter on transport (The activity contains a picture prompt. The picture shows some vehicles on a road lined with some plants/ trees. The question is: State the difference between the plants close to the road and those far away from the road based on the following points – freshness of leaves, colour of leaves and appearance of plants). We see certain additions by teachers. This activity was provided in the textbook, and it required students to observe an image and then answer corresponding questions. However, Prajakta initiated a discussion saying, “Do you hear any noise? This noise is coming from outside. Can you see?”. Prajakta turned the students' attention to the trucks unloading construction material adjacent to the school. She then took the students out into the schoolground and asked them to spot plants in the vicinity, both near the school's inner ground and outer ground (the outer ground was closer to the construction site). She then asked them to observe the texture and colour of the leaves on the plants in the two grounds. As opposed to



Prajakta, Nilima used the same activity but used a few different images from her phone which she had captured from around her own neighborhood. She repeatedly mentioned, “all these images that I am showing are real photos that I have clicked. So that you can see the leaves in detail. You must observe the difference in the colour and texture of leaves in various parts of your neighborhood also”.

Approaches to a definitive task: (The activity required students to fill in the blanks in sentences about oral hygiene). In her approach to the definitive task, Parul asked questions about oral hygiene in the sequence of the ‘fill in the blanks’ as given in the textbook and then asked the students to make a larger chart on which they were to write the same information from the textbook but with few drawings of the process of brushing teeth. Whereas, Rekha added an extended discussion while conducting the same task. First, she asked a few basic questions – “Why should we keep our teeth clean? How do we keep our teeth clean? When should we brush our teeth?”. Then, she asked the students to draw “happy teeth and sad teeth” in their notebooks. Next, she initiated an elaborate discussion about what types of toothpastes are better, while emphasizing that students must look for “toothpastes with natural ingredients” in order to have “happy teeth” along with their “usual practice of brushing twice a day as mentioned in the textbook”. Rekha used her mobile phone to show images off the internet of certain “natural ingredients” such as cloves, salt and mint leaves. It is important to note here that Rekha was aware of an upcoming school exhibition which had the theme of organic and eco-friendly living. Rekha initiated a ‘happy teeth sad teeth’ poster making activity from the ‘fill in the blanks’ activity keeping in mind the exhibition theme. In contrast to Parul and Rekha, Amit read out all the points of the task and gave the answers by himself, stating that “you all already know the answer to these questions”.

Approaches to an inquiry task: (The activity required the students to fill a large container with water, collect the materials listed, and observe which of the materials float and which of them sink). While attempting the inquiry task ‘float or sink’, we again see some very different approaches by teachers. Kapil and Maria followed the activity exactly the way it was given in the textbook, but with slight differences. When Kapil realized that the students gave a few wrong answers, he paused to ask the students about their answer. He asked them to think why an object might float or sink, but did not spend much time waiting for students’ response. Also, he did not include a wide range of objects, and picked only a few objects from the textbook list as part of his discussions. Maria, on the other hand, followed the activity by spending more time on resolving students’ queries such as “what will happen to the objects if the water is replaced with oil?”. However, neither Kapil nor Maria attempted to physically do the activity in class. They only used discussions and questioning.

In contrast to Kapil and Maria, when Zareena conducted the ‘float or sink’ activity, she spent more time asking students questions about which of the objects provided in the list would sink or float. She then asked them to bring some objects from home and promised to dedicate a Saturday (designated as activity day by her school) to experimenting with more objects. She thus extended the time of the activity beyond normal class sessions. Amar conducted a lesson that had already been covered by Gauri (in the absence of Amar as he was on leave). In this activity, students had to collect some objects mentioned in the activity and drop them in water to check whether they sank or not. Gauri had conducted the activity by reading it in class, and stating the outcome of the activity

as mentioned in the textbook – “As time is short you all will do this at home. When you do this activity, you will find that things that float are lighter than water and things that sink are heavier”. She went over each of the objects and gave the answer as to which one would float or sink. She had asked the students to do the activity as homework and write their findings in their notebooks.

In contrast to Gauri, Amar introduced “guessing”. He first checked whether students knew the answers to the exercise. Interestingly, Amar did not ask the students how they knew the answers. Here, Amar initiated the exercise by saying, “... you all must have copied answers from each other or seen the picture in the textbook and written the answers. But then you have not experimented enough”. Amar can be seen explicitly mentioning the relevance of the adaptation he wishes to make, by describing the premise. He then asked five students to walk around the school and collect different small objects, thus providing an opportunity for out-of-classroom exploration. As the students went to hunt for several small objects, Amar got a small plastic tub filled with water. He divided the class into two teams, thus changing the participant structures. The objects brought by the students were assembled neatly besides the tub. He proceeded by writing ‘team A’ and ‘team B’ on the blackboard. Right before beginning the activity, a student spoke of how he plays with paper boats with his friends and that he knows that a paper boat would float but a simple piece of paper would get soaked and sink quickly. Amar incorporated the student’s response and initiated a few more questions – “What do you think will happen if we make a crumpled paper ball and throw it on water?”. After a while, Amar began the activity – “I will call a student from each team turn by turn. That student will drop one of these objects in the tub. But before dropping the object into the tub you all have to guess whether the object will sink or float. The team with the correct guess will get a point. Ready?”. Once the activity was over, he said, “You all might have done this activity in haste, but did you see how you got confused with some objects? Some objects had different types of materials with different properties. So, you don’t know what might happen when they are dropped in water”. Here we see that Amar attempted to change the amount of time spent on an activity, he emphasized the activity’s goal of experimentation and conducted extended discussions on properties of objects.

## Discussion

Although there has been significant discussion about the need for curriculum and textbook reform over more than a decade, viewing teachers as more than implementers of the textbooks is a perspective missing from the education dialogue in India. In our study with 15 participants – we observe that some teachers adhere to the textbook activity with minor modifications, some teachers personalize activities, and others either attempt modifications while inserting new activities or; attempt parts of or avoid activities. Thus, we find that teachers’ adaptation approaches of the activities are varied.

Firstly, the majority of the teachers in our sample pursuing the textbook activities through different approaches, is a finding commonly present in research elsewhere with teachers newly experiencing reforms (Remillard, 2005; Glasnović and Jukić, 2021; Singal et. al., 2018; Dar, 2021; Bianchini and Kelly, 2003). Yet this finding

has significant implications for a context where the textbook is considered the prime resource for teachers, which is the case with EVS textbooks in India. As is evident, that teachers tend to rely on their own methods of instruction or spend efforts gathering supplementary material from other sources. As a result, the reforms introduced through the textbook and allied material may not be utilized as envisioned. Secondly, by focusing on a range of teachers across four government schools, who were predominantly adhering to the textbook activities though with a range of different adaptation approaches, we were able to investigate teachers' capacities to design various experiences for the students in their process of engaging with the affordances of the textbook activities. We see different ways of mobilizing their pedagogical capacities around tasks. Recognizing that teachers' approaches are not identical is important in terms of not just curriculum designing but also the associated teacher support. Small scale initiatives are starting in science education (Ramadas, 2017) – where teachers' varied experiences with curriculum contributes to curriculum design. Yet, such studies are almost absent in primary EVS in India. We find that teachers have varying approaches to the activities in the textbooks, however it is important to note here that our findings do not imply that the teachers will always teach in these ways. Thus, these are not fixed labels for teachers, rather indicators to help situate teachers' work in relation to the textbooks.

#### **Adhering to the textbook activity with minor modifications**

Devika, Kapil, Parul and Maria, four teachers, were observed to supplement the textbook activities with small additions and modifications, but mostly treating the textbook as a script. In a way, these teachers may be seen as “adhering” to the textbook (Nicol & Crespo, 2006), which means that the textbook is being considered as an authority by these teachers. This commitment does not, however, imply that these teachers always agreed with the content and design of the textbook. Devika and Parul, two of the teachers, highlighted what they felt to be a number of problems with the textbook activities. For instance, Devika expressed her displeasure with the textbooks and noted that the writers had overemphasized community-based exercises. She mentioned how an activity was incongruent to the social situations in student families.

“Activities are beneficial, but some of them are very strange. For example, this one (points to the textbook) – ‘write an application to the school administration requesting that parents be allowed to run the school for a day’. Do parents have so much time? They drop the children to school, go to work, ask the grandparents to take care of children once they are back from school, and even send the grandparents for parent-teaching meetings. The grandparents come here reluctant, clueless and helpless.” – Devika

When it came to her lessons, Devika was seen concentrating on most of the assignments from the textbook, trying all the different kinds of questions, and very occasionally modifying activities. She mentioned, “a textbook is ultimately like our sacred text, we must follow it”. The 'official' status of the textbook itself may be one cause for such a difference between the teacher's opinions about the textbook and her instruction. She considered it a part of her job in the government school to follow and conform with this curriculum, which may have contributed to her allegiance to the textbook assignments. Since the teacher has delegated the agency to the

textbook, the pervasiveness of the textbook culture also suggests that the teacher herself did not conceptualize her instruction as being shaped by her own views. Because of this, even though they disagreed with the textbook in some ways, Parul and Devika seemed to think that it had to be the main authoritative source of information (Kumar, 2005b) in their classes.

Understanding teacher practice also requires taking into account the institutional context in which the teachers work. Throughout the duration of our fieldwork, Devika (senior teacher) in particular was frequently asked to carry out a number of administrative tasks because few other senior teachers had recently retired and new teachers were not as experienced in administrative tasks. She continually emphasized how much time this took away from her, leaving little time for teaching. Maria and Kapil also stated how “schedule conflicts” (Maria) and “non-teaching responsibilities” (Kapil) made it difficult for them to give their lessons the attention they needed. Teachers’ workload has often been discussed as a barrier in curriculum implementation (Rose and Sika, 2019), along with decreasing focus on pedagogical skills (Gitlin, 2001). Teachers must balance their numerous responsibilities and hence teachers like Devika and Parul may not be able to use their time to work on a suitable implementation approach for a task, amidst the institutional framework of the textbook culture, and work pressure. There was only one teacher, Kapil, who seemed to show closer alignment between his views and the way he conducted the textbook activities. He did not disagree with the way the textbook activities were structured. It’s interesting to observe the contrasts between Kapil and Parul, who both follow the textbook’s instructions; are from the same institution, have similar levels of expertise, and instruct the same grade. But the way they viewed the textbook activities was different. Neither of them noted how their professional training translated into their practice. Instead of noting any formal professional training inputs, Parul noted one short storytelling workshop she had referred to online during her preparation for World Environment Day celebrations, which she could “use in her EVS lessons on biodiversity”. This workshop link was shared with her by a colleague who taught science in higher grades and had been organizing ‘eco-club’ events in schools where she worked earlier.

### **Personalizing activities**

Prajakta, Rekha, and Zareena, three other teachers, could be seen taking a more active role in modifying the textbook activities to better reflect their own perspectives (personalizing) on environmental education pedagogy. They were seen organizing their teachings around some new activities and complimenting them with certain adaptations of the textbook activity. They gave greater priority to conducting activities, while still managing to complete the rest of the chapter sections through posing questions along with lectures. In Zareena and Prajakta’s classes, they could be seen devoting time to certain activities in different ways than the textbook. They also decided which section of the activity was to be done during class-time and as homework. As the textbook does not indicate time-breakdown of sections of an activity, teachers exercised their agency in determining the same. When Zareena conducted the ‘float or sink’ activity, she spent more time asking students questions about which of the objects provided in the list would sink or float. She then asked them to bring some objects from home and promised to dedicate a Saturday to experimenting with more objects. Zareena was very clear about her decision

to “extend” the activity. She said, “This activity is rushed past by many teachers in my own child’s school or given as homework. Sometimes the teacher just gives away all the answers. But it is an important one, so it should be given extra time. The textbook must mark it as important or mandatory”. This decision in Zareena’s opinion was essential and she also makes a recommendation to have some activities to be especially marked as “mandatory” to be done with students in class. Prajakta mentioned that she introduces an activity on planets in the beginning of the chapter on solar system.

“I always teach the names and positions of the planets on my own. Right at the beginning of the chapter. Students must know and remember this basic information. I ask them to come in front of the class and then I arrange them as planets in the way it is shown in the textbook and help them to memorize their names and positions. I was taught this way when I was a child, and it works well. For this chapter, the textbook only has questions and no physical activity as such.” – Prajakta

Prajakta also began the lesson on transport through an activity rather than following the textbook headings. She explained her approach saying, “In some chapters they have put too many activities. Yet in some other chapters where hands-on activities are actually needed, there are only questions and answers with some small accompanying illustration which is not very helpful”. Rekha, Zareena, and Prajakta modified and added material because they felt it better reflected their personal interpretation of activities and their relevance for children’s needs. Here, teachers used the textbook as a guide. They took pedagogical decisions in elaborating the activities (Nicol and Crespo, 2006). Teachers’ perspectives on EVS learning must be taken into account in order to comprehend the motivations for this type of textbook implementation. Teachers seemed to find a mismatch between their expectations of “important” activities and availability of such activities in the textbook. Teachers consider certain activities as more relevant, and when they do not find the activities in the textbook as prominently present, their confidence over the textbook seems to diminish. Teachers’ opinions regarding the (perceived) missing components in the textbook further demonstrate their lack of “curricular trust” (Drake and Sherin, 2009); in other words, these three teachers appeared not to trust the textbook and utilized their autonomy to tailor their implementation strategy. Because of this perceived deficiency and mistrust of the textbook, personalization emerged as a way to bridge the “gap” (what is lacking) between their objectives and what they observed in the textbooks. Teachers look for resources other than the textbook to aid in ‘personalisation’. Zareena sought ideas from Eco-club workshops at school, but mentioned her failure to attend such workshops “peacefully”.

“Sometimes, Eco-clubs happen and I look forward to them as I feel I could gain some new ideas from them to incorporate in the classroom. But I do not have the time to peacefully attend these workshops as I am busy organizing its events along with my other school-work” – Zareena

Zareena’s comments are in line with research on efforts of the National Green Corps (NGC) in India – the majority of school teachers, or “teachers in charge”, report having little free time to devote to Eco-Club projects because they are overburdened with other teaching duties and school-related responsibilities. This is also a result

of the unavailability of qualified trainers and the dearth of high-quality training, both of which revealed a pattern of irregularities in the supervision and execution of the programme (Roberts, 2009). Moreover, the lecture style is predominant even in the teacher-trainings for EE, and there is no mandatory, uniform training (Personal conversation with a teacher educator from a teacher training college in Mumbai, Oct 3 2022). The NGC report suggests that in order to ensure organized learning and professional development, more practical strategies are required and are advised for the future. Few teachers also sought help from videos on social media as well as some privately published textbooks which they got from their own children who were studying in private schools. Nilima, Zareena, and Avni in particular talked on how they included them into their lessons. For instance, Nilima believed that the privately published textbooks had “larger and easily comprehensible” pictures which she could use with her students. Zareena mentioned using a video on her phone and some images from other textbooks showing night-sky constellations and asked her students to guess their names.

“The textbook asks teachers to arrange a night-sky watch with students and their parents. It is difficult to arrange this type of large event. Using images from elsewhere is the next best option.” – Zareena

These teachers demonstrated the opposite pattern from Kapil, who placed his reliance on the textbooks. They believed the privately printed textbooks to be better than the state-produced textbooks in some cases. Due to their own children attending private schools, all three of the teachers had access to the privately-published textbooks.

“If our regular textbooks can have better support in terms of executing the activities, then children in the government school would also benefit. We would not have to hunt for support elsewhere”. – Avni

In such a scenario where teachers’ views on the official textbooks are divided and various other materials are affecting teachers’ personalisation of the textbooks; it is essential to encourage effective teacher professional development initiatives that help primary school teachers comprehend, interact with, and use these textbook activities as they were really intended to be used – as robust yet flexible resource material empowering the teacher to create contextually relevant learning experiences.

### **Attempting modifications and inserting new activities**

There were three teachers – Ameena, Amar and Sheena who did not criticize the textbook’s structure or the activities. These teachers were rather appreciative of how the textbook was “flexible” to provide teachers the opportunity to see it as a “companion”.

“It is like a companion in my teaching. I am free to pick and choose which activities are possible and required in my context, and take help from the textbook.” – Ameena

“I often refer to various teacher-handbooks just as I refer to this textbook. It is like a tool to think with.” – Amar

While these teachers are comfortable with the way EVS textbooks are, they do not use the tasks as described in the textbook, but instead modify them or add their own smaller activities. This presents a chance for us to discuss their own distinctive capabilities to consciously design their acts around the given activity in elaborate ways. Their intention to bring something new to the students' classroom experience echoes a shift towards seeing the teacher as an active agent in shaping the curriculum on the field. Earlier, curriculum reformers and developers depended on the notion that only high-quality resources created by experts could improve teaching, and that teachers would use those resources in the manner intended by the resource's creators (Clandinin & Connelly, 1992). They disregarded the teacher's function and her impact on instructional strategy, which reduced the teacher to only serving as a mediator for the material to reach students (Love & Pimm, 1996). However, the perception of the teacher's role within the curriculum setting has changed recently: from being seen as only a mediator between the curriculum and students to a developer of curriculum instructions (Brown, 2009; Remillard, 2005). According to Pepin et. al (2013), "teaching as design" refers to a dynamic and collaborative relationship between the teacher and the curriculum materials. Teachers use curriculum materials to organize lessons; they interpret and modify them as they develop instruction. This is referred to as the teachers' design capacity (Brown, 2009). It is also described as the teacher's capacity to identify and observe the potential of resources (Remillard, 2005). We notice this when Amar says that the textbook is a tool to think with. This interpretation and resource design continues in the implementation of lessons. We contend that Ameena, Amar and Sheena's opinions and use of the textbook could be conceptualized using this kind of teaching-as-design perspective.

Unlike teachers who describe how they use textbook activities; Ameena, Amar and Sheena believed that the adaptations were not a separate alteration or disruptive element but a naturally essential aspect of the textbook's implementation process. For instance, Sheena responded, "This exercise which I have thought of is part of the whole activity itself. It is part of how we must respond to student needs while conducting the activity.", showing that she did not see her additions as being all that different from the textbook. She also had a different perspective on the textbook activities than the teachers who personalized them. She and Ameena were the only teachers in the study who stressed that they would change teaching strategies based on student understanding as opposed to their own assumptions about how students must absorb EVS concepts. Discussing why Ameena, Sheena and Amar were such peculiar instances is crucial, particularly when opportunities to expand on such skills are minimal for teachers. Ameena explicitly stated that during her pre-service training she would make sure to attend internships in schools while most others in her batch would spend the internship-period completing pending assignments.

"I would observe senior teachers, and discuss my doubts with them. We would talk about student problems or our difficulties in preparing a lesson." – Ameena

Sheena mentioned diligently using the resource material provided to her at a skill-enrichment camp organized at her school. She had won an award during a workshop for making eco-friendly teaching-learning material and she had received an invitation to host a session at the next event. Sheena repeatedly stated the importance of

such incentives in making her feel confident about her work as a teacher and her contentment in sharing her learning with her colleagues.

In India, teachers' reflective practice is hampered by a summative learning strategy that emphasizes exam achievement and rote learning, which forces them to operate as a mere intermediary who transmits textbook material (Samuel, 2019). But we find that Ameena's case reveals a unique instance. Ameena kept an activity-register, in which she would note down new activities or even some small issues encountered while interacting with students. She mentioned that she developed this habit when she shifted from being a teacher in a private school to the current government school. She noted, "I moved to this locality as my family moved here. This school was the nearest. But I took some time to get accustomed to the atmosphere and students of this school. Maintaining my own activity register helped. I often refer back to the activities to see what worked and what were the issues. Initially some of my colleagues would laugh at me, but then slowly a couple of them also got into this habit as they felt it helped them to understand their students better." Ameena's decision to use her phone to capture pictures of students' lunch-boxes was not an in-the-moment decision. She explained, "I had noted down that children often make mistakes in giving answers in this activity. This left me puzzled, because it is quite a simple activity. So, a week before this class I took photos of my own meal. I also decided to capture students' lunch-box photos and then asked them to observe quantities of various food items. I showed all these pictures to them. I realized that they were making mistakes because their own food items were quite different from the food items in the textbook, and the quantity of items varied too." Thus, we see how Ameena's focus on documenting challenges pertaining to students' learning needs is an important aspect of her daily practice. Here, we see that more than just being able to respond to change, adaptability also involves putting the needs of the students ahead of even the best-laid plans. We align with Wender's (2021) description of adaptability as more than "just being ready to adjust to change". In Rekha's case, she extended the 'fill in the blanks' activity about oral hygiene to a poster activity, based on her awareness of the 'organic and eco-friendly living' themed school-exhibition. Here, her purpose for adapting the textbook activity was determined by a situation other than purely increasing student participation. She was also meant to lead the preparation of a tableau in the school foyer on the theme of oral hygiene. Rekha's own views about this event were mixed. She said, "I am supposed to guide the students into making a huge thermocol tooth and toothbrush and install it in the foyer. On the one hand the textbook teaches about protecting the environment, and here we have been given thermocol. Those posters showing organic toothpaste-ingredients which we made as part of the classroom activity will be hung around that tooth. Inspectors will be coming to visit, so it all needs to look grand."

The above examples show that some teachers seemed to allow more time for students to engage with activities, and attempted to provide support depending on student needs. This suggests that they intentionally created and extended their own curriculum, proving that active planning was employed by them.

### **Attempting parts of or avoiding activities**

Three of the fifteen teachers – Amruta, Gauri and Amit, held very brief sessions for their EVS classes (around



25 minutes long) as compared to the other subjects they taught; and only attempted a few activities from the textbook. Unlike other teachers, they did not consider EVS to be as important a subject as the rest of subjects. They would often assume that the activities provided in the textbook need not be conducted in the class as these activities “do not require class time” (Amit) or “are unnecessarily far too many” (Gauri). These teachers neglected activities, and EVS as a subject. There are a number of reasons for this kind of textbook avoidance and subject neglect. First, they mentioned that “something concrete” (Amit) and “usual question and answer type” (Amruta) exercises were expected by the student’s parents in terms of written classwork, and hence these teachers put more emphasis on fact-based tasks. Accountability pressures experienced by teachers have been mentioned in previous research as well, wherein “teachers argue that instructional time is considered to be well spent by school administrators and parents if it is used in direct lecturing” (Bansal, 2018). For parents, effective teaching is marked by order, memorization, and homework that emphasizes reading and writing; eventually perceived as leading to satisfactory performance in exams and subsequent access to professional opportunities (Sriprakash, 2012).

“Parents want to see something concrete in their ward’s notebooks such as ‘fill in the blanks’ or usual ‘question and answer’ or ‘essay’.” – Amit

“Children’s parents are just seeing EVS as any other subject in which rote learning works like history facts or mathematics formulae. All rote, rote, rote. So, they expect us to dedicate more time for written classwork and less for activities.” – Amruta

Second, the teachers were in charge of teaching all subjects, EVS included. They distributed their time across subjects according to their choice. For instance, Amruta and Amit spent less time on EVS subject lessons. Amit who spent around 25 minutes on an EVS lesson explained how he would “cover just the important activities”. The “important activities” which he prefers to spend time on, are essentially fact-based questions or tasks for which answers could be easily found in the chapter text. Similarly, Gauri seemed to avoid the activities which specifically required her to invite student experiences. In Gauri’s case, we see a similar situation. When she began a chapter about biodiversity, she asked her students to describe a forest and note down all that they see in a forest. When one of the students spoke of having seen garbage lying around during his visit to a forest, Gauri paused and brought the conversation back to the image in the textbook listing green leaves, huge trees, colorful birds and animals, a pond and so on. Gauri’s discomfort with the student’s response became clear when she said (in post-observation interview), “I was not sure whether to take the discussion forward. It would have been a deviation from the textbook topic which we were studying at that point and I was not sure what that discussion might have led to”. One of the criticisms of teacher education in India is that it doesn't take into account the requirements and conditions of the contexts where it operates. Since “teacher training is predominantly academic and theoretical; and socially, economically and environmentally dislocated” (Ravindranath, 2007), teacher candidates struggle to connect their instruction to real local concerns and are inadequately aware of the sociocultural, economic, and environmental factors at play in the communities in which they teach. Furthermore, teachers could be confused about what subjects are suitable for their students to discuss and

understand (Hartsfield and Kimmel, 2020; Oulton et al., 2004). All students and teachers come to the classroom with diverse experiences and worldviews, which may influence their comfort level and willingness to discuss sensitive subjects.

Third, there was a sense of hesitation and low self-confidence about teaching EVS in these teachers. Amruta expressed that she did not consider herself an “expert” of this subject because it seemed to require a special set of competencies as compared to other subjects. This comment echoes previous research on the need for specialized training for environmental education (Ravindranath, 2007). Another reason expressed by Amruta for making her feel hesitant to teach this subject was its distance from how she was taught this subject during her own school days.

“We were never taught this way. We never even had something called EVS in our school days. I just remember the ‘good habits and bad habits’ chart which used to be hung on our classroom wall. I remember we had a moral science textbook, which said plant trees and be kind, and our teacher would just ask us to repeat sentences after her. Not many hands-on ‘EVS’ activities like they have now. So, I have to put in more effort in comprehending these activities, and sometimes I do not know how to go beyond verbal examples.” – Amruta

Research on teacher challenges with EVS has found similar issues, which raises important questions about whether current training practices are adequate in providing teachers with the skills for activity-pedagogy for EVS (Dogra, 2013). It also shows how the textbook activities might appear complicated for some teachers, and might affect their confidence in adapting the activities to their context. Anxiety can increase when a textbook presents itself in a complicated manner and requires careful and deep study (Bapat & Takker, 2016).

## Conclusion

We believe that teachers attempt to strike a balance between accurate curriculum application and essential modification while implementing EVS activities. While a majority of teachers in our study adhere to textbook activities; we found that they follow, omit, extend, edit and modify activities in varying measures; and sometimes even insert new activities. This finding is important in a scenario where claims of teachers’ over-reliance on EVS textbooks are dominant (Ravindranath, 2007). The significance of this finding lies in the way it allows us to reconceptualize curriculum adaptation. In line with Wender (2021), when we broaden the notion of adaptability to include instances of actively looking for opportunities for modifying activities prioritizing student learning, adaptability starts to resemble more of a viewpoint or an approach or an outlook than just a strategy for dealing with uncertainty. The evidence for this argument can be found in teachers systematically tracking their own and students’ learning (Ameena and Amar’s case); actively tapping into out-of-classroom opportunities to conduct textbook activities (which may/may not mention an ‘outdoor’ component) (Prajakta’s case), seeking collegiality and professional support to aid activity implementation (Ameena, Sheena, Amar’s case), and employing local resources beyond textbook (Nilima, Zareena and Avni’s case). These methods are

developed by teachers over time in response to their documentation of local concerns and resources. As stated by Mascarenhas et. al (2012), adaptive teachers are those who are constantly aware of the potential ways they may modify their instruction to better support students' learning. This finding has implications for how training needs to acknowledge teachers' local knowledge of supporting student learning. The term "local knowledge" refers to knowledge that is based on experience and reproduced in a culturally specific environment (WINKLERPRINS. (n.d.)). We also find that the teachers' strong sense of professional agency was reflected in their explorations with curriculum-adaptation possibilities while critically contemplating textbook goals. Here, we align with previous research which suggests that teachers who have a strong sense of professional agency see a lot more possibilities in terms of nurturing transformative curricula (Dyer et. al, 2004). We contend that teachers' adaptation of activities is encompassed not only by their views about reform-oriented EVS pedagogy; but also, by how they view their own abilities to engage with the textbook content.

This contention arises from instances of teachers' omitting or modifying certain aspects of an activity due to their feeling of being a 'non-expert' (Amruta's case), teachers' level of trust in textbook activity design (for instance, Devika's comment about an activity involving community participation; or Amar's comment about using the textbook as a tool to think with), dependence on availability of appropriate logistics and resources (Zareena's comment on arranging the night-sky watch activity), and teachers feeling under-confident in their ability to conduct certain activities owing to their experiences of how this subject was taught to them during their school days or as part of professional training (Amruta's case). Thus, some activities seemed complicated for the teachers. The possibilities of adapting activities are limited for these teachers by a deficit interpretation of their setting, which they may also apply to themselves. This amounts to teachers' varying confidence in the viability of policy proposals encouraging child-centered, activity-based learning under the current system (Dyer et al. 2004). Without addressing this problem, ongoing efforts to improve teachers' adaptive capacities are likely to encounter obstacles since training-messages may not sufficiently support teachers' confidence in their own capacity to make a difference (Pryor, 1998).

## **Recommendations**

The several ways that primary school teachers use EVS textbooks are examined in this study. Insights from the study expand our knowledge of how teachers interact with textbook activities in a setting where the "textbook culture" (Kumar, 1988) is pervasive. The development of textbooks and teacher education can both benefit from the study's findings. The study contends that teacher professional development for reform-oriented textbooks must include teachers' local knowledge and experience. Recognizing that teachers' involvement with textbooks varies emphasizes the need for establishment of suitable teacher education support to build teachers' pedagogical design capacities. The relationship between the teacher and the EVS textbook activities must be adequately taken into consideration especially when future curricular changes are likely as a result of the new National Education Policy 2020 (NEP 2020).

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## Sociological Portraits: A Heuristic Tool

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**Abstract:** Sociology is a paradigmatic and methodologically eclectic science that aims to explain the social through the social. This does not exclude the existence of instruments with relevant heuristic potential. This article seeks, in a brief presentation, to expose the *sociological portraits*, a proposal that originated in Bernard Lahire, in their elaboration process and respective potential. To attain this goal, the authors performed a collection and document analysis of the *sociological portraits* of Bernard Lahire and other authors who discuss and/or problematize and implement this sociological tool. The result is a discussion of the concept of *sociological portraits* and a proposal for their elaboration, highlighting their potentialities. The conclusion is that the *sociological portrait* is a tool with a high heuristic potential that can account for the plurality inherent in an individual scale by allowing an understanding of the internal and external relationships that shape the practices of actors.

**Keywords :** Lahire, plural actor, Sociological analysis, *Sociological portraits*, Sociology

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### Introduction

Sociology, as a science, which “perceives in its specific way the social reality, producing plural theoretical topics, formulating research problems within the context of these topics, and developing methodical strategies that guide empirical research” (Ferreira & Serpa, 2017, p. 1), has always been paradigmatic and methodologically eclectic (Serpa & Ferreira, 2020; Sebele-Mpofu, 2020; Babalola & Nwanzu, 2021). This does not prevent the existence of instruments with relevant heuristic potential. One of these theoretical and methodological tools with heuristic potential are the *sociological portraits*, an original proposal that emerged from the work of Bernard Lahire and that is intrinsic to a theoretical perspective based on the plural actor. This perspective emphasizes the analysis of intra-individual and inter-individual variations of plural actors and focuses on understanding how their individual heritages of dispositions are constructed and how each individual socially constructs their individual heritage of dispositions (Martins, 2019). It favors the analysis of collective

action practices at the individual and local scale. This goal implies considering the situational elements and their effects, not exclusively derived from either the social position or the social dispositions of the actors, but shaped by the multiple and plural socialization processes, by the very processes of social interaction and imbricated with the domains of activity, the situations and the contexts (Gomes et al., 2014 and 2015). Social situations in everyday life are not a neutral component where actors mobilize means to achieve certain pre-established ends, but rather strategic social contexts generating multiple singular and collective intentionality's, among them collective action (Nunes et al., 2016, p. 9).

This article aims to contribute to the understanding of the heuristic capacities of the theoretical-methodological tool *sociological portraits*, namely its conceptual and methodological components and its elaboration process, without forgetting its potentialities but also the difficulties that shape the use of this tool.

Given the high relevance of Bernard Lahire's theoretical, methodological and empirical proposal for a sociology at the individual scale, we suggest that potential readers of this article read both the works of this French sociologist and the critical reflections developed by various authors on the contributions of this author, presented in the bibliography of this paper,

## Methods

To attain the objective of this paper, the authors carried out a collection and document analysis of the sociological portraits of Bernard Lahire and other authors who discuss and/or problematize and implement this sociological tool. Documents found in two major bibliographic databases were selected and analyzed – B-ON (The Online Knowledge Library widely used in teaching and research institutions in Portugal that provides access to scholarly texts such as published papers and allows accessing repositories of master's and doctoral dissertations and research reports) and SCILIT (a centralized platform that aggregates scholarly publication with DOI). In these two bibliographic databases, the collection of documentation focused on the results of the advanced search combining the keywords *sociological portrait*, *plural actor* and *Lahire*, using the Boolean operators *and*, *or* and *not* in various fields of the bibliographic record, namely in referential bases and full-text bases of bibliographic data.

## Sociological Portraits

### Conceptual component

Bernard Lahire's proposal of *sociological portraits* is shaped by a look into "multi-socialized and multi-determined actors" (Amândio, 2014, p. 47), with necessarily plural dispositions resulting from a high heterogeneity, variety and multiplicity of socialization processes and the inter-individual and intra-individual variations of behaviors (Lima Junior & Massi, 2015; Academic trajectory and sociological thought: Interview with Bernard Lahire, 2004; Lahire, 2001a, 2005, 2007, 2019). According to Lahire (2005),

Actors are not made of one piece but, on the contrary, are composite collages, nuanced complexes of

dispositions (to act and to believe) more or less strongly constituted. This does not mean that they are “without coherence” but rather without a single coherence principle – of beliefs (models, norms, ideals, values...) and dispositions to act (p. 35).

Lahire develops a critical reflection of Pierre Bourdieu’s theoretical and empirical positions on the *habitus* and fields and produces a dispositional sociology that takes into account the multiplicity of socialization contexts that condition the acting, thinking and feeling of social individuals (Dias & Gauche, 2021; Lahire, 1995, 2001a, 2001b, 2002a, 2005, 2007, 2012, 2019; Lima Junior & Massi, 2015; Alves, 2016; Atkinson, 2020; Machado, 2019; Academic trajectory and sociological thought: Interview with Bernard Lahire, 2004; Rodrigues, 2018; Martins, 2019). For Bourdieu (1979), the *habitus* functions as a matrix of perceptions, appreciations and actions that embodies the objectively observable class condition, thus consisting of a “structuring structure that organizes practices and the perception of practices, the *habitus* is also a structured structure: the principle of division into logical classes that organizes the perception of the social world is itself the product of the incorporation of the division into social classes” (Bourdieu, 1979, p. 191). Directly and more straightforwardly, but that responds to the purposes of this paper, for Bourdieu, similar social conditions of existence tend to generate *habitus*, which function as a system of dispositions, perception and action in the world with a certain homogeneity and regularity in the social space. An illustrative example is Bourdieu and Passeron’s (1983) stance on the role of the School in the reproduction of social inequalities. The authors argue that the traditional education system manages to give the illusion that its inculcating action is entirely responsible for the production of the cultivated *habitus* or, by an apparent contradiction, that it does not owe its differential efficacy to the innate aptitudes of those who submit to it and is independent of all class determinations (Bourdieu & Passeron, 1983, pp. 275-276). Its action enshrines and reinforces a class *habitus* which, established outside the School, is at the beginning of all school acquisitions, contributing to perpetuating the structure of class relationships and, simultaneously, to legitimizing it, concealing that the school hierarchies it produces reproduce social hierarchies (Bourdieu & Passeron, 1983).

For Lahire (2005), no homogeneous and unifying universalizing *habitus* would define and classify all practices and dispositions of the social agents in all situations and fields where individuals act. The existence of a plurality and heterogeneity of dispositions incorporated by each social actor in complex and differentiated societies is considered, in which the family has become an agent of primary socialization in competition with other actors for the legitimacy of their education (Martins, 2019). The conditions of existence of an individual are, first and foremost, conditions of coexistence. This premise makes it possible to avoid any reification of these conditions of existence in the form of abstract properties, assets or resources (abstracted from real social relationships). These properties, assets or resources are not things that determine individuals but realities inscribed in concrete social beings that gradually enable them to establish a relationship with the world and with others (Lahire, 1995).

Lahire highlights that the socialization processes in differentiated societies are increasingly complex and heterogeneous, resulting from multiple, early and potentially varied processes of socialization among

themselves (Lahire, 2007; Academic trajectory and sociological thought: Interview with Bernard Lahire, 2004). Furthermore, dispositions are not universally transposable but updated under condition, depending on the situations, contexts of action and social universes that shape and are shaped by individuals (Martins, 2019), that is, each individual is socially produced but adds world to the world in which they are inserted, inscribing their trajectory (their biography) in historical contexts that condition or enable them (Lopes, 2023). Lahire (2007) argues that

This complexity is due to two main reasons: a) individuals are, in our societies, subject to heterogeneous and sometimes even contradictory socializing experiences (this holds in matters of culture as in other areas) and are therefore carriers of a plurality of dispositions, abilities and competences; b) these individuals are not led to acting always under the same conditions, in the same contexts of action, and their individual heritages of dispositions, abilities and competences are therefore subject to variable demands (p. 187).

Therefore, dispositions, as coherent, durable and systematic ways of thinking, acting and feeling, have a certain origin and trajectory, which is shaped depending on whether or not they are activated and mobilized by the contexts (Lopes et al., 2014). A disposition cannot be considered as an omnipresent and omnipotent entity that automatically adjusts individuals to situations, or the present to the past, but the result of the intersection (unique and unrepeatable, although able to be framed in trends and sometimes in regularities) of structural, institutional, interactional and biographical dimensions (Costa, Lopes & Caetano, 2014; Lopes et al., 2016; Martins, 2019).

It is this sociological framework that shapes the sociological *portraits* as sociologically constructed singular configurations (Lahire, 2002b), as a theoretical-methodological tool that is a form of analysis and presentation of information maintaining the “unity of each configuration [...] [in a] comparison that operates between configuration portraits” (Lahire, 1994, p. 105), thus valuing the internal dynamics of situations in contextualized interdependence relations identifying the multiple interaction of causes and effects (Lahire, 1995), and to “reach its subjectivity, capturing the social marks contextualized in the individual” (Santana, 2020, p. 65). An attempt is made to understand the variation of individual behaviors along the trajectory (diachronic line) and the various contexts and situations (synchronic dimension) (Lopes, 2023). This methodological tool of *sociologique portraits* (Davet & Venera, 2021; Lima Junior & Massi, 2015; Nunes et al., 2016; Lopes, 2012; Lopes et al., 2016) aims to

[...] to rescue a double plurality in individual trajectories: on the one hand, the plurality of internal dispositions, taking into account their genesis, their unequal strength and systematicity; on the other hand, the contextual, external plurality, associated with the multiplicity of processes, agencies and contexts of socialization or ways of life. In other words: we are plural individuals in plural contexts (Lopes et al., 2015, p. 5).

### **Preparation of the Sociological Portraits**

But how are sociological portraits prepared? The methodological tool of the sociological portrait requires

complexity in its production and analysis (Lopes, 2014). In the production of sociological portraits, the accounts of the individuals themselves through in-depth interviews are central (Nunes et al., 2016; Lahire, 2002b) in the form of a semi-directive biographical interview (Lopes, 2012) to “understand the processes of socialization from the ‘how’, that is, to unveil the ways in which an individual constructs his/her own subjectivation, taking into consideration the most different agents and institutions that are part of his/her life” (Machado, 2019, p. 206), with the aim of “objectifying subjectivity, identifying the marks of the social in the individual, establishing a bridge between the macro-sociological and micro-sociological contexts” (Lima Junior & Massi, 2015, p. 572).

However, and despite this inductive component (Junqueira, 2019), there is a *sociological* theoretical referential (Lima Junior & Massi, 2015) that shapes the collection and production of these *sociological portraits*. We revive that, for Lahire, “the sociologist is a person who must walk on their two legs: an empirical leg and a theoretical leg” (Hasegawa et al., 2020, p. 205). The sociological portrait consists of semi-directive biographical interviews. Its main objective is to understand how individual dispositions are formed and embodied in the actor’s different social roles in the multiple social worlds that successively, alternately, concurrently and simultaneously shape those dispositions and their reconfigurations throughout life (Lopes, 2012; Sena, 2019). Lopes (2012), seeking to update Lahire’s proposal for the production of *sociological portraits*, indicates six stages in the composition of the *sociological portrait* tool as depicted in Table 1. In the analysis of *sociological portraits* it is possible to make a vertical reading and a horizontal reading (Maia, 2021). It should be emphasized that portraits do not take the form of a linear narration, already seeking an implicit comparison between them, in a “communication” between them (Lahire, 1995, p. 60).

Table 1. Stages in the making of *sociological portraits*

1. Design of a semi-directive interview script of a biographical nature, appropriate to the research objectives and covering various spheres of life deemed relevant, domains of activity, social roles, contexts and frameworks of interaction.
2. Conduction of two to three interview sessions, preferably separated from each other by a period of days or one week, encouraging reflexivity from the interviewee and the interviewer.
3. Transcription of the interviews, following the classic rules for this purpose.
4. Editing of the interviews, transforming them into a fluid discourse in the first person of the interviewee.
5. Favoring the articulation between theoretical resources and empirical material, the portrait is built by interpreting the information.
6. Provision of an interpretative title for each portrait, a summary and main body in a set of paragraphs (they may appear in bold) able to function as a summary of the trajectory and, finally, a more detailed body. There are three complementary reading possibilities for the series of portraits: by title (ultra-fast), by summary (fast) and by main body (longer).

Source: Lopes, 2012; Gomes et al., 2014.

In the project *The Students and their Trajectories in Higher Education* (ETES), coordinated by António Firmino da Costa and João Teixeira Lopes, which seeks to understand the interdependent relationships between inequalities in the trajectory, inequalities in access and inequalities in success in higher education, the script of sociological portraits detailed in Table 2 was drawn up.

Table 2. Guide for sociological portraits, ETES research

INTERVIEW SCRIPT
<p><b>Block A: Trajectories in higher education</b></p> <p>A1. Description of the trajectory</p> <p>A2. Type of trajectory</p> <p>A3. School integration</p> <p>A4. Ways of studying</p> <p><b>Block B: Other dimensions of social and educational trajectories</b></p> <p>B1. Social origins</p> <p>B2. Previous education</p> <p>B3. Work</p> <p>B4. Family and residence</p> <p>B5. Sociabilities and networks</p> <p><b>Block C: Evaluations and suggestions</b></p> <p>C1. Respondent's assessments of factors, causes, reasons for their type of trajectory in higher education</p> <p>C2. Respondent's assessments of the general situation of success/failure in higher education in Portugal</p> <p>C3. Suggestions for success in higher education</p>

Source: Costa & Lopes, 2009.

Of the potentialities of *sociological portraits* (Atkinson, 2020; Amândio, 2014, Alves, 2016; Meier, 2003; Lopes et al., 2018), the capacity of this methodological tool to provide visibility to the double plurality of individual trajectories is highlighted. On the one hand, the plurality of internal dispositions and, on the other hand, the plurality of contexts, associated with the multiplicity of processes, agencies and contexts of socialization (Lopes et al., 2015; Gomes et al., 2014 and 2015). Sociological portraits do not require exclusivity in terms of their application. As an eclectic methodology, they respect the relational nature of the object of study, thus giving rise to the mobilization of a set of techniques that, however, “respect the objectives of enhancing the reflexivity of the actor and of rescuing the intrinsic plurality of practices on an individual scale” (Gomes et al., 2014, p. 9). Empirical research strategies may be of a more extensive type (as in the ETES study mentioned above, where 170 portraits were constructed) or of a more intensive type, where the portraits emerge much more developed and complemented by an ethnographic approach (Gomes et al., 2014).

However, the application of sociological portraits is not easy or simplistic, inasmuch that it implies an in-depth



analysis of the information collected, always in a permanent dialogue that respects its heterogeneity, maintaining the “unity of each configuration [...] [in a] comparison that operates between the portraits of configuration” (Lahire, 1994, p. 105), in their interdependencies and without reductive simplifications. For example, in the research conducted by Dias and Gauche (2021) on the use of the sociological portrait as an investigative method in Brazilian research in the areas of Education and Teaching, the researchers carried out a review of theses published between 2011 and 2020, highlighting that, in several of the research papers, the analysis was not sufficiently in-depth in the sense desired by the creator of the *portraits sociologiques*. The statement that a particular individual has a *disposition to*, without conducting an analysis of what this inference means and in which contexts it was observed, can be put into perspective as an acknowledgement of the heuristic relevance of the interdependence between the plurality of internal dispositions and the plurality of contexts, but also of the degree of difficulty researchers have encountered in using this theoretical-methodological tool (Dias & Gauche, 2021).

## Conclusion

The sociological portrait is a theoretical-methodological tool with high potential of development (Lima Junior & Massi, 2015; Sánchez Criado, 2007; Alves, 2016; Atkinson, 2020; Dias & Gauche, 2021), following the guidelines proposed by Lahire, which can account for the plurality inherent in plural practices on an individual scale by allowing the apprehension of internal and external power relationships (Lopes, 2012; Lopes et al., 2015). Every individual is the bearer of a plurality of dispositions and goes through a plurality of social contexts. What determines the activation of such a disposition in such a context results from the interaction between internal and external power relationships: power relationships between dispositions established during past socialization (internal) and power relationships between elements (objective characteristics of the situation, which may be associated with different people) of the context that shapes more or less the actor (external) (Lahire, 2007). The result is a discussion of the concept of sociological portraits, as well as a proposal for their production, highlighting their potentialities. The conclusion is that the sociological portrait is a tool with high heuristic potential that can account for the plurality inherent in plural practices on an individual scale by allowing an understanding of the internal and external power relationships that shape actors' practices.

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## Reforming Early Childhood Education Programs in Rural Areas of India: Equity in Preschool Education

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**Abstract:** A child's early years (0-8 y) are the critical development years, as this is when the foundation for learning is laid. A strong learning foundation yields better school performance and increases the likelihood of attaining higher education, resulting in major social and economic gains for society. The early childhood care and education of nearly 80 million Indian children, below the age of six, is covered by Integrated Child Development Services through 1.37 million Anganwadi centers (AWCs). Sixty percent of these children are from rural areas. Preschool education, immunization, health check-ups, referrals, dietary supplements, growth monitoring, and education on health and nutrition are provided at the AWCs. Forty-two percent of these rural children receive pre-school education at the AWCs, and the majority are from disadvantaged families. In this study for evaluating the status of early childhood education programs at rural AWCs, quantitative and qualitative data were collected from 71 AWCs across 25 villages in Haryana, to assess their physical setup, availability of learning resources, and administration and Anganwadi workers' knowledge, attitudes, and skills regarding early childhood education. The findings suggest that most of the AWCs do not have proper infrastructure, are not adequately safe, and compromise on health and hygiene. Further, learning resources are scarce and the Anganwadi workers are not trained well enough to impart knowledge and skills to children in a sustained manner. Many of them do not understand the importance of partnering with parents for children's holistic development. Although this study is limited to 71 AWCs in Mewat, the literature review indicates that these issues and challenges are common to rural villages, which is a serious concern for equity in preschool education. Thus, there is a need for several prompt reforms in early childhood education programs in rural areas of India to bring equity into preschool education.

**Keywords:** Early childhood education, Pre-school education, Anganwadi, Mewat

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## Introduction

Numerous scientific studies on neuroscience and early child development indicate that 85% of cumulative brain development occurs between 0-8 years. Thus, children's early years are critical for their future development and learning abilities. A research analysis on the impact of early childhood programs shows that investment in young children yields a 7–13% return through better health, education, and social and economic outcomes (Heckman, 2012). The importance of early childhood education for holistic development and school readiness is well established through research and studies. School readiness primarily focuses on developing age-appropriate basic competency skills in the physical (gross and fine motor skills), cognitive, social/emotional, and linguistic domains of child development, thereby leading to children's holistic development.

The United Nations Educational, Scientific and Cultural Organization (UNESCO, n.d.) stresses on the importance of Early Childhood Care and Education (ECCE), stating that '*early childhood care and education is more than a preparatory stage assisting the child's transition to formal schooling. It emphasizes developing the whole child attending to his or her social, emotional, cognitive, and physical needs - to establish a solid and broad foundation for lifelong learning and wellbeing.*' It reinforces the connection between quality Early Childhood Education (ECE) programs and school readiness through the Sustainable Development Goal 4, which aims to ensure that all children access quality ECE programs by 2030.

A crucial concern in Indian rural primary schools is the diverse range of competency levels and skills exhibited by children in the same classroom. This is a challenge for primary-level teachers, resulting in slow progress of children's abilities and levels of retention. A possible reason for this lack of school readiness is the non-exposure of children to foundational learning programs that can nurture the appropriate skills for development (Kaul et al., 2017). A conceptual framework on school readiness by the United Nations Children's Fund (UNICEF) states that equitable access to quality ECE could improve learning outcomes, especially for marginalized children (Britto, 2012).

In 1975, the Indian government started a major initiative named, Integrated Child Development Services (ICDS). It is world's largest early childhood care and development program providing integrated services for children under six years, and expectant and nursing mothers. The services include health check-ups, dietary supplements, immunization and informal pre-school education. These are delivered cohesively to children and women through the Anganwadi centers (AWCs), that are located in villages and slums under the ICDS program. Each center is managed by a government appointed Anganwadi Worker (AWW), along with a helper. Presently, the program covers approximately 84 million children aged below six through 1.34 million operational AWCs (MWCD, 2013). Recognizing the importance of ECE programs, the Indian government issued the Early Childhood Care and Education Policy in 2013, which focuses on establishing a holistic framework to impart state-of-the-art developmentally appropriate curriculum principles and guidelines, with flexible contextualization for catering to the diverse needs of young children (Ministry of Women & Child

Development, Government of India [MWCD], 2013).

The Indian government's initiatives have helped in the provision and accessibility of ECCE; however, quality remains a concern. The AWCs are major providers of ECE for children in rural India. However, research studies conducted across the country indicate that the quality of ECE in the AWCs needs improvement. The Indian Early Childhood Education Impact Study (Kaul et al., 2017), conducted by the Center for Early Childhood Education Development (Ambedkar University, Delhi) and Annual Status of Education Report (ASER Center, New Delhi), in collaboration with UNICEF, between 2011 and 2015, in three states (Assam, Rajasthan, and Telangana), recommends an urgent strengthening of ECE for school readiness among children (3-6 y) by making policy changes, ensuring quality, and involving the community.

A narrative review of research studies on the quality of ECCE in India, during the years 2000–2016, shows that inadequate teaching-learning facilities, inappropriate teacher learning processes, and improper assessment measures affect the quality of ECCE. The recommended enablers for ensuring quality ECCE include the provision of basic infrastructure and facilities, recruitment and training of exclusive ECCE teachers, rollout of developmentally appropriate curriculum, regular and systematic assessment of children, ensuring parent and community involvement, and making ECE mandatory in all formal schools (Reetu et al., 2017).

The ASER Centre conducted a national survey titled “ASER 2019 - Early Years” in 26 districts across 24 Indian states, on the pre-schooling/schooling status of children aged 4–8 years, and their performance on competencies in four domains - cognitive development, early language, early numeracy, and social and emotional development. The findings of this survey highlight that a large proportion of 5-year-old children are unable to do age and developmentally appropriate tasks with ease, especially those from less advantaged homes. The survey recommends strengthening the AWCs for implementation of appropriate school readiness activities (ASER Centre, 2020).

This study builds on the existing research, by evaluating the status of ECE in the rural areas of Mewat district in Haryana, India. The objectives of the study are assessing the quality of the ECE program in Mewat and aiding stakeholders in holistic evaluation of early childhood programs, aiding future studies, and advocating the improvement of AWCs for ensuring equity in Preschool Education.

## **Method**

The area of this study is Mewat, a minority concentrated district, which ranks extremely low on essential development aspects like health, education, and women empowerment. Approximately 88.6% of people in the Mewat district live in its rural areas. The male literacy rate is 70%, and the female literacy rate is 37% (Census of India, 2011). In 2015, 74% of male children and 56% of female children were enrolled in school (S M Sehgal Foundation, 2015). Overall, the dropout rate is high, and the literacy rate is low among children in Mewat.



The permission was sought from the District Programme Officer, ICDS, Mewat to do a survey of AWCs in Nuh Block of Mewat. The data was collected from the AWCs and AWWs to understand the state of the AWCs' physical infrastructure and learning environment, along with the knowledge, attitude, and skills of AWWs as early childhood educators. A mixed approach was employed to incorporate both qualitative and quantitative data-collection tools. All participants were informed about the data collection and their consent for participation was obtained. The anonymity of the AWCs and AWWs is maintained in the study.

In total, 71 AWCs were selected from across 25 villages of Nuh Block, Mewat. A checklist was used as a quantitative method of data collection on the AWCs' physical setup, availability of learning resources, and center administration. In the process of data collection, participants' behavior, gestures, eye contact and body language were observed and noted. In addition to noting physical characteristics and settings, photographs of the AWCs and classrooms were taken for further interpretation and analysis. Anganwadi workers from these 71 AWCs were questioned about their knowledge, attitudes, and skills regarding ECE, through structured and semi-structured interviews. Semi-structured interviews were conducted telephonically with 36 AWWs. After a rapport had been built, each worker was asked a set of nine questions which were formulated in advance. It included both objective (closed-ended) and subjective (open-ended) questions. All AWWs were informed of the purpose of the interview, and permissions to record the calls were obtained.

The validity of the tools was established by involving early childhood educators, researchers and Anganwadi workers during their preparation. For test-retest reliability, the tools were tested multiple times to check the consistency of the answers. The data was collected in the field within a period of two months from August to September 2021. A structured method of cleaning and storing was done to ensure quality cleaning of data. Once the cleaned data set was ready, the analysis of the data with necessary tabulations was done.

## Results

This paper includes findings on the assessment of the AWCs, and the competency level of AWWs as early childhood educators. A mixed approach was used, incorporating both qualitative and quantitative tools, to collect data from 71 AWCs and AWWs. In terms of infrastructure safety, the majority of AWCs, i.e., 41 out of 71 (57.75%), had boundary walls, and 39 out of 71 (54.93%) had a main gate. However, only 23 out of 71 centers (32.39%) had a safe building structure, and only 14 centers (19.72%) had leveled floors (see Table 1).

Table 1. Infrastructure safety in AWCs

Infrastructure Safety	AWCs
Boundary walls	41
Main gate	39
Safe building structure	23
Leveled floor	14

On investigating the parameters for a healthy physical learning environment, as shown in Table 2, it was found that approximately half of the AWCs, i.e., 35 out of 71 (49.30%), had space for children to sit comfortably, but no center had basic amenities like durries and mats, or desks and chairs, for students to use. Twenty-six of the centers had well-ventilated rooms, and lights/fans were available only in three centers. An investigation of sufficient outdoor play areas revealed that only 27 (38.03%) fulfilled this criterion. Further, upon inquiry on sufficient outdoor play equipment, it was noted that only one center had it.

Table 2. Physical Learning Environment in AWCs

Physical Learning Environment	AWCs
Space for children to sit comfortably	35
Doors and windows for ventilation	26
Light and fan	3
Durries and mats	0
Desk and chair	0

The health and hygiene parameters, as seen in Table 3, revealed a clear lack of primary facilities. Only three out of 71 centers had arrangements for a safe and clean kitchen, clean drinking water, and a functional toilet, implying their absence in 95.77% of centers. Only eight of the centers (88.73%) had safe and clean surroundings.

Table 3. Health and Hygiene in AWCs

Health & Hygiene	AWCs
Safe and clean surroundings	8
Functional toilet	3
Clean drinking water	3
Safe and clean kitchen	3

It was observed that most centers had roof leakages, unlevelled floors, and broken walls. Sanitation was poor; for example, one center had a dump yard next to the boundary wall and a small drain in front of the gate. In another, rainwater seeped into the classrooms, due to the lack of a proper drainage system. Although boundary walls and open verandahs were part of most AWCs, basic facilities were often missing. These include a proper supply of electricity and water, fans, lights, desks, and chairs. Learning resources aid the teaching-learning process and are preliminary to any child's early education. These include teaching materials (in good condition), sufficient stationery and age- and reading-level appropriate books, flashcards, blocks/puzzles, worksheets, indoor play equipment and musical instruments. Games and Building as Learning Aid (developing classrooms, floors, walls, doors, pillars, corridors, the outdoor spaces as learning resources) paintings were not available in any center. Most AWCs lacked the basic resources and equipment required to teach effectively and engage and help students in active learning.

Anganwadi workers are responsible for garnering community support and participation for running the program. They are responsible for children’s nutritional needs, providing PSE, maintaining children’s health records, keeping in touch with supervisors, counseling parents, and performing home visits. In terms of center administration, all 71 centers maintained an attendance register. However, no center had a timetable for PSE, and most had neither a PSE register nor parent meeting records.

The data on educational qualifications, as seen in Figure 1, showed that many AWWs, i.e., 31 out of 71 workers (43.66%), had only passed the 8th grade, while having a matric degree is a prerequisite for being an AWW. Twenty-two had passed the 10th grade (30.99%) and 13 (18.31%) had passed the 12th grade. Five of the workers (7.04%) had only passed the 5th grade. All 71 workers had over six years of *work experience* in AWCs. Their knowledge and attitudes were assessed through structured interviews, as shown in Table 4.

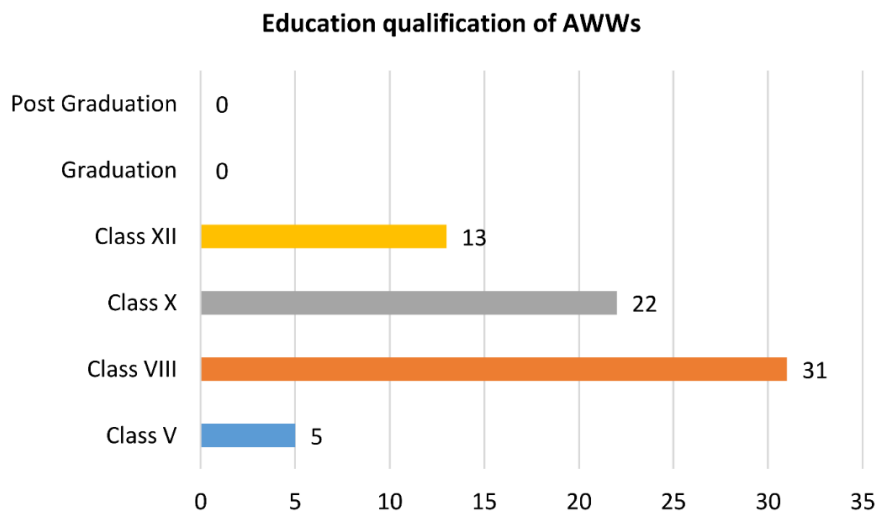


Figure 1. Educational qualification of AWWs

When asked about whether the AWWs were aware of the center’s role in developing readiness for school among the children, it was found that approximately half—36 out of 71—were unaware, whereas the other half were partially aware. Further, when questioned about the curriculum content, none were familiar with the five domains of development (physical, language, cognitive, social, and emotional) and their importance in children’s holistic development. In total, 98% of workers were unaware of the learners’ various needs and did not incorporate a variety of activities and experiences to promote holistic development.

Table 4. Knowledge and Attitude of AWWs

Knowledge & Attitude	Don’t know	Partially	Completely
Readiness for school	35	35	0
Curriculum content	70	0	0
Five domains of development	70	0	0

www.icres.net	May 18-21, 2023	Cappadocia, Turkiye	www.istes.org
Activities and experiences	69	1	0
Strengths as a pre-school teacher	68	2	0
Areas for development	70	0	0
Update knowledge & skills	15	53	2
Involve the parents	47	23	0
Maintain records of children	68	2	0

Of the 71 workers, 69 (97.18%) were neither aware of their strengths as pre-school teachers, nor of the areas they needed to work on to develop as effective pre-school teachers. When asked about whether they were interested and engaged in activities/information to increase their knowledge and skills, 16 of them (22.54%) said they were not, 53 (74.65%) said they partially were, while the remaining two (2.82%) demonstrated enthusiasm, saying that they work on it conscientiously. It was found that the AWWs did not receive training sessions frequently and did not fulfill many duties attached to their roles. Most workers—48 out of 71 (67.71%)—mentioned that they did not involve the parents in their child’s growth and progress. Only 23 (32.39%) did so partially. When asked about maintaining records for the children’s benefit, it was found that barring 2 (2.82%), no worker maintained any record.

The AWWs must use a variety of instructional techniques and experiences to motivate and engage the learners. Their pedagogical skills were assessed by questions on the teaching-learning process implemented on children at the centers. As shown in Figure 2, 63% of AWWs practiced the repetition and memorization method while teaching children the pre-literacy concepts, for example, repeating the numbers or reciting a set of rhymes regularly. Some AWWs (37%) practiced activity-based education, by engaging children in hands-on activities like counting objects to teach numbers, or encouraging children to speak, for development of their language skills.

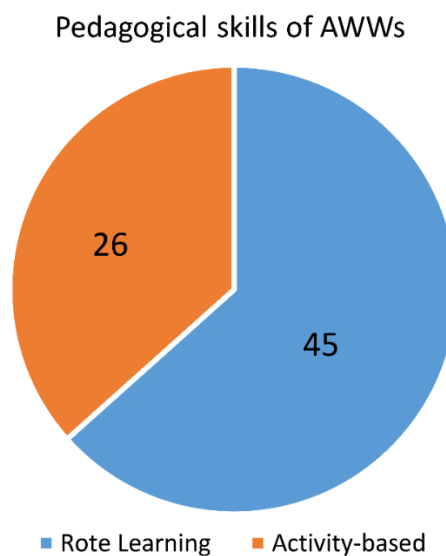


Figure 2. Pedagogical skills of AWWs. AWWs: Anganwadi workers

The semi-structured interviews were conducted telephonically, with 36 AWWs. Certain conclusions can be drawn from the collected data and information at hand. Most AWWs believe that children start responding to their environment at the fairly young age of a few months, and proper learning starts at the age of three. In their opinion, children must learn basics like counting, color names, writing and reading letters, and poems, through educational games and activities. However, the AWWs reported a lack of basic infrastructure in the centers. These include tables, chairs, books, stationery, electricity, and water supply. The dearth of these resources has a direct impact on teaching and learning processes. Furthermore, the village members and children's parents barely had the opportunity to cooperate with the workers. AWWs need parental support for children's regular attendance, and their engagement and encouragement for learning. They also require material and financial assistance to make children's Anganwadi experiences successful.

## Discussion

This study outlines the conditions of ECE programs across 71 AWCs in Mewat. Most of them do not have proper infrastructure, are not adequately safe, and compromise on health and hygiene. Further, learning resources are scarce, and as a result, learning outcomes may be compromised. The AWWs are not trained well enough to impart knowledge and skills to children in a sustained manner. Many of them do not understand the importance of partnering with parents for children's holistic development. Parents are also unaware of the importance of brain development in children's early years, resulting in early education receiving inadequate attention. Although this study is limited to 71 AWCs in Mewat, the literature review indicates that these issues and challenges are common to rural villages, which is a serious concern for equity in preschool education.

Rural areas often lack proper infrastructure and resources for early childhood education. Many villages do not have well-equipped Anganwadi Centers or appropriate learning spaces. The lack of basic amenities like electricity, clean water, and sanitation facilities hampers the quality of education. There is a shortage of qualified and trained Anganwadi Workers in rural areas. The availability of skilled early childhood educators is limited, leading to underqualified or untrained individuals being hired. This impacts the quality of instruction and the ability to provide age-appropriate teaching methods. Poverty, lack of awareness, and low socioeconomic status influence the quality of early childhood education in rural areas. Parents may have limited education themselves, and their involvement in their child's early education may be minimal. Lack of awareness about the importance of parental engagement and limited support at home can hinder a child's learning and development. The diverse linguistic and cultural background in the rural areas make it challenging for children to understand and communicate effectively in the classroom. Inadequate representation of local languages and cultures in the curriculum further limits the relevance and effectiveness of education. The monitoring and evaluation mechanisms for early childhood education in rural areas are often weak. The lack of proper assessment tools and processes makes it difficult to gauge the quality of education and identify areas for improvement.

Today, there is an increased awareness of children's development and learning during their formative years.

ECE has become a global focus in the past few years, as one finds an increasing number of countries amending their policies to make education mandatory and free. With the National Education Policy 2020 (NEP), India has also given due credit to ECE by including children aged 3–6 years in the ambit of the Right to Education Act for free and compulsory education. The first chapter in the policy is on “Early Childhood Care and Education: The Foundation of Learning,” with the objective that “Every child in the range of 3-6 years has access to free, safe, high quality, developmentally appropriate care and education by 2025” (Ministry of Human Resource Development, Government of India, 2020). According to the NEP 2020, early childhood education (ECE) plays a crucial role in a child's development and lays the foundation for future learning. The policy emphasizes the importance of providing quality early childhood care and education to children from the ages of 3 to 6 years.

The NEP emphasizes a holistic approach to early childhood education that focuses on the physical, cognitive, socio-emotional, and creative development of children. It encourages a play-based and activity-based approach to learning, considering the natural curiosity and creativity of young children. The policy emphasizes the need for a flexible, inclusive, and multidisciplinary curriculum for early childhood education. The curriculum should be age-appropriate, play-based, and focus on developing foundational skills such as language, numeracy, critical thinking, problem-solving, and social-emotional skills. The NEP also emphasizes the importance of well-trained and qualified early childhood educators. It promotes capacity building programs to enhance their understanding of child psychology, teaching methodologies, and assessment strategies specific to early childhood. On parental and community engagement, the policy recognizes the crucial role of parents and the community in a child's early learning and development. It encourages parental and community participation in the early childhood education process, including regular communication, awareness programs, and capacity-building initiatives. The NEP highlights the need for a robust monitoring and evaluation mechanism to ensure the quality and effectiveness of early childhood education programs. Regular assessments, feedback mechanisms, and data-driven monitoring are encouraged to improve the overall quality of ECE.

It is important to note that the NEP 2020 provides a broad framework for early childhood education, and the implementation of specific policies and programs may vary across states and regions in India. The education is a concurrent subject under Article 42 of the Indian Constitution, state governments must pass their own laws and decide on the specifics of implementing this policy in their states. Continuous efforts and investments are required to ensure that all Anganwadi centers offer high-quality early childhood education experiences to children.

## **Conclusion**

The early childhood education in rural areas of India faces several challenges that affect its quality. Some of the key challenges include infrastructure and learning resources, skilled early childhood educators, socioeconomic factors, language and cultural barriers, parental engagement and support, and monitoring and evaluation. Addressing these challenges requires a multi-faceted approach, including increased investment in early

childhood education, improved infrastructure, enhanced training and support for Anganwadi Workers, community engagement, and effective monitoring and evaluation systems. By addressing these challenges, India can work towards providing quality early childhood education in Anganwadi centers, ensuring a strong foundation for children's lifelong learning and development.

## Recommendations

A systematic plan and implementation strategy for setting up basic infrastructure and providing learning resources in all AWCs must be developed, with a specific timeline. Standardizing the compulsory, non-negotiable physical infrastructure for a conducive learning environment, such as safe building structures, toilets, drinking water facilities, leveled floors etc., will ensure uniformity and accountability across Anganwadi Centers in India. Since, the quality of ECE programs is largely dependent on the capacity of AWWs, the Anganwadi workers must be trained on child development, age and developmentally appropriate curriculum and its transmission, classroom management, and soft skills. The current need is to create awareness among parents about children's development and learning, through sustained campaigns for encouraging parents' participation in ECE programs. A focused approach by state governments, in partnership with parents, communities, NGOs and Corporate Social Responsibility, for the implementation of quality ECE programs, can aid children from rural areas in maximizing their potential in the early years and help bring equity in pre-school education.

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## **Factors Related to Students' Satisfaction with Social Constructivist Learning Environments on the EduNext Platform**

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**Abstract:** The outbreak of the Covid-19 pandemic along with the gradually changing educational trends facilitate the transformation from traditional learning methods to digital learning methods. Besides, student satisfaction is vital in remote education course evaluations because it is associated with the quality of online programs. Recently, the EduNext platform has been created based on Vygotsky's social constructivism (1978), which intends to provide an educational technology for socially constructive learning. The authors tested the correlation between undergraduate students' satisfaction and perceived usefulness, perceived ease of use, and factors related to cognitive presence. The participants included 186 students participating in at least a course on EduNext at a private university in Viet Nam. The instrument employed in the quantitative phase was 22 items from Technology Acceptance Model (TAM) (Davis, 1989), cognitive presence items (Garrison et al., 2010; Shea & Bidjerano, 2008; Swan et al., 2008), and student satisfaction (Ejubović & Puška, 2019). The qualitative phase used semi-structured interviews with 10 students individually to analyze and provide characteristics of the EduNext. The findings revealed that there is a correlation between student satisfaction and perceived usefulness, resolution, and triggering events. The study provides implications for students and curriculum developers. Specifically, students can express their opinions and curriculum developers can review the ideas and improve the platform better.

**Keywords:** Social constructivist learning, EduNext platform, student satisfaction, TAM, Cognitive presence

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## Introduction

The outbreak of the Covid-19 pandemic created a 'chaos', causing activities around the world to slow down or stop altogether. Although protective measures have been implemented, the world is still not immune from the penetration of the virus completely. The education sector is also severely affected when children, students or even staff, teachers and lecturers cannot go to school. Schools at all levels must suspend face-to-face teaching activities (Dinh & Nguyen, 2020; Pokhrel & Chhetri, 2021). Besides, the complicated pandemic situation contributes to accelerating the process of changing the learning trend from traditional (face-to-face) to digital learning (Dhawan, 2020; Dinh & Nguyen, 2020; Pokhrel & Chhetri, 2021). Additionally, the technological revolution has had a great impact on many areas of human life, including education. Therefore, the expectation of implementing courses through technological devices and software is increasing (Schindler et al., 2017). Moreover, because of the overpopulation and the need for more places to study, the trend of learning from the commune has been considered, evaluated and developed for many years. Many schools have implemented online learning methods through technology devices and achieved many positive aspects (Dumford & Miller, 2018). The term online learning is now gradually becoming popular in the field of education (Singh & Thurman, 2019). Because of receiving a lot of attention, this type of education has also continuously developed and divided into many different types such as blended learning, distance education, etc. (Dhawan, 2020). Many online courses are also offered (Dumford & Miller, 2018) and with a variety of distance learning formats, access to technology devices is also widely available.

When carrying out a novel learning and teaching approach, student satisfaction is increasingly emphasized as it contributes to the assessment of the quality of the platform or curriculum. More importantly, this term has been and is a key criterion or measure for schools to assess the quality of a curriculum or learning platform (Bailey & Lee, 2010; Elliott & Shin, 2002). The developers can evaluate and gain a detailed view of improving the curriculum thanks to student satisfaction.

According to Karaksha et al., (2013) study, students grow up in the evolution of technology and are exposed to new technological achievements day by day. Therefore, students are natives of the new digital as well, they need more than traditional teaching methods, and the application of technology tools to learning and teaching brings more advantages to their learning. The study revealed that students have had a positive attitude towards the implementation of application technology into their learning.

Another factor affecting the success of distance learning is tied to the use of technology, and the TAM Model of Davis (1989) is also a typical model for evaluating the success of a technology platform. In particular, perceived usefulness and perceived ease of use are the basic and typical factors to evaluate an initial success of a platform.

The reason is that it opens up a whole new perspective on communicating, using, and learning on a new platform.

In addition to technology, cognitive presence is also a significant determinant of the quality of an online learning experience since it involves authentic methods derived from jointly creating knowledge in an online classroom. More importantly, cognitive presence is known as the key indicator of the Community of Inquiry (CoI) framework in order to support the social constructivist learning approach i.e the pivotal role in enhancing learning effectiveness. In the same vein, in a systematic review of empirical research on 30 articles about cognitive presence in online learning from 2000 to 2019, Sadaf et al., (2021) affirmed that cognitive presence makes a great contribution to the quality of online learning. The findings, however, revealed that the majority of the studies were carried out in tertiary education in the United States and Canada and quantitative research approaches were used in over half of the studies.

Recent advancements in information technology offer a number of platforms that supply constructive learning opportunities both inside and outside of the classroom. Recently, a cutting-edge educational platform named EduNext has just been created by Mr. Cao Van Viet, one of the leading figures in the EdTech sector and a specialist in leveraging technology to construct educational products at FPT Corporation (this is truly inherited and developed from CodeLearn). From the Spring semester of 2021, this platform, which intends to provide both students and teachers with a variety of educational technologies for socially constructive learning, has been used in several courses at a private university in Vietnam. Besides that, Vygotsky's social constructivism (1978)-knowledge construction occurs through social and cognitive processes – is the key foundation to constructing this platform. Thereby, relatively little research information about this platform has not been determined through many authentic studies. Therefore, the aims of this research are to identify factors that influence student satisfaction when learning through the novel platform. To fill in the blank of the research gap above, the current study is aimed to answer the following questions:

RQ1: To what extent do perceived usefulness, perceived ease of use, cognitive presence, and student satisfaction correlate with each other?

RQ2: How do perceived usefulness, perceived ease of use, and cognitive presence affect student satisfaction?

## **Literature Review**

### **Constructivism**

Constructivism appears to be a strict association between behavior and cognition. In other words, it is the process by which learners form their own knowledge and turn it into their own knowledge. More importantly, they have to be able to turn it from theory into practice (Amineh & Asl, 2015). Learner-centered is a principle emphasized in constructivism (Pope et al., 2005). It means that the processes of analyzing, remembering, and absorbing knowledge will be learner-centered and they are almost active people in stages to form new knowledge. According to Phillips (2000), the most popular variations of constructivism include Jean Piaget's

personal constructivism (Piaget & Inhelder, 1969) and Lev Vygotsky's social constructivism (Vygotsky, 1978).

### **Social Constructivism**

Social constructivism is a sociological and communication theory of knowledge that looks at how people come to form their collective knowledge and understanding of the world. According to this theory, human beings collaborate to produce understanding, significance, and purpose. The assumption that people rationalize their experience by building models of how the social world works and the notion that language is the primary tool used by people to construct reality are the two key tenets of this theory (Leeds-Hurwitz, 2009). According to Vygotsky (1978), cognitive development ultimately takes place on a social level before it may happen within an individual. Making sense of people and building knowledge on such a social level enables students to relate to situations. Social constructivist researchers view learning as an operational process in which students should learn to determine data for themselves, consequently they encourage and assist learners' use of intuition and guessing (Brown, 1989). In other words, social constructivism emphasizes that reality is something that individuals cannot locate since that didn't already exist before people started constructing it in society. Furthermore, Vygotsky (1978) stated that learning is a continuous progression from the learner's current intellectual level to a higher stage that more strongly matches their capability.

### **Student satisfaction**

Student satisfaction is an important term in assessing whether a curriculum or platform is successful. Specifically, this term can be understood as students' feelings or evaluations after experiencing knowledge from a certain service. Universities tend to use student satisfaction as a measure of their programs (Elliott & Shin, 2002; Lee, 2010). The concept of satisfaction is gradually changing with the times. Especially, in the online teaching environment, it is even more necessary to be aware of the importance of this term. Specifically, it is strongly perceived in terms of interaction, technology, and perception (Strachota, 2003).

### **Edunext Platform**

Edunext was created by Mr. Cao Van Viet, one of the leading figures in the EdTech sector and a specialist in leveraging technology to construct educational products at FPT Corporation (this is truly inherited and developed from CodeLearn) in 2021 with the aim of providing a place where students can share their critical thinking, and interact with their peers. Moreover, students can acquire knowledge from their lecturers, their classmates, and other sources to construct their own knowledge. Besides that, the key foundation to constructing this platform is based on the social constructivist model. Figure 1 depicts the interface of this platform.

Because EduNext is developed to help students build knowledge and skills through interactive activities, personal views are encouraged to be shared and self-assessment is formed. To illustrate, Edunext has plenty of features that permit instructors to create constructive questions; Students joining the class are required to answer

the questions; Edunext also permits students to rate their classmates' answers by star voting. (which is illustrated in Figure 2). The questions are set under the form of social construction, hence the answers are always general. Teachers always comment on the answers so that students can absorb them correctly. More importantly, the Edunext platform also provides instructors with features to help them manage classes effectively. For instance, they can know which students haven't answered the questions, and which students are most active or least active.

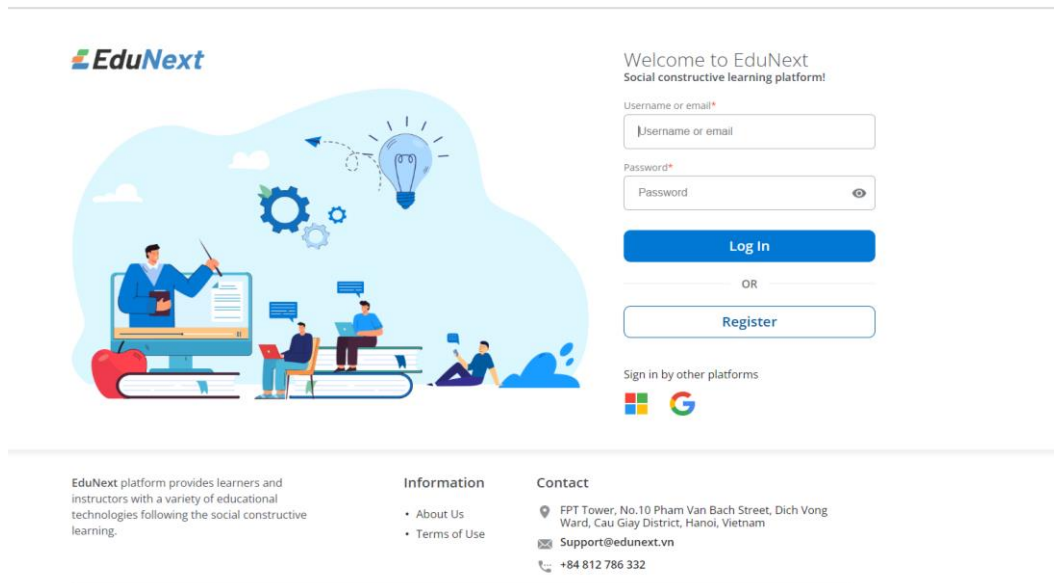


Figure 1. EduNext's interface

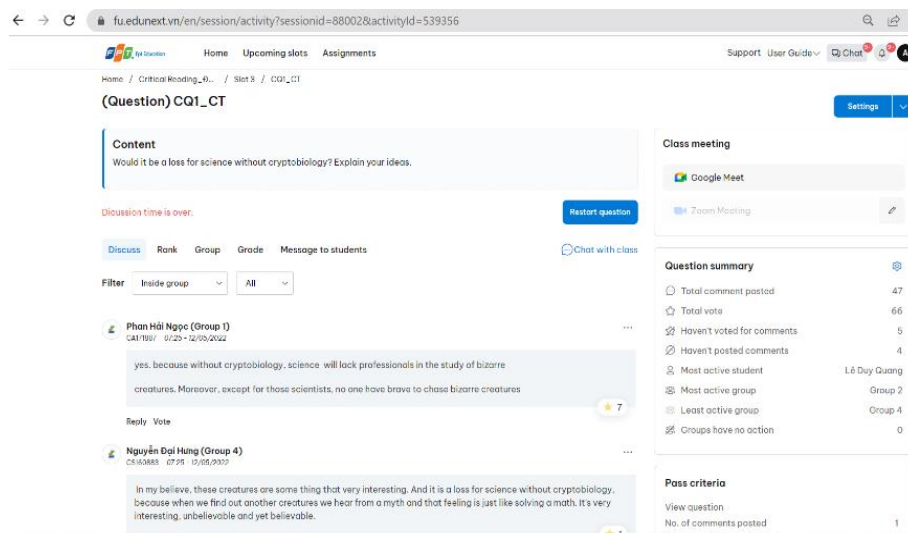


Figure 2. Space to participate in answering social construction questions and voting stars on EduNext

The interaction between peers is developed by EduNext through the integration of chat between group members. Figure 3 shows the chat feature on EduNext. Members in the same group can use the group chat feature to discuss with each other. Group members can exchange text or visual information via Google Meet.

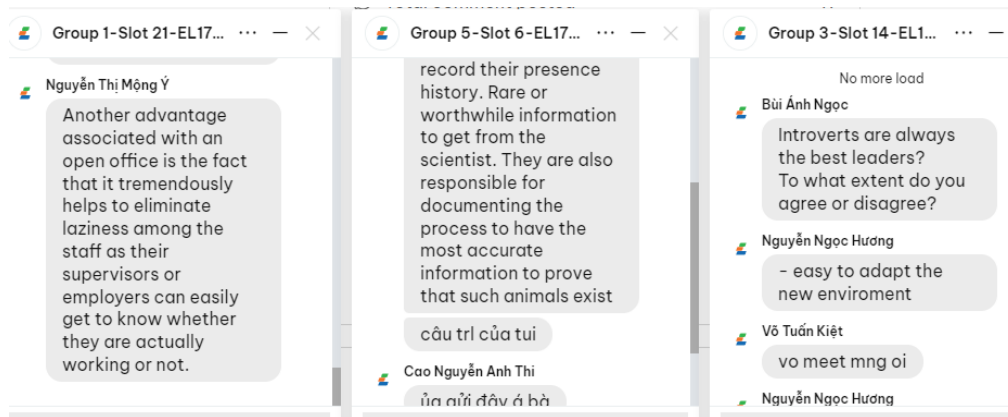


Figure 3. Group chat feature on EduNext

## Theoretical framework

### *Technology Acceptance Model (TAM)*

The Technology Acceptance Model (TAM) is a theory of information systems that describes the method users accept and choose to embrace technology. Davis (1989) developed the model based on investigations on perceived usefulness regarding utility and ease of use. Besides, one of the reasons for designing TAM was to anticipate and explain user adoption and usage of technological information. The model has been utilized in a range of technology-related sectors and situations, and it is recognized as a significant model suitable for examining the adoption of different online learning tools. That's the reason why "TAM" (Davis, 1989) was selected for the research.

### *Community of Inquiry (CoI)*

The CoI framework developed by Garrison et al., (1999), outlines the crucial components of an effective online learning approach. It is based on Dewey's educational theory and social constructivism. It offers a collaborative-constructivist perspective (Arbaugh et al., 2008). According to Garrison et al., (1999), this framework included social, teaching, and cognitive presence. Firstly, social presence is defined as one's realness via affective expression, open dialogue, and group cohesiveness. Secondly, teaching presence is referred to as the planning, facilitating, and guiding of social and cognitive development to produce worthwhile and practical learning outcomes. Eventually, cognitive presence refers to how effectively students are capable of generating and validating meaning via extended thought and discussion within a critical Community of Inquiry (Garrison et al., 2001).

### *Cognitive Presence*

Cognitive presence was defined by Garrison et al., (2001) as "the extent to which learners can construct and

*confirm meaning through sustained reflection and discourse in a critical community of inquiry*". Obviously, learners' online experiences have been deeply revealed via reflection and discourse. Therefore, cognitive presence is considered the core value of a community of inquiry even though it may be the least studied and understood. In fact, cognitive presence has a more stable meaning compared to the other presences because its meaning is originally from the Practical Inquiry Model (PIM) which is widely used in measuring cognitive presence in virtual activities and highlighted the integral role of collaboration between cognitive presence and the need of community. There are four phases in PIM comprising trigger event, exploration, integration and resolution/application (Garrison et al., 2001). The trigger event is defined as the first stage of critical inquiry to identify problems, dilemma emerged from experience. The next phase is exploration which is a vital and time-consuming stage for learners to individually and collaboratively search for various materials and share their ideas. Ideas searched from the second phase will be constructed into meaning in the third phase, which is Integration, besides it provides learners an opportunity to evaluate the feasibility and applicability of ideas to consider whether or not they are well-connected to the problem and to offer some promising solutions. The ultimate one is resolution/ application which is the phase to test solutions for problems from the initiation stage.

### **Previous Studies**

The evolution of technology, recently, has been changing the way of learning as well as the training strategy of educational institutions, popularly the use of technology tools. There is no doubt about the benefits that technology tools bring to learners; besides that, there are also factors that also affect students' satisfaction. Therefore, there have appeared more and more research papers in international studies and studies in Vietnam, which are conducted with the aim of giving an overview of students' experiences in online learning.

According to Azhari et al., (2020)'s research with pharmacy students' perceptions on social constructivist learning environments. The findings showed that their positive feelings as well as their positive perception decreased with each school year (first year to final year). This is caused by the background, knowledge of the students, and interaction. It can be seen that although students have a positive satisfaction towards social constructivist learning environments, the majority of students expect e-learning associated with their professional practice, the second students have higher satisfaction than the final-year students. Furthermore, readiness was also reported by Chung et al., (2020) emphasizes having an impact on students' learning experience and satisfaction. They suggest that readiness is also affected by student maturity. The report shows that the ages of 3rd - 4th year students show more readiness for online learning than 1st - 2nd year students (Chung et al., 2020; Hung et al., 2010; Wojciechowski & Palmer, 2005). By the way, readiness has the opposite effect reported by Chung et al., (2020) compared with that reported by Azhari et al., (2020).

Cole et al., (2014) conducted a 3-year study on student satisfaction with an e-learning learning environment. Specifically, students did not show high satisfaction with the online learning environment, and they only rated satisfaction at a moderate level. Student satisfaction in blended learning will be higher than in synchronous online learning. Moreover, two main factors affecting students' satisfaction and dissatisfaction with the learning

environment are convenience and lack of interaction, respectively. Cole et al., (2014) also stated that gender has no significant influence on their satisfaction with e-learning. While Chung et al., (2020) determined that student satisfaction with online learning varies by gender and study program. Their research shows that females and degree students show more satisfaction than males and diplomas. The research time of the two reports is different, which leads to different results (2014-2020).

Moreover, by using TAM (Davis, 1989), Sahin & Shelley (2008) postulated that skillfully using online tools and well awaring of the benefits of online learning will positively impact students' satisfaction. Similarly, an investigation into the application of technology in teaching tourism students during the Covid-19 epidemic by Kallou et al., (2022), partly through TAM, has shown that it is a positive sign for the continued development and adoption of web conferencing technology in higher education. Research results show that the acceptance and satisfaction of students are gradually improving.

In Viet Nam, owing to the outbreak of the Covid-19 epidemic, most institutions required their students to switch to online and distance learning methods (Chen & Bui, 2020). At an early stage, when first exposed to a new type of learning, a study conducted by Pham et al., (2019) shows dissatisfaction with this form among the majority of students because of the new and sudden exposure to the new type of education while a study conducted by Chen & Bui (2020) with first-year English language students showed a certain difference. The majority of students expressed satisfaction with this educational policy.

In the same vein, a study by Dinh & Nguyen (2020) at a national university in the southern region of students exposed to online learning in the first 2 months, shows that most students have a certain satisfaction about the online learning environment. They have expectations for the future of distance learning because it is flexible and supportive. Thereby, it also shows a very quick adaptation of students although it also had the identified impediments like internet connection, interaction or audio problems. However, Dinh & Nguyen (2020) also reported that in the choice of learning method, students still focus on face-to-face learning more than online learning. This is the author's assumption that students easily acquire knowledge in a familiar environment.

Additionally, Nguyen (2022) showed that knowledge acquisition and satisfaction have a close relationship. In his research at a Law school, he demonstrated that the benefits of online learning are markedly changed through the elements of ease of use, ease of learning, and factors of the TAM Model (Davis, 1989). The benefits of learning are appreciated if students have a good feeling about the above factors. Since then, student satisfaction has also increased significantly. Another study on the use of technology in learning by Hoang & Dang (2021) showed a positive impact students' learning outcomes, on the cognitive side of students from the application of technology. This is a positive result compared to traditional learning methods (Alves & Raposo, 2007; Abrahams, 2010). However, Hoang and Dang (2021) also emphasize the usage control of students.

From the above-mentioned sections, there is scarce research on the impact of cognitive presence on other learning environments such as video-based learning platforms, learning management systems, etc. Therefore, it



urges us to carry out the study to explore factors affecting the factors that influence student satisfaction with the novel learning tool-EduNext in terms of cognitive presence and the TAM framework.

## Method

### Research design

The mixed method study was used in the current study because this is regarded as an effective method to land a broad insight and strengthen the conclusion (Morse, 2016). The paper makes use of quantitative and qualitative analysis methods and references from a few relatively early research to explore students' satisfaction with factors related to perceived usefulness, perceived ease of use, and factors related to cognitive presence when they experience courses on the novel mediating tool-EduNext.

The participants of the current study consist of 186 students who participated in at least one subject on EduNext. They are from all majors at a research site consisting of Business Administration (45,70%), Information Technology (28,49%), and Linguistics (25,81%).

The sampling technique used in the study is purposeful sampling since this is also known as a non-statistical participant selection method, which enables researchers to determine and choose study participants based on initial volunteers who refer them to further study participants who fulfill the criteria (Flick, 2009).

### Research instruments

At the quantitative research stage, the questionnaire was used with two main parts. Initially, the filter question and the demographic information included name, email, gender, school year, age, major, and the number of subjects students participated in EduNext. Next, the survey continues with constructs affecting students' satisfaction. A questionnaire consisting of 22 items from the Technology Acceptance Model (TAM) developed by Davis (1989), Cognitive presence extracted from the Community of Inquiry framework (Garrison et al., 2010; Shea & Bidjerano, 2008; Swan et al., 2008), and student satisfaction (Ejubović & Puška, 2019) were deployed to collect the data. The items were in the order of 3 items from perceived usefulness, 3 items from perceived ease of use, 12 items from the perceived cognitive presence, and 4 items from student satisfaction. A 5-point Likert scale with 1 = strongly disagree and 5 = strongly agree was applied.

In the qualitative phase, semi-structured interviews with 10 students individually were used. Each interview was 15 minutes. Then, the data is content-analyzed. The data of the variables, which were purposefully collected early from 40 students who attended at least 1 course on EduNext, were used to demonstrate the reliability of the research questionnaire with Cronbach's Alpha based on SPSS 26. Cronbach's Alpha indexes will be considered at the level of 0.7 or higher, which is the appropriate level to demonstrate the reliability of the variables (Pallant, 2007). According to the tested result, the index of the variables is determined to reach higher

than 0.7, particularly the details shown in Table 1. Additionally, respondents may be impacted by their current emotions, prejudices, or level of comprehension when completing questionnaires, which could lead to their responses not correctly reflecting their true thoughts, hence the questionnaire was translated and modified to be appropriate for the objective of our study and the Vietnamese context while keeping the reliability and validity of the used instrument. Besides, all members of the team and an EFL lecturer have devoted time to verifying the language's accuracy. Taking everything into consideration, the questionnaire has high reliability.

Table 1. The Reliability of The Questionnaire

Variables	No. Items	Mean	No. Participants
Perceived Usefulness (PU)	3	.923	
Perceived Ease of Use (PEOU)	3	.903	
Cognitive Presence (CP)	Triggering Event (TE)	.892	40
	Exploration (E)	.828	
	Integration (I)	.803	
	Resolution (R)	.912	
Student Satisfaction (SS)	4	.909	

## Results

### To what extent do perceived usefulness, perceived ease of use, and student satisfaction correlate with each other?

Pearson correlation analysis was conducted on student satisfaction (SS) variables with two factors of the TAM model, perceived ease of use (PEOU), and perceived usefulness (PU). The purpose is to answer research question 1. The results of the analysis are shown in Table 2.

Table 2. The Pearson Correlation between SS and PEOU, PU

		Correlations		
		SS	PEOU	PU
SS	Pearson Correlation	1	.016	.806**
	Sig. (2-tailed)		.151	.000
	N	186	186	186
PEOU	Pearson Correlation	.106	1	0.085
	Sig. (2-tailed)	.151		.249
	N	186	186	186
PU	Pearson Correlation	.806**	.085	1
	Sig. (2-tailed)	.000	.249	
	N	186	186	186

\*\*Correlation is significant at the 0.01 level (2-tailed)

The results of the analysis show that there is a strong correlation between student satisfaction (SS) and perceived usefulness (PU) ( $p=0.00 < 0.05$ ). It is obvious that the use of learning on the EduNext platform contributes to student satisfaction, which is highlighted via the data from the interview “*One of the things I like about the EduNext is that I can refer to the answers of all of my friends' comments. It is great when I haven't come up with any ideas for the question.*”(P8)

In contrast, there is no correlation between student satisfaction SS and perceived ease of use (PEOU) ( $p=0.151 > 0.05$ ). It means whether or not the use of the platform is easy or difficult, it does not affect the satisfaction of students in the learning process. One of the interviewed participants stated that “*We are GenZ and digital citizens, hence using a new platform is not a huge deal for us.*” (P10)

Additionally, to explore the relationship between student satisfaction and cognitive presence, we conducted a Pearson correlation analysis between SS and 4 factors of cognitive presence including TE, E, I, and R, which are shown in Table 3.

Table 3. The Pearson Correlation between SS and Factors of Cognitive Presence (CP)

		Correlations				
		SS	TE	E	I	R
SS	Pearson Correlation	1	.709**	.584**	.637**	.693**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	186	186	186	186	186
TE	Pearson Correlation	.709**	1	.613**	.667**	.678**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	186	186	186	186	186
E	Pearson Correlation	.584**	.613**	1	.725**	.610**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	186	186	186	186	186
I	Pearson Correlation	.637**	.667**	.725**	1	.656**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	186	186	186	186	186
R	Pearson Correlation	.693**	.678**	.610**	.656**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	186	186	186	186	186

\*\*Correlation is significant at the 0.01 level (2-tailed)

It asserts a strong correlation between student satisfaction (SS) and elements of cognitive presence variables including triggering event (TE), exploration (E), integration (I), and resolution (R). Specifically, based on the results, it reflects the relationships of the variables. Variables of cognitive presence have a strong impact on student satisfaction in the learning process. The more positive the perception of these variables, the higher the student satisfaction with learning on EduNext. This was also emphasized via ideas from the interview:

“*I think EduNext will help students to finish the questions posed by the teacher and to become self-study as they will have to explore the answers from a variety of sources.*” (P1)

Moreover, students affirmed that EduNext provides them an opportunity to enhance their cognitive thinking through the process of searching for answers. “*I post the answer on my own, besides I frequently read and consult good answers from my peers to make my answers more insightful and complete.*” (P2)

### How do perceived usefulness, perceived ease of use, and cognitive presence affect student satisfaction?

The study aims at investigating the impact of the constructs hence multiple regression analysis was performed. Multiple linear regression was calculated, at the 0.05 significance level, to estimate the effect of PU, PEOU, and

TE, E, I, and TE on their satisfaction with the social constructivist learning environment on the EduNext platform. According to Sarstedt et al., (2019), the Variance Inflation Factor (VIF) should be lower than 3 in order to avoid the degree of collinearity or even multi-collinearity among the independent variables. As a result, the regression analysis of this model is accepted.

Table 4. Regression of Student Satisfaction

	B	Std. Error	Beta	t	Sig	Statistics VIF
(Constant)	-.544	.245		-2.224	.003	
PU	.539	.061	.518	8.795	.000	2.257
PEOU	.031	.045	.028	.698	.486	1.064
TE	.151	.069	.140	2.174	.031	2.716
E	.065	.077	.051	.841	.401	2.431
I	.049	.087	.037	.568	.571	2.804
R	.263	.072	.218	3.676	.000	2.292

a. Dependent Variable: SS

b. Independent Variables: PU, PEOU, TE, E, I, R

c. Model Summary: R=.851; R<sup>2</sup>=.725; Adjusted R=.716; Sig=.000

As can be seen from Table 4, the model explained 71,6% the variance in student satisfaction when they study on the EduNext platform under the impact of PU (p=0.000; B=0.518; VIF=2.257), R (p=0.000; B=0.218; VIF=2.292), and TE (p=0.031; B=0.151; VIF=2.716). In particular, the impact of PU was the most influential (B=0.518) followed by R (B=0.218) and TE (B=0.151). This also means that the more students perceive the EduNext platform as useful, the more satisfied they will be. In terms of R(resolution), student satisfaction will be higher if students can find the solutions for the problems easily and accurately (p=0.000; B=0.518). Another element of cognitive presence that positively influences satisfaction is TE (Triggering Event). This means that the questions posed on EduNext are more obvious and easier to understand, and the more satisfied students feel. Conversely, the regression also indicated that PEOU (p=0.486 > 0.05), E (p=0.401 > 0.05), and I (p=0.571 > 0.05) are withdrawn from the model.

## Discussion

Initially, the research results revealed that, in terms of TAM, PU is the factor that has a great impact on student satisfaction. The more they find the platform to be of great benefit to them, the better their satisfaction with the platform gradually changes. This is in line with Nagy (2018) and Pham et al., (2021). However, our results are in contrast to those of Daneji et al., (2019). Specifically, Daneji et al., (2019) showed that PU had no major impact on SS. Besides, there was no correlation between PEOU and SS. This is similar to the report of Nagy (2018). Furthermore, our novelty in this report is to determine how it affects interviews. In other words, students interviewed in the study said that they had access to many sources of information to answer according to

instructions when studying on EduNext. Those sources can include the Internet or friends in terms of PU, yet they were born in the age of technology so interacting and using technology did not create difficulties for them, leading to PEOU does not correlate with SS.

Finally, the results indicated that factors of cognitive presence including TE, E, I, and R were strongly correlated with SS. Perceived value as well as knowledge from learning on the platform will significantly contribute to their satisfaction. The results of this study are supported by previous work by Zhonggen et al., (2018) with a positive relationship between cognitive presence and student satisfaction when applying technology platforms to learning. The reason can be mentioned that their main purpose is learning and must get knowledge from that learning. Thus, it is understandable that cognitive presence has a huge impact, especially when adopting a new educational technology platform. In the results of the regression analysis, 2 factors of a cognitive presence having significance were (R) resolution and TE (triggering event). R has a stronger impact than TE on satisfaction. More specifically, the knowledge learned from the course becomes useful to the students by applying it outside the course which contributes to satisfaction. Furthermore, the initial requirements for answering questions are students' interest, curiosity, or motivation. If these requirements are fulfilled, students will be more satisfied.

## Conclusion

In conclusion, the findings of the current study revealed that perceived usefulness, resolution, triggering event, and student satisfaction were significantly correlated with each other. Specifically, usefulness will enhance the learners' satisfaction when experiencing courses on EduNext. Additionally, students will become more satisfied when they can find out the answers to the fixed and triggering questions on EduNext. Therefore, there is a need for the program developers to select materials and assign content linked to students' demands to increase their satisfaction with courses on the EduNext platform. In addition, lecturers need to pose effective questions to stimulate students' engagement.

Generally, the results of the study have some implications for students at the research site as well as provide educators especially the board of planning and curriculum developers with overall views about factors affecting student satisfaction when experiencing courses based on the social constructivist learning approach on the EduNext. The initial implication is for participants. Participating in the study, undeniably, is a valuable opportunity for students to express their thoughts after approaching the innovative kind of educational platform. Through their conceptualizations, institutional educators can deeply understand learners' demands and thinking. The remaining significance is discovering successful factors impacting student satisfaction when adapting the novel platform, EduNext, and the characteristics of EduNext. Accordingly, the board of planning and curriculum developers, and education staff including lecturers and technicians will design appropriate curricula, and their teaching methods/ techniques, and adjust the tool to adapt to learners' expectations.

## Recommendations

Social constructivist learning through the EduNext platform brings many improvements and innovations in learning and teaching. Therefore, we encourage more research on learning on this platform to bring to a multi-dimensional view. It is necessary to implement the following studies to synthesis and analysis for students, instructors, and course contents to have a more complete view about the E-learning model. Furthermore, it can extend the scope of research to other institutions that use EduNext as a compulsory teaching platform.

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## Contribution of Project-based Learning and Integrated Learning to Develop Student' HOTS

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**Abstract:** The development of higher-order thinking skills requires appropriate learning techniques. Project-based learning and integrated learning are learning models that can be used for this purpose. This study aimed to evaluate the contribution of project-based learning and integrated learning to the HOTS development of students in 6 private schools. The sample in this study was high school-level students who were determined by purposive sampling and random sampling techniques. The number of samples is 500 students. The instruments used are a measurement scale and a questionnaire with open questions. Data analysis was performed using the partial least squares technique. Based on the results of measurement scale data analysis, it was found that project-based learning combined with integrated learning showed a significant contribution to the development of students' HOTS. Project-based learning and integrated learning provide flexibility for students to study according to their characteristics so that the application of the student-center approach is practical. In addition, students are more motivated to undergo the learning process with this model approach because of the challenges of producing quality projects.

**Keywords:** HOTS, Project-based Learning, Integrated Learning

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### Introduction

Developing students' thinking skills is one of the essential goals in the educational process. According to Marzano and friends, thinking skills have levels/levels starting from simple thinking skills (LOTS) to complex thinking skills (HOTS). The learning method or model widely used by teachers in Indonesia develops lower-order thinking skills; only a few teachers used learning models that develop students' higher-order thinking skills. The results of the PISA and TIMSS tests placed Indonesia in a below-average rating as a result of this problem.

Teachers are responsible for designing and implementing excellent and appropriate learning to develop students' higher-order thinking skills. Teachers use many learning methods or approaches in the learning process, but not all of these methods can train and develop students' thinking skills into higher-order thinking skills. It was found

that project-based learning can develop students' thinking skills (...). Through the Ministry of Education, the Indonesian government launched a curriculum revision called the Merdeka Curriculum. In this curriculum, all schools in Indonesia must carry out project-based learning. The aim is to develop the character of Pancasila while at the same time developing students' higher-order thinking skills. Several private schools have implemented a combined learning model between project-based and integrated learning. This study aims to examine the contribution of the combined learning model of project-based and integrated learning in developing students' thinking skills in these private schools.

### **Higher Oder Thinking Skills**

Higher-order thinking skills (HOTS) are skills in using complex cognitive powers. Lewis and Smith (1993, 136) define HOTS as thinking that occurs when a person retrieves new information stored in memory and interrelated or rearranges and expands this information to achieve a goal or find possible answers in a confusing situation. Brookhart (2012, 3-8) defines higher-order thinking skills (HOTS) into three categories, namely 1) transfer, 2) critical thinking, and 3) problem-solving. According to Brookhart, in the transfer process, it is indicated that meaningful learning occurs, meaning that it can give meaning to the learning material. The definition of critical thinking contains the notion of being able to make an assessment or produce critical thinking (criticism) that has a basis or reason based on the results of reflection and makes a choice/decision. Meanwhile, the definition of HOTS in problem-solving is thinking to solve problems and produce new solutions. Schraw, McCrudden, Lehman, and Hoffman (2011, 21) explain that the definition of thinking ability contains various cognitive abilities. Several factors influence the development of higher-order thinking skills in students. In the curriculum, the learning approach used is the thematic approach and the subject approach. Thematic approaches can support the development of HOTS (Zohar, 1994; Madhuri, 2011). An essential factor in the implementation HOTS-Based curriculum is the quality of teachers in higher-order thinking skills. Teachers who have mastered and applied higher-order thinking skills will develop these skills for their students (Hassan, 2017; Row, 2016; Saido, 2015).

### **Project-based Learning**

Project-based learning (PjBL) is a learning model that schools can implement. In this model, students are trained to solve local problems. According to Chard in Drake and Burns (2004), project-based learning planning includes three stages, namely: 1) selecting topics to be studied based on interests, curriculum standards, and local sources; 2) the teacher explores the knowledge students already have and helps them to make exploratory questions, provides resources, and opportunities to go into the field; 3) students share their work with their friends, report their work, and evaluate their work. In project activities, students learn to make connections between knowledge and apply knowledge to solve real-life problems (Curtis, 2002).

Project-based learning aims to help students to explore knowledge as well as apply this knowledge in a tangible form, namely the results of the project. The processes carried out by students in project-based learning based on

practice in schools are literacy, planning project activities, implementing projects, and reporting or presenting project results. Through this learning activity, students are trained to apply simple research steps. These steps start from extracting information about knowledge following the objectives to be achieved through project activities. In the next step, they practice planning the process to be carried out, from preparation to getting results. After that, they started implementing the plans that had been made until they finally achieved the project results. Project results can be in the form of goods or new concepts from solving problems on issues worked on in project activities. Through project activities, students are given real experience solving social or environmental problems. It is essential for students. Students practice analyzing, evaluating, and creatively creating something helpful/meaningful to achieve the results set at the project's beginning. Problem-solving, communicating, collaborating, and decision-making skills are developed in the project implementation process. Through project learning activities, they are also trained to sharpen their sensitivity to social issues and natural environmental issues around them. In addition, through project activities, students' character can develop because they deal directly with real-life experiences.

### **Integrated Learning**

Integrated learning (IL) is a learning model that aims to help students develop a holistic way of thinking. According to Drake & Burns (2004), the definition of integrated learning can be seen from three different points of view. The three viewpoints provide three definitions based on the integrated learning approach category. The first approach is multidisciplinary integration, the primary approach to scientific disciplines. Integration occurs through one particular theme. The second approach is interdisciplinary integration through general learning across disciplines; for example, students learn about water when learning/practicing reading skills. The third approach is transdisciplinary integrated, which is an approach in which the teacher organizes the curriculum around student concerns and questions (Drake & Burns, 2004). Integrated transdisciplinary is carried out in the form of project-based learning.

Learning combines several subjects through a particular theme (thematic) or learning about a matter/problem from various knowledge angles. Through integrated learning, students are trained to think as a whole, not compartmentalized, and broaden their perspective on various things that happen in life. In integrated learning, students practice studying an object or event from various points of view. Integrated learning begins by raising a problem or giving specific issues to students. They are guided to analyze and criticize these issues from various perspectives based on the existing field of study at the senior high school level. The ability to analyze and criticize these issues will help them find solutions or determine their alignment.

### **Method**

This study evaluates the contribution of project-based learning and integrated learning models to the HOTS development of students. This study uses a convergent-parallel design approach from mixed methods.

Respondents in the quantitative research were high school students in six private high schools. Following the research objective, namely evaluating the contribution of the learning model implemented in several private schools, the school selection technique was purposive sampling, while the determination of students as samples were carried out by random sampling technique. The sample in the study amounted to 500 students. Respondents in the qualitative research were the teachers who taught at the six schools and their students. Teachers who answered the questionnaire with open questions totaled 50 teachers. Students who gave answers to questionnaires with open questions totaled 100 students. The instrument used in quantitative research is a Likert measurement scale of 1 to 8 to explore information about project-based learning and integrated learning. Test the ability to dig up information about students' skills in higher-order thinking skills. Meanwhile, the qualitative research instrument was an open questionnaire to teachers about their students' HOTS developments, . For testing the instrument's feasibility, the researcher conducted instrument testing: reliability test, validity test using factor analysis, and differential power test. The following are the results of instrument testing.

Table 1. Reliability Instrument

Variables	Result	
HOTS	Spearman-Brown Coefficient	.947
	Guttman Split-Half Coefficient	.947
Method (PBL & IL)	Spearman-Brown Coefficient	.920
	Guttman Split-Half Coefficient	.919

Instrument reliability was measured using the Spearman-Brown split-half method. Based on the measurement results in Table 1, the instrument has fulfilled the reliability test requirements with a value of  $r > 0.70$ .

Table 2. Validity Instrument

Variables	Result		
HOTS	Kaiser-Meyer-Olkin	Measure	of .956
	Sampling Adequacy.		
	Sig.		.000
Method (PBL & IL)	Kaiser-Meyer-Olkin	Measure	of .945
	Sampling Adequacy.		
	Sig.		.000

Testing the instrument's validity uses factor analysis to test the strength of the indicators in representing the construct. Based on the test results, as shown in Table 2, the KMO-Bartlett value  $> 0.60$ . These Five items from the HOTS variable were discarded from the differential power test results because the differential power values were below 0.3. In comparison, 21 items were used because the differential power values met the requirements. At the same time, the method variable shows the different power results of all items that have met the requirements.

results indicate that the validity requirements have been met.

Table 3. Discriminant Test

Variables	Discriminating Power	
HOTS	H1, H3, H4, H5, H6	Poor
	H2, H7 – H26	Good
Method (PBL & IL)	M1 – M18	Good

A partial-least square is used to analyze data. PLS analysis includes two stages/steps of model testing: testing the measurement or external models and testing the structural or internal models. Testing the measurement model is carried out to test the validity & reliability of the model, while testing the structural model is testing the relationship between the independent and dependent latent variables. The measurement model testing phase has been described above. The testing phase of the structural model (inner model) is carried out to test the significance of the contribution of the exogenous variables to the endogenous variables. Structural model testing assesses the relationship between latent variables (Ghozali, 2014, p. 73). The results of structural model testing are seen from the R-square, f-square, Q-square, and path coefficient values (direct effect, indirect effect, total effect). The R-square value explains the contribution of exogenous to endogenous latent variables. If the value of  $R^2 > 0.67$  indicates a robust contribution/model;  $R^2 < 0.30$  moderate contribution/model; and  $R^2 < 0.19$  contribution/weak model (Chin, 1988). The  $f^2$  value is used to assess the strength of the influence with  $f^2$  criteria  $> 0.02$  weak influence,  $> 0.15$  moderate influence, and  $> 0.35$  strong influence (Sarwono & Narimawati, 2015, p. 24). The  $Q^2$  value is used to prove whether or not the reconstruction of the observed values is good. The criteria for seeing the relevance of predictions are the value of  $Q^2 > 0$ : the model has predictive relevance, and  $Q^2 < 0$ : the model has less predictive relevance. The following criterion used to analyze the results of the structural model test is the t-value provided that t-count  $> 1.65$  ( $\alpha$ : 10%), t-count  $> 1.96$  ( $\alpha$ : 5%), t-count  $> 2.58$  ( $\alpha$ : 1%) (Ghozali, 2014, pp. 78-81).

## Results

The following is the result of data processing to test the construct validity, discriminant validity, and measurement model reliability of this research model. The following model image shows the loading factor values of the items in the variable.

From the model image, the loading factor value of all items in each variable is more than 0.50, so it can be said that all items meet the requirements as indicators for their respective constructs.

Table 4 shows that Cronbach's alpha and composite reliability values of the three variables have met the reliability requirements with test results greater than 0.70, while the AVE value is more significant than 0.50.

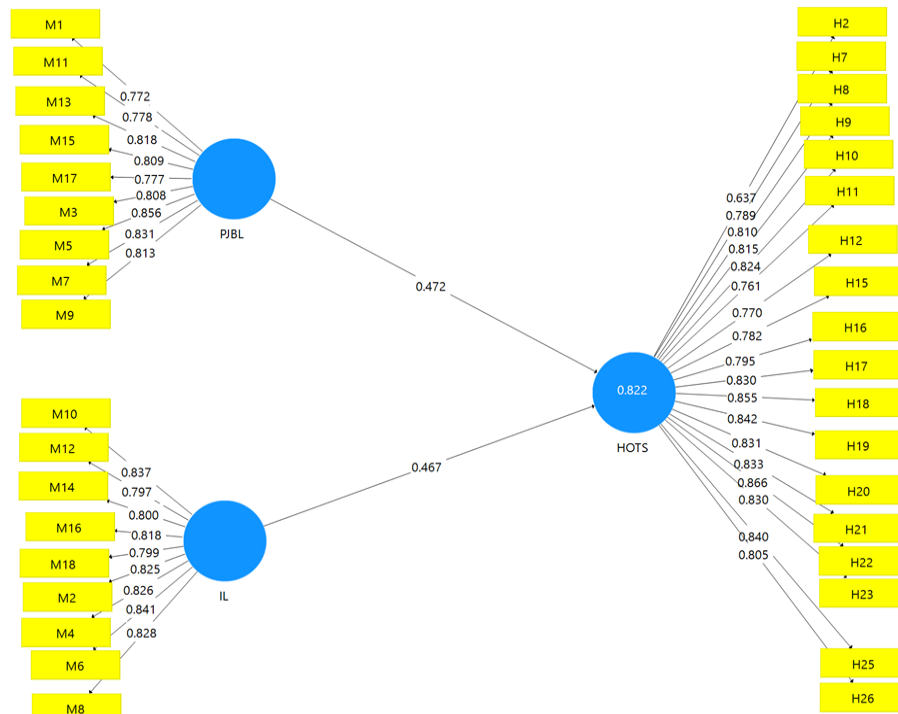


Figure 1. Loading Factor

Table 4. Reliability and Validity Test Results

Variables	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
HOTS	0.968	0.969	0.971	0.653
PJBL	0.939	0.939	0.948	0.671
IL	0.933	0.935	0.944	0.652

Table 5. Discriminant Validity: Fornell-Larcker Criterion

Variables	HOTS	PJBL	IL
HOTS	0.808		
PJBL	0.876	0.819	
IL	0.876	0.866	0.807

From the results of testing the validity of discrimination with the Fornell-Larcker criteria, the result is less than 0.90. Likewise, the loading-factor results show that all indicators of each construct have a more excellent loading-factor value for its construct compared to the loading-factor value for the other constructs. It shows that the set of indicators for each construct can explain each construct well.

Based on the results of the Fornell-Larcker discriminant validity test and the loading factor, it can be concluded that the outer model meets the requirements for discriminant validity.

Table 6. Cross Loading Factor

	<b>HOTS</b>	<b>IL</b>	<b>PJBL</b>
<b>H10</b>	<b>0.824</b>	0.767	0.702
<b>H11</b>	<b>0.761</b>	0.615	0.671
<b>H12</b>	<b>0.770</b>	0.691	0.635
<b>H15</b>	<b>0.782</b>	0.679	0.751
<b>H16</b>	<b>0.795</b>	0.754	0.676
<b>H17</b>	<b>0.830</b>	0.689	0.743
<b>H18</b>	<b>0.855</b>	0.769	0.703
<b>H19</b>	<b>0.842</b>	0.717	0.792
<b>H2</b>	<b>0.637</b>	0.548	0.553
<b>H20</b>	<b>0.831</b>	0.777	0.692
<b>H21</b>	<b>0.833</b>	0.702	0.753
<b>H22</b>	<b>0.866</b>	0.742	0.755
<b>H23</b>	<b>0.830</b>	0.677	0.707
<b>H25</b>	<b>0.840</b>	0.690	0.738
<b>H26</b>	<b>0.805</b>	0.740	0.673
<b>H7</b>	<b>0.789</b>	0.675	0.726
<b>H8</b>	<b>0.810</b>	0.781	0.705
<b>H9</b>	<b>0.815</b>	0.686	0.738
<b>M1</b>	0.614	0.629	<b>0.772</b>
<b>M3</b>	0.666	0.714	<b>0.808</b>
<b>M5</b>	0.757	0.742	<b>0.856</b>
<b>M7</b>	0.700	0.737	<b>0.831</b>
<b>M9</b>	0.748	0.707	<b>0.813</b>
<b>M11</b>	0.703	0.676	<b>0.778</b>
<b>M13</b>	0.760	0.711	<b>0.818</b>
<b>M15</b>	0.719	0.690	<b>0.809</b>
<b>M17</b>	0.680	0.681	<b>0.777</b>
<b>M2</b>	0.698	<b>0.825</b>	0.723
<b>M4</b>	0.691	<b>0.826</b>	0.719
<b>M6</b>	0.732	<b>0.841</b>	0.742
<b>M8</b>	0.694	<b>0.828</b>	0.713
<b>M10</b>	0.756	<b>0.837</b>	0.728
<b>M12</b>	0.725	<b>0.797</b>	0.688
<b>M14</b>	0.740	<b>0.800</b>	0.698
<b>M16</b>	0.720	<b>0.818</b>	0.707
<b>M18</b>	0.691	<b>0.799</b>	0.667



The cross-loading factor values shown in the table show that all items in each construct show a higher value compared to the loading factor values in the other constructs. From the Fornell-Larcker value and cross-loading, discriminant validity has been met.

### Structural Model

The model's structural testing results are seen from the R-square, f-square, and Q-square values.

Table 7. R-square

	<b>R Square</b>	<b>R Square Adjusted</b>
<b>HOTS</b>	0.822	0.821

The R Square value indicates the joint or simultaneous effect of PBL and IL on HOTS of 0.822 with an adjusted R-square value of 0.821. Thus, it can be explained that all exogenous constructs simultaneously affect the endogenous construct by 0.821. Because the Adjusted R Square is more than 0.67, the effect of all exogenous PBL and IL constructs on HOTS is strong.

Tabel 8. F-square

	<b>HOTS</b>	<b>IL</b>	<b>PBL</b>
<b>HOTS</b>			
<b>IL</b>	<b>0.305</b>		
<b>PJBL</b>	<b>0.312</b>		

Based on the table of F-Square values above, which has a significant effect size with F-Square criteria  $> 0.35$  is not there. While those that have a moderate effect, namely with F Square between 15 to 0.35, are the effects of IL and PBL on HOTS.

Tabel 8. Q-square

	<b>SSO</b>	<b>SSE</b>	<b>Q<sup>2</sup> (=1-SSE/SSO)</b>
<b>HOTS</b>	9000.000	4209.286	0.532
<b>IL</b>	4500.000	4500.000	
<b>PJBL</b>	4500.000	4500.000	

Q-square value  $> 0$  indicates the model has predictive relevance; conversely, if the Q-Square value  $\leq 0$  indicates the model has less predictive relevance. The Q-square value in the model shows a value of  $0.532 > 0$ , so the model has predictive relevance. The results of the analysis of the direct effects inner model in the table below.

Based on the results of the analysis of the direct effects inner model in the picture above, it can be concluded as

follows: The direct effect of IL on HOTS is 0.467, which means that if IL increases by one unit, HOTS can increase by 46.7%. This influence is positive. The direct effect of PBL on HOTS is 0.472, which means that if PBL increases by one unit, HOTS can increase by 47.2 %. This influence is positive.

Table 9. Path Coefficients

	<b>HOTS</b>	<b>IL</b>	<b>PBL</b>
<b>HOTS</b>			
<b>IL</b>	0.467		
<b>PBL</b>	0.472		

Table 10. Path Coefficients

	<b>Original Sample (O)</b>	<b>Sample Mean (M)</b>	<b>Standard Deviation (STDEV)</b>	<b>T Statistics ((O/STDEV))</b>	<b>P Values</b>
<b>IL -&gt; HOTS</b>	0.467	0.468	0.041	11.483	<b>0.000</b>
<b>PJBL -&gt; HOTS</b>	0.472	0.471	0.041	11.414	<b>0.000</b>

The table above shows the t-value > 1,960, and the p-value is 0,000. So, the PBL and IL learning models each contribute positively to the HOTS development of students.

The learning carried out in the six schools in this study applies the transdisciplinary learning model of integrated learning through project-based learning. There are two ways to do in preparing the project. The first way the teacher determines the theme is according to the issues currently developing in each school's local community. Students are asked to determine the project according to their understanding of the theme. The second way, the teacher determines the project in the form of results or products expected from project activities. Students explore a variety of knowledge to prepare the project implementation process to produce the specified product or result. Based on the implementation of project-based learning, teachers and students responded to open questions about how much the students' abilities in higher-order thinking skills, communicating, and collaborating increased, the constraints experienced in the combined model of project-based learning and integrated learning, and the advantages of this learning model.

In an open-ended questionnaire, the teachers responded about how much the students' abilities in higher-order thinking had developed, including analytical, evaluation, and creative thinking abilities through IL and PBL learning. They gave answers based on data on the value of learning outcomes. From these questions, they said that above 75% of students experienced good development in their ability to do analysis, 60% experienced good development in criticizing a problem or issue, and 65% of students showed progress in creating or providing solutions to a problem. In solving problems, 70% of students can provide creative and appropriate solutions. 60 to 75% of students experience positive developments regarding communicating and collaborating.

The constraints teachers face in the combined learning process of project-based learning and integrated learning are summarized in three categories: 1) time constraints for project activities due to limited time allotted for project activities; 2) constraints from limited facilities and infrastructure at school, such as yards to carry out eco-enzyme projects, waste recycling processing, limited wifi facilities to dig up resources from websites, no land for gardening or animal husbandry; 3) constraints in integrating the competencies of certain subjects involved in the project; 4) constraints in providing individual student assessment of project activities. Teachers need intense training to design project learning models combined with integrated learning. Based on the answers, students, based on the order of the highest number of answers about obstacles they experience through the PBL-IL learning model: 1) greater demands from the project, 2) not being able to manage time properly so that assignments become overlapping, 3) misunderstandings in communicating in groups, 4) problems with friends who do not want to work, 5) inadequate school facilities to work on projects, 6) make decisions to be able to combine various ideas in the group, 6) many ideas come up so you have to be able to choose or combine these ideas and this takes time.

The advantages or advantages of the PBL - IL combination learning model are summarized in three categories. 1) Students experience progress in thinking skills. They show progress in their analytical, problem-solving, and creative abilities. It can be seen from the results of the reported project work. 2) Students experience development in the ability to cooperate/collaborate and communicate. Situations that require them to work together on projects encourage students to learn to communicate with different friends. 3) Learning is more interesting because it can be seen from students' enthusiasm for project activities. Students are enthusiastic because they are driven to make the best project results. While the advantages of this learning model based on the results of the answers of the students who have been sorted from the highest number of answers are: 1) learning is more exciting and not dull, 2) it trains independence and communication, 3) it can work with different friends so that they know more friends than before, 4) be more creative, 5) broaden horizons through collaborative activities, 6) learn to make decisions to combine various ideas in groups, 7) learn is more exciting and not dull, so it is more enthusiastic in learning.

## Discussion

The research data shows that the path coefficient value between the PBL learning model and the HOTS development of students is more significant than 1,960, with a p-value of 0,000, meaning there is a positive relationship. PBL is a learning model that makes students actively involved in the learning process. It can be seen from the steps of PBL activities, which begin with extracting subject matter/information to carry out the project, designing a project implementation plan to achieve the expected results, and planning implementation, namely starting to carry out project activities to produce the expected product. Students are required to carry out these steps independently with the help/guidance of the teacher. These steps illustrate how students are required to work and be active in the entire learning process until the requested product is obtained. In addition, in carrying out these steps, students must carry out analytical, evaluation, and creative thinking processes. This

thinking process is a high-level thinking process, as Marzano and Kendall (2007) explained in the New Taxonomy. Project-based learning provide flexibility for students to study according to their characteristics so that the application of the student-center approach is practical. In addition, students are more motivated to undergo the learning process with this model approach because of the challenges of producing quality projects.

The research data shows that the path coefficient value between the IL learning model and the HOTS development of students is more significant than 1,960, with a p-value of 0,000, meaning there is a positive relationship. Integrated learning combines various scientific fields to discuss a particular issue or problem. At school, the teachers use specific themes to discuss in an integrated manner. It aims to accustom students to look at things from all points of view so that they can assess them objectively. According to the teachers, students still need to be trained to see things as a whole because they are still used to separate learning. Based on the learning assessment results using the IL model, students showed broad analytical abilities in terms of insight compared to when they analyzed problems in one subject area. IL learning enables students to be creative more freely, demonstrated through IL learning works or products, such as school magazines, wall magazines, and other works. Integrated learning provide flexibility for students to study according to their characteristics so that the application of the student-center approach is practical.

The combined learning model between project-based learning and integrated learning is one of the models that teachers can use to develop students' self. The findings clearly show that the PBL – IL learning model encourages the development of students' thinking skills to a high level (Affandi & Sukyadi, 2016; Botha, 2010; Costa-Silva et al., 2018; Cudney & Kanigolla, 2014; Dzan et al., 2013; Mou, 2019; Rodríguez et al., 2015). One of the obstacles that arise is the problem of misunderstanding in communicating, but this problem is a means for students to practice communicating so that they experience progress in communication skills and organizing activities (Indrawan et al., 2018; Goldstein, 2016). Other soft skills that develop through the PBL – IL learning model are decision-making skills. From the project work process, students learn to combine ideas that arise in groups. The emergence of various ideas or ideas to work on projects is a challenge for students. Through this challenge, they learn to combine these ideas creatively or make decisions to determine which ideas to choose and use in their projects. From this, it can be seen that through the obstacles they face in the PBL-IL learning process, students hone their skills, such as the ability to analyze, evaluate, and make decisions, and be creative in order to be able to complete projects and produce whatever products or results they want—demanded from the activity. Problems in communicating help them find the right way to communicate to complete the task correctly. Another advantage of the PBL-IL model is that students' learning motivation is better than if the teacher uses the usual learning model in class.

The obstacle in developing IL learning experienced by teachers is the demand to find exciting and challenging student themes. The problem of collaboration between teachers in learning IL is a separate issue, some teachers are open to collaborating in the IL learning process, but some teachers need to be more open; this will be an obstacle in efforts to implement IL in schools. The problem that needs to be considered in the learning process is that teachers are required to be creative in finding specific themes or projects that can be a means for students to

learn about the integration of scientific disciplines - such as the integration of social and natural science disciplines - which is possible to do in schools. Limited facilities are also a significant obstacle for teachers in the PBL-IL learning process. This problem also encourages teachers to be creative in finding what projects can be carried out at school while accommodating a quality PBL learning process.

Based on the findings above, through the PBL-IL learning model, students and teachers experience development through preparing and implementing integrated project learning and through efforts to overcome the obstacles encountered.

## Conclusion

Project-based learning and integrated learning are learning models that positively contribute to developing students' higher-order thinking skills. Therefore, it would be terrific if teachers could use these two learning models more often to develop students' HOTS. In addition, these two learning models can be a means to develop skills in communicating and collaborating. Project-based learning and integrated learning provide flexibility for students to study according to their characteristics so that the application of the student-center approach is practical. In addition, students are more motivated to undergo the learning process with this model approach because of the challenges of producing quality projects.

The limitations in using project-based and integrated learning models are mainly the willingness to be active and collaborate. It is an obstacle for some students because they are used to learning individually. This model is less attractive for some teachers because it requires them to work with other teachers while they feel free to complete the learning process individually.

## Recommendations

Recommendations for further research are that it is necessary to explore qualitative research by observing the project implementation process to obtain a broader picture of PBL and IL.

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## **EFL Teachers' Beliefs about Technology Integration into English Language Classrooms: A Case Study**

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**Abstract:** In this era of information and communication technology boom, applying this advancement to all areas is a matter of course. This is a general tendency for technology integration into foreign language teaching at universities and schools in Vietnam. Following this trend, this paper reports the results of a study investigating teachers' beliefs about the effectiveness of technology application in English teaching at the university level. Two research instruments were a questionnaire and an interview. The results indicate that all participating teachers realized the significance and the trend of implementing technology into education and the advantages it brings to foreign language teaching and learning processes. These teachers, nonetheless, confessed their shortage of technical knowledge and skills and were satisfied with the sufficiency of technology equipment in the classrooms. Interestingly, despite these concerns, these teachers are still willing to apply technologies to their future teaching and strengthen their technology skills by self-learning and hopefully through professional training courses.

**Keywords:** teachers' beliefs, technology, integration, application, language classrooms

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### **Introduction**

The integration of technology into the contexts of language teaching and learning has been somewhat successful. Because instructors have such a huge capacity to impart beliefs to students, Yong and Cziko (2001) contend that teachers are a crucial component for successful technology integration into classrooms. Therefore, it is crucial to comprehend teachers' ideas, including prejudices and stereotypes regarding technology and technology use, as well as the connection between these beliefs and the practices they use in the classroom. On the other hand, teacher attitudes and beliefs are also significant variables in education, which is relevant to this study. The effectiveness of a teacher is significantly impacted by his or her stance on the pedagogy, method,



strategy, or instructional material that is used in the classroom (Başal, 2015; Biletska et al., 2021; Ding et al., 2019; Galvis, 2012; Hol & Aydn, 2020; Liu et al., 2017). As stated above, the current study intends to ascertain preservice EFL instructors' perceptions of and attitudes toward technology integration. As such, in line with this idea of technology integration.

This study explores the possible advantages and difficulties of utilizing technology in English learning. Studies on the advantages and challenges of incorporating technology in education and learning have been done, but there hasn't been much attention paid to how technology is used to learn English, particularly in Vietnam. The study investigates fresh perspectives on the advantages that users may obtain from utilizing technology in language acquisition. As a result, research must concentrate on how to integrate technology into English language instruction, particularly in Vietnam, and which obstacles must be overcome.

## **Theoretical Background**

### **Effects of Using Technology in Language Classrooms**

Teachers are urged to adopt a variety of cutting-edge teaching techniques that have recently been launched in foreign language programs. One generalization regarding the impact of technology integration in language learning environments is that it alters how children learn. As covered in the next sections, these changes take place in a variety of learning-related areas.

#### *Involvement*

One of technology's most notable benefits is that it fosters students' greater engagement, interest, and interest in the subject matter (Hill & Hannafin, 2001). In other words, learners' motivation increases since fun and games are introduced into the classroom. Creating well-structured tasks by teachers, such as problem-based projects, requires students to participate in worthwhile activities like searching the Internet for research for reports or practicing for presentation assignments. As a result, teachers successfully increase their pupils' motivation (Lin, 2009). Drayton, Falk, Stroud, Hobbs, and Hammerman (2010) contend that using systems like the Internet and email encourages students to learn with pleasure and act responsibly.

#### *A Paradigm Shift in Teaching and Learning*

An improvement in the learning environment that puts the emphasis on the student rather than the teacher is largely due to the integration of information technology in education. This tendency is the outcome of computers and other portable technology taking the role of traditional classrooms and learning environments as tools for learning and teaching. In a static environment where the instructor is the center of attention and the only source of knowledge, students no longer serve as passive information consumers. Instead, the classroom is transformed into a place where students are empowered to take ownership of their own learning through

engaging activities. In other words, a more hopeful alternative is that the teacher takes on a different role - that of a facilitator who guides pupils toward an attainable objective as opposed to the traditional instructor.

#### *An Evaluation Changes*

Thanks to the use of technology in the classroom, students can learn in a way that improves their ability for critical thought. Students who are independent in their learning and in monitoring and evaluating their own progress are more likely to complete tasks effectively. Students become more conscious of the quality of their work and are better prepared to face criticism from classmates and teachers because their work will be seen by many people. In a meaningful sense, technology also gives teachers the opportunity to assess pupils' performance with objectivity and accuracy. When determining the outcomes, the opinions of the teacher, the students, and their classmates are all taken into account. The emphasis on student autonomy in 21st-century education is increased by this evaluation method.

#### *Collaborative and Communicative Learning Enrichment*

The promotion of communication and collaboration between instructors and learners as well as among students both within and outside of the classroom is another advantageous aspect of using technology into language classes. In fact, new technology has made it possible for students to access a wide range of resources, including images and videos, as well as an infinite number of Internet users, including people outside of their school, like their peers from different institutions, subject matter experts, and members of interest groups. In other words, technology enables students to connect to the outside world, and as a result, their learning activities will involve a sizable number of people. Students' use of software and hardware to create and share items online serves as one example of this increased contact. These activities give students the ability to consolidate previously acquired knowledge and skills, apply these skills to those around them, and study, evaluate, and critique together. This improves students' sense of worth, self-assurance, engagement in group projects, and meaningful use of technology.

#### *Language Proficiency Enhancement*

All of the benefits of integrating technology into language courses that have been discussed thus far ultimately focus on the academic success of the students. Researchers claimed that when children are engaged in technologically advanced classrooms, their academic performance can be seen to improve in all subject areas (Means and Olson, 1997). Technology has certainly contributed to this advancement by altering pupils' attitudes toward studying and enhancing their self-confidence. Technology also encourages the social side of actual language use and empowers students to direct their own language learning process, which is uncommon in traditional classroom settings, by placing them in more real-world communication scenarios. In this approach, technology fully supports students' language learning and acquisition, and when used properly, it enhances language learners' academic performance. In a similar vein, Khan (2011) asserted that integrating technology

into language teaching and learning improves students' overall academic performance and language competency.

### **Teachers' beliefs**

#### *Definition*

The meaning of the construct "teachers' beliefs" has generated debate among researchers. Creswell (2009), who is credited with providing one of the most comprehensive theoretical syntheses of teachers' attitudes, examined definitions from 20 different academics but was unable to come to a consensus.

Academics have tried to conceptualize instructors' thoughts despite the lack of agreement on a definition by examining common traits observed in various empirical studies. There are four distinguishable qualities of beliefs, as per Kvale's identification from the year 2000: "existential presumption," "alternativity," "affective and evaluative loading," and "episodic structure." First, there is a strong relationship between teachers' beliefs and what is referred to as "existential presumption," which is a subjective judgment about a learner's aptitude, maturity, etc. Thus, teachers' opinions about the existence of such entities are shown in relation to their pupils' academic accomplishments. Second, beliefs frequently contain a vision of an ideal or other state that contrasts with the current situation. Here, "alternativity" alludes to that. In this sense, beliefs serve to create objectives, carry out tasks, and arrange important knowledge and information. Thirdly, beliefs can be comprehended through subjective feelings, moods, and preferences-based assessments thanks to their "affective and evaluative components," or AECs. Last but not least, "episodic structure" refers to the finding that ideas are usually connected to specific, vividly recalled events. Another researcher, Creswell (2009), provided a broader list of sixteen "fundamental assumptions that may reasonably be made when initiating a study." Creswell and Kvale are different in a few ways, including the following: a) Beliefs have a big influence on conduct since they are affective and judgemental in character. B) Beliefs rarely change as people age, and C) beliefs act as lenses through which new information or experiences are interpreted or processed. Williams and Burden (1997) state that beliefs have a greater influence on teachers' pre-class preparation, decisions, and overall classroom practice than knowledge because they "tend to be linguistically bound, to be formed promptly in life, and to be resistant to change" (p. 56).

From the discussion above, it can be concluded that teachers' beliefs influence their decisions, evaluations, and perspectives on teaching and learning. As a result, knowing what assumptions underlie teachers' decisions to integrate technology-based activities in their courses will come from analyzing their ideas about how technology is applied in the classroom.

#### *Teachers' Beliefs and Integration of Technology*

Lately, technology implementation is an essential part of successful teaching. However, the successful integration of educational technologies depends largely on the attitudes of educators, who eventually determine

how they are used in the classroom. In fact, “although the conditions for successful technology integration finally appear to be in place, including ready access to technology, increased training for teachers, and a favourable policy environment, high-level technology use is still surprisingly low” (Ertmer, 2005, p. 2). This is partly because the fact that most foreign language teachers lack knowledge of how to use technology effectively in education. Nevertheless, Hill and Hannafin (2001) found that despite a proper training shortage, English language teachers were willing to implement technology in their classrooms and some of them utilized some types of technology to promote students’ linguistic skills. In a quantitative study with one hundred Arab teachers, Göktürk (2012) found that teachers incorporated various technologies in their class activities to enable students’ learning.

Corresponding to these ideas about teachers’ beliefs and the relationship between teachers’ beliefs and their technology integration, this research focused on examining the beliefs of teachers at a public university about using technology in their classes to obtain an understanding of underlying thoughts that influence their teaching practice with regards to technology implementation.

Utilizing technology effectively in the classroom has become crucial in recent years. However, the attitudes of educators, who ultimately decide how they are utilized in the classroom, have a significant role in the effective implementation of educational technologies. In reality, "high-level technology use is still surprisingly low," even though "the requirements for successful technology integration finally appear to be in place, including ready access to technology, increased training for teachers, and a favorable policy environment" (Ertmer, 2005, p. 2). This is partially due to the fact that few foreign language teachers are proficient in integrating technology into the classroom. However, English language teachers were willing to use technology in their classrooms, and some of them used specific types of technology to support students' linguistic skills, according to research by Hill and Hannafin (2001). Goktürk (2012) discovered that teachers used a variety of technology in the classroom to support student's learning in a quantitative investigation with 100 Arab teachers.

In accordance with these theories regarding teachers' beliefs and the connection between teachers' beliefs and their use of technology, the goal of this study was to examine teachers' attitudes toward using technology in the classroom at a public university in order to gain insight into the underlying ideas that guide their teaching practices.

## **Method**

### **Participants**

Interviews with participants in person are used in the present qualitative research to collect data and information. The study tries to pinpoint the advantages and challenges that English language learners have when learning the language technologically, along with some of the difficulties associated with accomplishing this.

A total of twenty English language teachers were requested to participate in the study by the researcher, but five of them declined for personal reasons. All of the participating instructors, who have at least three years of experience teaching university English, are female in-service educators. They all graduated from reputable Vietnamese academic universities with teaching degrees.

## Research Instruments

### *Teacher Surveys*

The first tool utilized was a survey with a Likert-scale based on the teachers' attitudes about the use of technology in education today, the advantages of integrating technology into classrooms, and their abilities to use technology in their classrooms. There were 24 questions on the questionnaire, with answers ranging from strongly disagree (1) to strongly agree (5). The author created it, and it was given to the teachers for their feedback on the validity and content before they began to provide their responses. The questionnaire was then modified and given to the teachers once more.

### *Semi-structured Teacher Interviews*

In this study, semi-structured interviews were used to collect data by having genuine talks with the participants. The 10 participating teachers, who also responded to the survey, provided valuable insight into how they view the integration of technology directly into teaching and learning in this example. The educators also provided some insight into their use of technology in the classrooms.

Table 1. Research Questions and Instruments

Research questions	Methods/Instruments
1. What are ELF teacher's beliefs about technology integration into English language classrooms?	Quantitative: Questionnaires Qualitative: Semi-structured Interviews

## Results

### **Teachers' Beliefs about Technology Use in Education Today**

The study's instructors, in general, had positive attitudes toward the use of technology in the classroom, which was a key conclusion. In the age of contemporary technology, all fifteen teachers viewed the use of technology as essential. They appeared to take the use of technology in teaching and learning as something that comes naturally. Additionally, as the survey's results indicated, the majority of instructors thought that the use of modern technology in classrooms was limitless. Teacher 3 gave the following explanation: "Because it's our society's way of life now and in the future."

More than half of the teachers countered that creativity was a key component in a teacher's ability to successfully integrate technology into the classroom. One component of this problem can be that teachers need to be astute enough to choose the most appropriate and useful technology, or a combination of these tools, to use in a certain educational activity. In many circumstances, it is ineffective to duplicate the same program into a

different context. The teachers also understood that they needed to modify their instruction to match the needs of the new technologies rather than continuing to teach in the same manner as in the conventional sessions. Nearly all of the participating teachers agreed that students also adjust to what they are being taught.

### **Teachers' Beliefs about Benefits of Technology Integration into their Classrooms**

According to the participating teachers, using technology in the classroom has several advantages for both teachers and pupils. First off, all of the teachers agreed that technology supported advancements in both teaching and learning. Regarding the benefits to children, the clear majority of the teachers claimed that implementing technology in their classrooms improved students' academic performance overall, motivation, comprehension, collaborative learning, and language-learning outcomes. From the interviews, several teachers made it quite evident how they supported their pupils' learning through technology.

Technology is such an amazing tool, says Teacher 7:

*"The activities we offer students help them become more involved and give them the chance to interact with real language."*

Teacher 9 says:

*"Using computers in language classes is a good idea. My students are able to simply switch into different groups to make conversations thanks to the language acquisition and instruction software that has been placed on the computers. They are really interested in these computer-based activities. They actually interact as well."*

Almost all teachers who were asked how technology helped them in their language classes said it helped them develop their curricula, pay attention to their students, use effective teaching methods, treat students with special needs, evaluate students' performance, and expand their information sources. Most importantly, it helped them stay motivated as teachers. According to some teachers who were questioned, lectures became more authentic and vivid with computer-assisted slide show presentations that included illustrated graphics and sound to interest pupils in the courses. Teacher 10 remarked.

*"I can flexibly create different fascinating activities and entice students to join in thanks to flexible software like Hot potatoes, Toondoo, and Movie maker."*

### **Teachers' Beliefs about their Skills in Using Technology in Education**

The perspectives of the teachers were largely congruent when it came to the use of their technological talents in the classroom. Only one teacher claimed to be comfortable using technology-based activities in her courses and to have sufficient knowledge of contemporary technology. The remaining fourteen teachers, on the other hand, admitted that they lacked computer expertise and proficiency, which made it much more difficult for them to create teaching materials and exercises than in conventional classes. Teacher 2 stated:

*"I lack computer abilities, therefore it can be difficult for me to handle the resources I discover online. To adapt those resources to my pupils' level takes a lot of time."*

Those sentiments show that the teachers' lack of proficiency with technology was a challenge when they tried to

integrate it into their lesson plans. The fifteen teachers all agreed that one challenge was the necessity for them to stay current on technological advancements in order to offer students with the support and facilitation they require in order to meet the needs of digitally mature learners.

Additionally, every interviewee cited a lack of training and technological resources, such as computers and Internet access, as a barrier that prohibited them from integrating computer-based activities into their lessons.

Teacher 5 emphasized:

*"I feel I have gained skills by myself more than in training."*

Teacher 8 explained.

*"Whenever I want to show something on the Internet as an illustration for my explanation, I have to turn on the Cellular Data in my mobile phone and connect the computer to this phone in order to access the Internet,"*

However, the majority of the instructors acknowledged they enjoy creating technology-based activities in their language classrooms when questioned about their opinions on using technology in the classroom. Teacher 4 said:

*"I think I have a positive attitude towards the integration of computing resources in the teaching-learning process, despite the current difficulties and limitations."*

In the interviews, those instructors also expressed their desire to use technology in their lessons going forward and their willingness to improve their technological know-how and competencies through self-learning and, if practical, training programs.

## Discussion

The findings of this study generally confirmed a number of factors that had been discovered in earlier studies. First, the results were consistent with the literature about a paradigm change in teaching and learning that was previously highlighted. The participants employed technology because it improved a variety of learner-related aspects and because it offered a more effective teaching method, just like the teachers in earlier studies. They were also hindered by a lack of trust in their computer literacy and skills, a lack of access to suitable equipment, and a lack of professional support. The participating teachers also stated that they would be willing to continue integrating technology into their classrooms despite the limitations on professional development opportunities and the physical teaching environment.

## Conclusion

The study's findings showed that each participant instructor was conscious of the value and wide use of technology in education as well as the benefits that technology might bring to their language classrooms. However, many expressed concern about their own knowledge and abilities in the field as well as the lack of digital tools in classrooms. But they also expressed a desire to employ technology in education in the future. This suggests that even though there are a variety of factors influencing instructors' decisions about the use of

technology, personal opinions were still the main consideration. Another inference about why the teachers continued to take the initiative to learn about it themselves despite receiving limited support can be formed from the teachers' intention to use technology in future teaching and eagerness to develop their technological abilities. They most likely did so because they recognized its value to them and, more importantly, to their students. The participants continued to look for opportunities to participate in professional training programs in the intention of enhancing their technology knowledge and skills to handle any difficulties they may have had integrating technology. As a result, training must include practical sessions that demonstrate to teachers how to successfully use the technology into classroom activities rather than being restricted to a mere introduction to how it works.

## Recommendations

Research limitations must be disclosed in order for new research to be established on a more reliable foundation. There are two main limitations to the current study. To begin with, additional participants would have increased the generalizability of the findings. Additionally, suppose a comparative investigation is to be carried out in contexts beyond classrooms. In that case, the quantitative findings may have been supplemented by qualitative data as well as tools such as semi-structured interviews with some of the study's participants. Therefore, larger studies using a variety of research approaches should be used in future studies to produce more conclusive and reliable findings.

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## Factors Affecting Undergraduate Students' Adoption of Massive Open Online Courses (MOOCs)

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**Abstract:** The present study does have a great contribution to Vietnamese higher education institutions that adopted blended learning using Coursera MOOCs, especially blending the courses with offline mentors in brick-and-mortar classrooms. In the current study, the perceived value of constructs of the extended UTAUT2 model with additional variables of language competence and teacher influence was used to examine undergraduate students' MOOC adoption at a private Vietnamese higher education institution. This study was conducted via an online survey with 322 students who participated in at least one Coursera MOOC. The quantitative instrument consisting of a 36 items questionnaire was adapted from the UTAUT2 model Venkatesh (2003) and Venkatesh (2012); Barak et al., (2016), and Sebastianelli et al., (2015). The findings revealed that there was a correlation between performance expectancy, effort expectation, social influence, facilitating condition, hedonic motivation, price value, habit, language competence, teacher influence, and students' behavioral intention for continued use of MOOCs. More importantly, while social influence, hedonic motivation, price value, and habits had a strong impact on MOOC adoption, the variables of performance expectancy, facilitating condition, language competency, and teacher influence unexpectedly did not have any effects on the behavioral intention of undergraduate students towards MOOC adoption. Interestingly, effort expectation had an inverse impact on students' adoption of MOOCs. From the findings, implications and future suggestions of the research have been presented.

**Keywords:** Coursera MOOC, UTAUT2, Behavioral Intention, Language Competency, and Teacher Influence.

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## Introduction

The internet has dramatically impacted every aspect of human life. Education is no exception. In the other words, it has transformed the way knowledge is conveyed from traditional classrooms to scalable modern classrooms called MOOCS (Massive open online courses) that are regarded as a tool for “innovative disruption” which will be the promise for education (Tirthali, 2016). Besides, one of the main goals of the Sustainable Development Goals (SDG4) for Quality Education, which are to be attained by all of the member countries by 2030, is to promote lifelong learning, and MOOCs are thought to be a great medium for doing it. Additionally, MOOCs have been “a game changer” in the education domain because of their ability to grant users instant access to varying forms of education at any time and place, often as a free or affordable service. In other words, students who cannot fully commit to significant commitments such as traveling abroad to seek education from prestigious foreign higher education can now participate anywhere and at any time (Barak, Watted & Haik, 2016).

Among MOOC providers, Coursera is known as the largest MOOC provider across the globe with over 2.700 courses. Moreover, according to Class Central, a top MOOC aggregator, there are approximately 78 million users of MOOC (Shah, 2018). It is the soaring penetration of MOOCS that has attracted numerous researchers and scholars, who have studied plenty of various aspects of MOOCs to contribute to the existing body of knowledge of the prevailing MOOCs in the world. According to Meet and Kala (2021), 102 MOOC-related articles were published from 2013 to 2020. Though lots of researchers examined MOOC adoption, the current study targets Asian undergraduate students in a non-native English-speaking country, particularly in Viet Nam.

Although Vietnam is currently still in the early stages of implementing MOOCs into its educational system when considering readjustments and following the global model, MOOCS have been adopted by many universities (<https://vietnamnews.vn>, 2021). However, Vietnam is still facing obstacles that prevent it from reaching the true potential of MOOCs as time constraints, and the limited interaction between instructors and students. Prof. Giap Van Duong, founder of the first MOOC in Vietnam, during an interview with vnExpress, has even suggested that the lack of emotional expression from the teachers which is a common occurrence in MOOCs has led to a detachment between teacher and student which hinders the potential of MOOCs even further (htkh.hou.edu.vn, 2019). Thus, the current study was carried out at a selected private Vietnamese university by using the extended UTAUT2 with two additional variables of language proficiency and teacher influence to explore MOOC adoption by undergraduate students. The reasons for adding two more constructs to the model are explained as follows. First, language proficiency plays an integral part in MOOC enrolment and students only participate in MOOCs that are available in their language (Aldahdouh & Osório, 2016; Connolly,

2016). Likewise, Mendoza et al. (2017) noted in highlighting the necessity to investigate the impact of language proficiency on MOOC adoption. In addition to the significant role of language proficiency, teachers' or instructors' influence on the learning process of MOOC users is needed to be evaluated (Littlejohn et al., 2020). The term "teacher's influence" is regarded as a teacher's involvement in inspiring and guiding a student to use MOOCs for his or her improved comprehension and knowledge of the subject. It could be said that a teacher positively impacts a student's activities in a brick-and-mortar classroom or a virtual setting. Along with encouraging a positive attitude toward MOOC learning, a teacher's prior experience with MOOC as a learner, their familiarity and ease with educational technology, and their teaching expertise could all be potential influences (Tseng et al., 2019; Jung & Lee, 2020).

In light of the aforesaid, more studies are needed to explore MOOC adoption by students at higher education institutions. In particular, the application of MOOCs combined with offline mentors and learners' language proficiency in these courses (Ho et al., 2022). As a result, the aims of our research are to explore factors impacting students' behavioral intention of using MOOCs via the UTAUT2 model. Additionally, we undertake the study with undergraduate students as the core subjects of the research and language competency and teacher influence in offline sessions as additional variables positively affecting MOOC adoption. For such purposes, it leads to our research with the following questions:

RQ1: To what extent does students' behavioral intention toward the adoption of MOOCs through UTAUT2?

RQ2: To what extent does language competency affect students' behavioral intention toward the adoption of MOOCs?

RQ3: To what extent does teacher influence affect students' behavioral intention toward the adoption of MOOCs?

## **Literature review**

### **Definition of MOOCs**

MOOCs are defined as "a MOOC integrates the connectivity of social networking, the facilitation of an acknowledged expert in a field of study, and a collection of freely accessible online resources" (McAuley et al., 2010). Another definition of MOOC is an online course that provides instruction in virtual settings, which are known as a website that contains online courses in video format, lectures formatted as short videos combined with formative quizzes, automated assessments, and peer and self-assessment, and an online forum for peer support and discussion (Glance, 2013). It is also considered an online course that can gain significant participant numbers to learn for about 4-10 weeks and is subject to a certain rule. The first week is for participants to learn content via videos, and the last week is used to submit assignments and presentations for assessment (Taneja and Goel, 2014).

### **The Unified Theory of Acceptance and Use of Technology (UTAUT)**

UTAUT's theoretical model of the use of technology in learning is defined by actual behaviors. The UTAUT model shows that the adoption of technology in learning MOOCs will be directly influenced by four main constructs, namely performance expectations, effort expectations, social influence, facilitating conditions, and other moderators viz. gender, age, and experience (Venkatesh et al., 2003). In addition, the UTAUT model will synthesize existing theories about how people use technology to learn (Venkatesh and Davis, 2000; Venkatesh et al., 2003).

### **The Extended Unified Theory of Acceptance and Use of Technology (UTAUT 2 Model)**

According to Venkatesh et al., 2012, “consumer effect, automaticity, and monetary costs” were later added to the UTAUT2 model in addition to the four primary constructs of the UTAUT. The extended UTAUT2 model was used in the current study because of the following reasons. First, the UTAUT2 model can be said to have overcome the incompleteness of the previous TRA (Ajzen & Fishbein, 1975), TAM (Davis, 1989), TPB (Ajzen, 1991), and UTAUT1 models and has also been applied by many researchers in new technology acceptance models in general and MOOC in particular (Venkatesh & Davis, 2000). Second, plenty of researchers have used and verified the UTAUT2 model on a variety of technologies, but little research has been done to support UTAUT 2 in the context of education (Mittal et al., 2021; Tseng et al., 2019). Third, the extended model is widely used as it can address the limitations of the UTAUT model (Venkatesh et al., 2012). It is significantly noted that moderators of the original UTAUT model are not used in the current study because these moderators may not impact the adoption context. (Dwivedi et al., 2019).

#### *Performance expectancy (PE)*

It is defined as the extent to which individuals believe that the use of technology can support them to improve their performance and fulfill plenty of tasks. (Venkatesh et al., 2003).

#### *Effort expectancy (EE)*

Students are willing to accept the application of technology in learning if they feel that using MOOC technology is very easy called the effort expectancy by Dečman, (2015) and Fianu et al., (2018). Likewise, the phrase "degree of ease associated with utilizing the system" is used to characterize effort expectation. (Venkatesh et al., 2012; Zhou et al., 2010).

#### *Social influence (SI)*

Social influence (SI) is also a significant factor that leads students to use MOOCs as people such as family members, and friends, whom students believe that their use of the new system will help their studies (Venkatesh et al., 2003).

#### *Facilitating condition (FC)*

Facilitating conditions define the extent individuals believe the organizational and technical infrastructure is in place to support their use of the system (Venkatesh et al. 2003). In other words, students can use phones, laptops, and compatible electronic devices that can easily study with supporting students anywhere and anytime (Brown and Venkatesh 2005; Venkatesh et al., 2003).

### *Hedonic motivation (HM)*

Hedonic motivation (HM) has been included as a crucial predictor in the study of each student's behavior, pleasure from using MOOCs in learning, and level of interest in MOOCs is essential to students' interest in the use of MOOCs in education (Holbrook and Hirschman, 1982).

### *Price value (PV)*

Price value (PV) is described as an individual user's cognitive trade-off between the benefits they receive from using technology and the amount of money they spend on it (Venkatesh, 2012). In the institutional context of research, even though students do not have to pay any cost to study MOOCs on Coursera, tuition and fee payment for courses on the platform are truly included in the school's tuition fee.

### *Habit (H)*

Habit is defined as the degree to which a person tends to act automatically as a result of learning (Limayem et al.2007). Venkatesh et al., (2012) argue that the use of previous experience is a prerequisite for the habit of using technology and that habit is a key factor in the future adoption of that technology.

### *Language competency (LC)*

Language competency (LC) refers to a student's knowledge and ability in the language in virtual classrooms. Research in information systems has found that language influences the acceptance of technology (Deng et al., 2019). MOOCs have a lot of reading materials, lectures, and videos for users to refer to, all in English. If a person is fluent in the language, it is possible to understand all the content of the MOOC lecture. In developing countries, language strongly affects students' MOOC adoption (Aldahdouh & Osório, 2016; Anand Shankar Raja and Kallarakal, 2020).

### *Teacher influence (TI)*

The term "teacher's influence" (TI) refers to a teacher's involvement in inspiring and encouraging a student to use online learning resources for his or her increased comprehension and topic knowledge. According to Safri & Hanafiah, (2020), certain MOOCs do not provide mentors, or coaches, for students, which prevents them from connecting with MOOC instructors and creating opportunities for participation. Therefore, offline mentors are crucial for students to handle MOOCs.

## **Previous Studies and hypotheses development**

The considerable impact of performance expectations on behavioral intention to use e-learning has been noted in existing research on technology adoption (Dečman, 2015; Fianu et al., 2018; Jambulingam, 2013; Persada et al., 2019). Performance expectations were discovered to be a key factor in the adoption of online teaching and learning during the Pandemic due to its utility (Kala & Chaubey, 2022; Mittal et al., 2021). It is in the same vein, Šumak et al., (2010) discovered that performance expectation was a significant predictor of student attitude toward e-learning. Similarly, performance expectancy influenced behavioral intention in a number of online contexts, such as the acceptance of blended learning (Azizi et al., 2020), the adoption of e-learning (Tarhini et al., 2017), the adoption of MOOCs (Tseng et al., 2019), adoption of emerging information technology in higher education classrooms (Lewis et al., 2013), use of learning management systems (Ain et al., 2016). These findings agree with the finding by Venkatesh et al., (2012) who postulated that behavioral

intention is directly influenced by performance expectation. As a result, we propose the hypothesis:

H1. Performance expectancy impacts undergraduate students' behavioral intention to adopt MOOCs.

Effort Expectancy is regarded as a key factor in influencing users' choice to adopt novel technology. To clarify, Im, Hong, and Kang (2011) and Jung and Lee (2020) reinforce the result that simplicity of use influences the adoption of new technologies. The former studies also showed the positive effect of effort expectation on adopting new technology (Venkatesh et al., 2003). Similarly, Al-Adwan's research (2020) found that perceived ease of use has a positive impact on users' behavioral intentions toward MOOCs, especially in non-compulsory courses. When technology is easy to use on a high level, there is a probability that more effort will be required to use MOOCs. Therefore, we also hypothesize:

H2. Effort expectancy impacts undergraduate students' behavioral intention to adopt MOOCs.

Another element that motivated students to enroll in MOOCs is shown to be social influence. It has a favorable impact on the usage of MOOCs because of how simple they are to use and the advantages they are supposed to provide. Users are more likely to have high intentions of using the technologies if they perceive that significant individuals in their social circles encourage their usage of MOOCs (Chaveesuk et al., 2022). In agreement with the finding, social influence was discovered to be a factor in the adoption of online teaching by school teachers (Tandon, 2020) as well as the acceptance of blended learning (Azizi et al., 2020), e-learning (Tarhini et al., 2017), the use of a learning management system (Ain et al., 2016; Widjaja et al., 2020), MOOC adoption (Tseng et al., 2019), and emerging information technology adoption, hence we also hypothesize:

H3. Social influence impacts undergraduate students' behavioral intention to adopt MOOCs.

Facilitating Conditions were commonly highlighted as an indicator of MOOC uptake. MOOCs were seen as beneficial for gaining free access to high-quality educational materials and providing a flexible online setting where learning may take place without regard to time or location. The utilization of transcripts from a multidisciplinary curriculum, linkages to resources of current events, and brief media files with explicit learning objectives all supported students' learning in the case of MOOCs (Rosell-Aguilar, 2013). In Nanayakkara's opinion (2007), teachers and technical support positively influence students' use of learning management systems. A similar finding is echoed by (Bakar et al., 2013) who postulated facilitating conditions have a beneficial impact on the acceptability level of e-learning. Taking cognizance of this, we also hypothesize:

H4. Facilitating conditions impact undergraduate students' behavioral intention to adopt MOOCs.

The behavioral intention to use online and internet-based technologies, such as learning management systems, mobile learning, e-learning, digital social media, mobile banking, etc., is preceded by hedonic motivation (Baptista & Oliveira, 2015; Moorthy et al., 2019; Raman & Don, 2013). In the same vein, prior research has identified hedonic motivation as a strong predictor of BI's adoption of technology (El-Masri & Tarhini, 2017; Moghavvemi et al., 2017). Digitalization and peer pressure from social media has inspired Gen Z to value experiences more than previous generations do and to lead lives that are accelerated, exciting, enjoyable, and full of experiences. Besides, Gen Z will lead the adoption of all new online consumer technologies because of

their intrinsic familiarity with electronic goods and services (Weinswig, 2016), thus it is hypothesized that:

H5. Hedonic motivation impacts undergraduate students' behavioral intention to adopt MOOCs.

According to the UTAUT2 hypothesis, a product's quality, cost, and price are likely to impact the behavioral intention of using MOOCs. As a result, in the analysis of the adoption of MOOC use, the user's intention to use would be influenced by their perception of the quality of learning attained through the programs in comparison to the cost of supporting facilities, such as the Internet, computers, and cost of the education programs. These elements have a significant role in determining one's educational goals and decision-making processes, particularly for young people given the significance of learning outcomes. Previous research on online learning has demonstrated a strong link between pricing value and behavioral intention (Raman & Don, 2013; Tseng et al., 2019). As a result, we hypothesize that:

H6. Price value impacts undergraduate students' behavioral intention to adopt MOOCs.

Alsharo et al., (2020) claim that obligatory online learning, as was the case, compels students to continually utilize technology, which leads to automated executions. Moreover, Limayem et al., (2007) proposed that thoroughness of usage, frequent repetition of the behavior in question, degree of pleasure with the activity's results, and reasonably stable circumstances result in automated actions. For example, when learning online, students frequently log onto their computers and learning management systems, checking for emails, new announcements, and reminders for impending assignments and activities. Also, students would routinely read assignment summaries, finish tests, research topics, download educational materials, participate in web conferences, solve problems, and interact (through email, chat, emoticons, posting and commenting to message boards or blog threads) (Limayem & Hirt, 2003; Polites, 2009; Vishwanath, 2015).

H7. Habit impacts undergraduate students' behavioral intention to adopt MOOCs.

According to Meet et al., (2022) that language competence did not affect the behavioral intentions of students participating in MOOCs while Aldahdoh & Osório, 2016; Anand Shankar Raja, and Kallarakal, 2020 postulated the relationship between language proficiency and behavioral intention was statistically significant. Connolly (2016) echoed similar findings, underlining the importance of language skills in MOOC participation and recommending that students only enroll in MOOCs offered in their language. As communication is crucial to learning in all contexts, including online and offline learning, Garcia Mendoza et al., (2017) emphasized the importance of examining the influence of language proficiency on MOOC uptake. Learners perform better in their mother tongue (UNESCO, 2016). Hence we also hypothesize that:

H8. Language competence impacts undergraduate students' behavioral intention to adopt MOOCs.

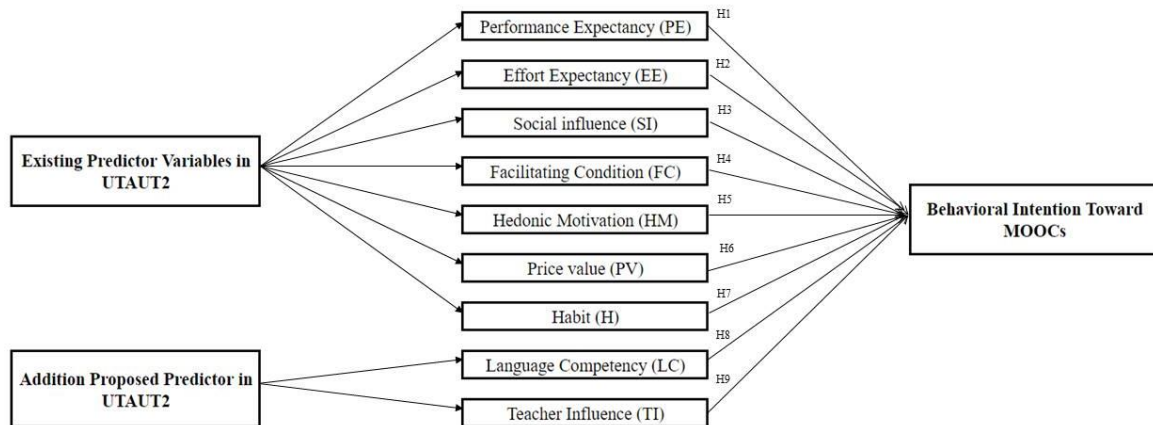
According to studies (Hoi & Mu, 2021; Al-Adwan et al., 2021a), teachers who play as significant social agents and nation-builders have a positive effect on student's mental health, behavior, and independent use of technology for learning. They also serve as an essential motivator for participants to sign up for MOOCs and foster a favorable attitude toward MOOC learning (Chang et al., 2015; Jung & Lee, 2020; Tseng et al., 2019). Likewise, teachers greatly influence students' offline and online learning activities (Garrison, 2000; Tseng et al.,



2019; Jung & Lee, 2020). Nonetheless, there is little correlation between instructors' impact and behavior intention (Al-Adwan et al., 2021a; Chang et al., 2015; Hoi & Mu, 2021). Therefore, it is hypothesized that:

H9. Teacher influence impacts undergraduate students' behavioral intention to adopt MOOCs.

**Research model**



**Figure 1.** Research model showing the hypotheses relationships

**Method**

The quantitative research method is the more suitable one for this research as Creswell (2003) postulated that only an analytical view using data analysis that realizes the united strength of multiple variables can give a more definitive answer to the research problem. Additionally, purposeful sampling is commonly used to efficiently identify and select samples with valuable information, making use of the limited resources on the researcher's end. It is the process of using one's judgment to purposefully pick a specific demographic out of the population who's experienced a phenomenon of interest to participate in the research (Palinkas, L.A, 2015).

**Participants**

The present study consists of 322 students who are required to participate in at least one MOOC on the Coursera platform. They are chosen from all majors viz. English language, Business Administration, and Information Technology at the research site.

**Research site**

The university in the current research has implemented MOOCs on the Coursera platform since the summer of 2019. All students from all majors (Information Technology, Business Administration, Graphic Design,

Linguistics, Multimedia Communication, and Hospitality Management) are required to take the courses in their curriculum. In each course on Coursera, students mandatorily spend 5 slots (7.5 hours) meeting with their offline mentor.

### Research Instruments

The first research instrument in the study was the questionnaire designed to collect data from participants regarding their experiences with MOOCs. The survey was separated into main sections. The beginning of the survey is demographic information such as age, gender, year of study, major, and the number of courses they participated in. The second part of the survey is the constructs of the research model including the factors such as performance expectancy (4 items), effort expectancy (3 items), social influence (3 items), and facilitating conditions (4 items) were developed by Venkatesh (2003), and the UTAUT2 model adapted from Venkatesh (2012) consists of 4 items that measure the constructs of hedonic motivation (3 items), price value (3 items), habit (3 items), and behavioral intention (3 items) while language competency (5 items) and teacher influence (5 items) were adapted from Barak et al. (2016) and Sebastianelli et al. (2015). The questionnaire adopted a 5-point Likert scale where participants could rate their level of agreement or disagreement with the statements ranging from 1 "Strongly Disagree" to 5 "Strongly Agree".

### Data collection procedures

#### *Piloting the questionnaire:*

After receiving approval from the Ethics Committee of the English Language Department at the research site. The research team undertook the survey (both English and Vietnamese versions) sent to 40 participants who experienced at least one MOOC on Coursera to test the reliability of the questionnaire.

Table 1. The reliability of the questionnaire

Name of variables	No. Items	Alpha	No. Participant
Performance Expectancy (PE)	4	0.824	40
Effort Expectancy (EE)	3	0.643	
Social Influence (SI)	3	0.909	
Facilitating Condition (FC)	4	0.625	
Hedonic Motivation (HM)	3	0.926	
Price value (PV)	3	0.855	
Habit (H)	3	0.771	
Behavioral Intention (BI)	3	0.913	
Teacher Influence (TI)	5	0.828	
Language Competency (LC)	5	0.782	

We tested the reliability of the variables using the Cronbach Alpha scale on SPSS with the results obtained from 40 students who took the survey on Google Forms. The variables all reached above 0.6 over 0.9, showing that

the reliability is acceptable (Cronbach, 1951).

*Quantitative data collection:*

To reach more participants, we emailed the teachers to ask for their permission to directly enter their classes to collect the data. Moreover, before participants answered the questionnaire, they had been asked to complete the consent form by scanning the QR code.

The data will be stored in personal researchers' laptops for 5 years. In case our laptop is broken, we still ensure your information, and data are stored and secured on google drive.

## Results

### Descriptive Characteristics of Participants

Out of a total of 322 participants, 32.3 % of them were male and the others were female. In terms of ages of participants, 44.1% of the participants were from 18 to 20 years old, 51.6% were from 20 to 22 years old and the other age groups accounted for 4.3%. Regarding the programs of the participants, students of Information Technology were 2.8%, students of Linguistics were 45.3%, and students of Business Administration were 51.9%. Next, while over half of the participants were second-year students (58.7 %), the remainder was made up of first-year students (4%), third-year students (8.7%), and final-year students (28,6%). Eventually, the number of courses the participants have taken varied. Specifically, 5.6% of the students took 1 course, 32.6% of the students took 2 courses, 14.6% of the students took courses, and 47.2 % of the students took more than 3 courses.

Table 2. Descriptions of participants in the study (N=322)

Demographic	Category	Number	Percentage
Gender	Male	104	32,3
	Female	218,0	67,7
Age	18 to 20	142	44,1
	20 to 22	166	51,6
	Other	14	4,3
Major	Business Administration	167	51,9
	Information Technology	9,0	2,8
	Linguistics	146	45,3
Year of study	First-year	13	4
	Second-year	189	58,7
	Third-year	28	8,7
	Final year	92,0	28,6
Number of courses	1 course	18,0	5,6

2 courses	105	32,6
3 courses	47	14,6
More than 3 courses	152,0	47,2

To test the correlation between behavioral intention (BI) and other variables of the extended UTAUT. We conducted the Pearson correlation table. In the results of Table 3, the sig test Pearson correlation among all variables is less than 0.05. Thus, the correlation between variables PE, EE, SI, FC, HM, PV, H, LC, TI, and BI was linear.

Table 3. The Pearson correlation coefficient between variables of the UTAUT2 model, LC, TI, and BI

		BI	PE	EE	SI	FC	HM	PV	H	LC	TI
BI	Pearson Correlation	1	.633*	.445**	.635**	.511**	.716**	.695**	.788**	.524**	.406**
	Sig. (2-tailed)		0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	322	322	322	322	322	322	322	322	322	322
PE	Pearson Correlation	.633**	1	.563**	.664**	.595**	.661**	.638**	.622**	.501**	.461**
	Sig. (2-tailed)	0,000		0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	322	322	322	322	322	322	322	322	322	322
EE	Pearson Correlation	.445**	.563*	1	.552**	.685**	.529**	.539**	.545**	.531**	.427**
	Sig. (2-tailed)	0,000	0,000		0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	322	322	322	322	322	322	322	322	322	322
SI	Pearson Correlation	.635**	.664*	.552**	1	.591**	.635**	.593**	.601**	.512**	.452**
	Sig. (2-tailed)	0,000	0,000	0,000		0,000	0,000	0,000	0,000	0,000	0,000
	N	322	322	322	322	322	322	322	322	322	322
FC	Pearson Correlation	.511**	.595*	.685**	.591**	1	.531**	.600**	.560**	.628**	.576**
	Sig. (2-tailed)	0,000	0,000	0,000	0,000		0,000	0,000	0,000	0,000	0,000
	N	322	322	322	322	322	322	322	322	322	322
H	Pearson Correlation	.716**	.661*	.529**	.635**	.531**	1	.631**	.715**	.415**	.385**
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000		0,000	0,000	0,000	0,000
	N	322	322	322	322	322	322	322	322	322	322
PV	Pearson Correlation	.695**	.638*	.539**	.593**	.600**	.631**	1	.682**	.595**	.532**
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000	0,000		0,000	0,000	0,000
	N	322	322	322	322	322	322	322	322	322	322
H	Pearson Correlation	.788**	.622*	.545**	.601**	.560**	.715**	.682**	1	.481**	.379**
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000	0,000	0,000		0,000	0,000
	N	322	322	322	322	322	322	322	322	322	322
LC	Pearson Correlation	.524**	.501*	.531**	.512**	.628**	.415**	.595**	.481**	1	.696**
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000		0,000
	N	322	322	322	322	322	322	322	322	322	322
TI	Pearson Correlation	.406**	.461*	.427**	.452**	.576**	.385**	.532**	.379**	.696**	1
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	
	N	322	322	322	322	322	322	322	322	322	322

Table 4. Regression of Behavioral Intention.

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.	Collinearity Statistics	
	B	Std. Error				Tolerance	VIF
(Constant)	0,005	0,186		0,028	0,978		
Performance Expectancy	0,082	0,055	0,071	1,509	0,132	0,403	2,484
Effort Expectancy	-0,195	0,057	-0,149	-3,414	0,001	0,463	2,158
Social Influence	0,148	0,050	0,134	2,976	0,003	0,436	2,293
Facilitating Condition	-0,058	0,068	-0,042	-0,859	0,391	0,374	2,675
Hedonic Motivation	0,217	0,048	0,216	4,489	0,000	0,379	2,639
Price value	0,189	0,052	0,175	3,639	0,000	0,382	2,619
Habit	0,466	0,052	0,439	9,040	0,000	0,374	2,675
Language Competency	0,208	0,062	0,157	3,335	0,001	0,397	2,519
Teacher Influence	-0,072	0,061	-0,052	-1,188	0,236	0,465	2,150
a. Dependent Variable: Behavioral Intention							
b. Independent Variables: PE; EE; SI; FC; HM; PV; H; LC; TI							
c. Model Summary: R=.852a; R2=0,725; Adjusted R=0,718; Sig=0.000							

The ANOVA table gives us the results of the F test to evaluate the hypothesis of the fit of the regression model. The sig value of the F test is  $0.000 < 0.05$ , and using a linear regression model is appropriate and statistically significant.

The model summary showed that the behavior intention R Square index (0.725) is approaching 1, the more independent variables explain the dependent variable. Besides, adjusted R Square is equal to 0.718, showing that the independent variables (teacher influence, habit, effort expectancy, social influence, performance expectancy, language competency, price value, hedonic motivation, and facilitating condition) included in the regression analysis affect 71.8% of the variation of the dependent variable (behavior intention). According to Sarstedt et al., (2019), the Variance Inflation Factor (VIF) should be lower than 3 to avoid the degree of collinearity or even multi-collinearity among the independent variables. Therefore the regression of the model is accepted.

According to Table 4, the variables PE, FC, and TI did not affect the dependent variable BI ( $p > 0.05$ ) while the remaining variables viz. EE, SI, HM, PV, H, and LC affected BI ( $p < 0.05$ ). Specifically, habit is the most influential factor on behavioral intention ( $B = 0.439$ ), followed by hedonic motivation ( $B = 0.216$ ), price value ( $B = 0.175$ ), language competency ( $B = 0.157$ ), effort expectancy ( $B = 0.149$ ), and social influence factors have the lowest influence on the behavioral intention of Vietnamese students using MOOCs ( $B = 0.134$ ).

## Discussion

In the current study, we identified constructs affecting students' adoption of MOOCs through the quantitative approach. While all nine of the hypothesized variables had an influence on the behavioral intention variable. Through data analysis, only 6 variables had a significant influence consisting of habit (H), hedonic motivation (HM), price value (PV), language competency (LC), effort expectancy (EE), and social influence (SI) while the remaining factors containing performance expectancy (PE), facilitating condition (FC), and teacher influence (TI) were irrelevant.

To begin, H7 was accepted because the findings revealed that habit had the strongest effect on students' adoption of Coursera MOOCs. This finding agrees with previous conclusions by Limayem et al., (2007), and Alsharo et al., (2020). Furthermore, hedonic motivation also significantly influenced students' adoption of MOOCs. This result is consistent with previous studies that have demonstrated the importance of enjoying the learning process and finding pleasure in it as a motivator for using MOOC platforms (El-Masri & Tarhini, 2017; Moghavvemi et al., 2017). This led to the H5 being accepted from the research. Additionally, price value has a positive effect on BI, which has been supported. This finding is notable as it underscores the importance of considering students' perceptions of the monetary value they receive from MOOCs; this has proven the legitimacy of theories presented by previous research (Raman & Don, 2013; Tseng et al., 2019). Moreover, H8 was confirmed because the findings revealed that language competency was found to have a positive impact on students' behavioral intention to adopt MOOCs. This finding supports previous research that has highlighted the importance of language proficiency in MOOCs (Connolly, 2016, Garcia Mendoza et al., 2017, Anand Shankar Raja and Kallarakal, 2020) and opposes the previous study by Meet et al., (2022). This indicates that students at the sampled and studied university are not adept in communication skills as well as language competency, which causes them a feeling of discomfort with MOOC content delivery and its understanding. This is easily understood because English is neither the official language nor the second language in Viet Nam.

An emerging suggestion for stakeholders namely English lecturers and institutional managers at the studied location is that they should design effective English programs as well as encourage students' English learning to enhance their English language proficiency. H3 was also accepted as the findings also showed that social influence (SI) had positively influenced students' behavioral intention to adopt MOOCs. This is in agreement with the previous research by Singha Chaveesuk et al., 2022. Furthermore, H2 was accepted because the findings showed that effort expectancy significantly affects BI. This finding is similar to the previous conclusion by Azizi, 2020; Al-Adwan, 2020; Meet et al., 2022. However, in the current study, effort expectancy(EE) had negative values. Obviously, Coursera's platform doesn't require users much effort in enrollment, and the features of MOOCs have nothing special to stand out. Participants can use MOOCs easily and skillfully with just some mouse-clicking. Moreover, it can be inferred that MOOCs' design is not interesting enough to attract students' engagement. Besides, the course content is quite monotonous, just clips, quizzes, assignments, and capstones. Therefore, it is suggested that MOOC designers and providers need to consider adjusting and

updating the “ appearance” as well as the content of MOOCs to make them more compelling.

On the contrary, the results indicated that performance expectancy (PE), facilitating condition (FC), and teacher influence (TI) has a non-significant effect on behavioral intention (BI). Specifically, PE had no positive effect on BI. This finding is dissimilar to the previous studies conducted by Venkatesh et al., 2012; Kala & Chaubey, 2022; Mittal et al., 2021. This led to the rejection of H1 from research. This may be explained that the courses that students were forced to enroll in do not satisfy their needs, thus they do not find them useful. In other words, curriculum and plan developers at the research site should reconsider the MOOC courses they intend to implement. If possible, they can let their students choose the courses they like in the given list. Furthermore, our findings showed that facilitating conditions had not influenced BI, thus H4 was rejected, which contradicts the results from the previous research (Bakar et al., 2013; Kala et al., 2022). All of the students are Generation Z, hence it is easy for them to access and use technological gadgets as well as technology-related aspects. They could even resolve the problems by themselves. Maybe they only need support when violating plagiarism. Likewise, the findings showed that teacher influence (TI) did not impact the BI of students to adopt MOOCs, which opposes the previous studies in the same area (Hoi & Mu, 2021; Al-Adwan et al., 2021a). As a result, H9 was rejected. Students at the research site have the ability to deal with problems related to the course. For instance, if they do not grasp the content, they can watch the lecture videos again or read the tapescripts. More importantly, Coursera MOOCs have not truly attracted their involvement, hence the presence of offline mentors is not significant.

## **Conclusion**

In conclusion, the findings of the current study revealed that habit, hedonic motivation, price value, language competency, and social influence had a positive impact on students’ accessibility to MOOCs while effort expectancy negatively affected students’ intention to use MOOCs. Specifically, the most influential variable on behavioral intention is habit, followed by hedonic motivation, price value, language competency, effort expectancy, and social influence. Conversely, the remaining variables viz. performance expectancy, facilitating conditions, and teacher influence did not affect the dependent variable-behavioral intention.

## **Recommendations**

The completion of the research comes with important discoveries that should be addressed. We suggest researchers consider the following: the mixed research method should be considered when conducting any further research. Second, Diversification of demographic selection should be considered; specifically, because this research was conducted only at one high institution, further research should be carried out at other institutions where MOOCs are mandatory. Furthermore, the attention should be allocated to the K-12 demographic rather than Undergraduate students.

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## Experimental Research on the Challenges of Distance Learning

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**Abstract:** As a result of the development of the Covid-19 pandemic, a rapid transition from the classic classroom-lesson form to a distance form of education was required. Thus, many questions arose regarding the applicability of this training method and its comparison with the classical face-to-face method. This article presents a study of the examination results of face-to-face and distance-learning students, assuming all other circumstances being equal. A hypothesis test is performed, regarding a difference between means of two independent samples for quantitative indicators that have normal distribution. Student's t-test for independent samples is applied. The research takes place in the University of Mining and Geology in Sofia, Bulgaria. The experimental results show that the examination results of the students are different for both methods and in the majority of the cases the results of the present in the class students are better. Comparing the advantages and disadvantages of both methods, it is concluded that only a combination of different forms of education - present in class, remote, hybrid and blended, can provide a modern education aimed at the sustainable development of society.

**Keywords:** Face-to-face learning, Distance learning, Blended learning, Hypothesis test

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### Introduction

The sudden appearance and severe course of the disease caused by the Covid-19 virus posed a great challenge to

the education system in all countries of the world (Barrot, 2021). Rapid measures were needed to move traditional education into an electronic environment (Ferri, 2020). This gave a powerful head on the development of distance learning. It is an attractive mode of education for independent study. (Bozkurt, 2022). But all learners, regardless of whether they are in the class or at home, need support and observation, hence there is a need for reintegrating social and teaching presence in online and distance education practices (Naidu, 2023).

Distance Education is defined as “a process to create and provide access to learning when the source of information and the learners are separated by time and distance, or both” (Stauffer, 2023). Unlike online learning, which can be both in and out of class, distance learning places the teacher and students in different locations. (Hodges, 2020, March 27). Online learning can be used as a blended learning method, together with other teaching techniques. In distance learning, the interaction between the teachers and the students is not face-to-face and nowadays it is realized mostly by digital communication. Therefore, we can consider online learning as the major form of distance learning (Bernard, 2009). The main advantage of distance learning is its flexibility. Students are feeling more independent and they can organize better their schedule. Distance education offers the students accessibility of time and place. It improves the concentration of the students on the studied material. The slow learners have an opportunity to study with their own speed of assimilation of new material. Distance education reduces students’ financial costs for transportation, accommodation, etc. It provides them with a comfortable environment to enjoy the education process (Stauffer, 2023).

On the other hand, there are also disadvantages. Focusing on the screen for a long time becomes boring for some students and their attention begins to be distracted and diverted to other pursuits. This circumstance determines the necessity of more breaks during the learning process. Another problem is to provide a consistent Internet connection with decent speed. Some students don’t have even personal computers at home. It causes a lack of stability and continuity in the education process. The lack of physical interaction between the students and their teachers, and also their peers creates a feeling of isolation. (Stauffer, 2023). Online and distance learning is not an easy solution. It requires the same level of rigor that is required for the development of campus-based learning experiences (Naidu, 2023). The adoption of distance education during the pandemic allowed educational institutions to continue their work in limited ways, challenging both the teachers and the students. This caused many studies to be conducted on the influence of different teaching methods on the quality of the learning process, which in turn led to the improvement of the process as a whole and its enrichment with new techniques.

### **Main aim of the study**

Distance learning during the Covid-19 pandemic raises a number of questions about the quality of the learning delivered and how it compares to face-to-face classroom learning. The main criterion for the quality of learning is the degree of achievement of the learning outcomes. This is a very important and complicated task. Usually,

the degree of assimilation of the learning material is determined by the exam results of the students. The exam has to cover all learning outcomes and has to include challenging tasks. The exam has to be (Semerdzhiev, 2021, b):

- fair – it should provide the students with equal opportunity;
- resource efficient, according to the available resources;
- technology agnostic – should avoid requirements for a specific hardware or software;
- fault-tolerant – should be independent of technical failures, as much as possible;
- auditable – should allow for an independent audit;
- familiar for the different students;
- secure – should avoid possibilities of cheating and unfair behavior of students.

The experiment is done at the University of Mining and Geology, Sofia, Bulgaria. The University course is “CAD systems” which is offered to full-time and part-time students. The main part of the course is dedicated to specialized middle-class general-purpose software, having an internal programming language, containing a powerful toolkit for automating the drawing activity and capabilities for modeling complex solid three-dimensional objects. Students become familiar with the possibilities of the system for creating and editing drawings in the two-dimensional and three-dimensional space, inputting and outputting graphic information, creating libraries of graphic elements. The computer graphics system AutoCAD is widely known in engineering and it is widely used in the automation of drawing activities and in supporting design and construction work. The accumulation of practical skills in the approaches to its use provides a good start in the profession of future engineers. Lecture material is presented in the form of multimedia presentations and demonstration work in an Autodesk AutoCAD environment.

After completing the course, students are expected to be able to:

- use AutoCAD tools to create and edit elementary drawings;
- use the capabilities of the system to work in different layers;
- create and use blocks;
- annotate and print their drawings.

The knowledge and practical skills for working with CAD systems obtained within that course can be used in the other special and profiling courses of the students’ training programs.

The assessment of the students is based on passing a written exam in the form of a test and practical work in the environment of the studied software, as a result of which the final assessment is formed.

The goal of this study is to compare the results of the examination of students, taught by the two methods - present in class and distance learning through online lectures, other circumstances being equal.

The present study considers the results of the examination of students, learning the same syllabus, with learning materials prepared by the same teacher, delivered by two methods - present in class and distance learning through online lectures. In both cases, the exams are done in the class and they include questions and tasks of the same degree of difficulty. The results of the exams are presented in points out of 100. Students are divided into groups according to their majors, as well as according to their type of study - full-time and part-time students.

## Research method

The research in this article is based on statistical inference and hypotheses. The term hypothesis in the context of statistical inference is usually defined as an assumption about the value of one parameter (or several parameters) of the sample space. This preset value has no direct relation to the statistical conclusion and is usually obtained on the basis of theoretical knowledge and prior experience in the research area (Bluman, 2004).

Hypothesis testing involves assessing the extent to which a predetermined parameter value is plausible, i.e. to conclude whether the information, obtained from the sample corresponds to expectations. In this way, a decision can be made about accepting or rejecting the hypothesis based on the results of the observations. The inferences that are drawn must relate to the whole sample space, and the data available to the researchers cover only the sample. Thus assumptions (hypotheses) are initially formulated and a check is made whether the data from the sample confirms or rejects them.

Two hypotheses are defined. The null or working hypothesis claims that there is no statistically reliable difference in the compared statistical indicators in the sample space. Although some variation may be observed in the samples, it is due to random factors and cannot be generalized to the whole sample space. Alternative hypothesis claims that the observed difference in the samples is statistically reliable and can be generalized to the whole sample space.

Decisions made in statistical hypothesis testing have a probabilistic nature character. This is due to the fact that the studies are representative, i.e. the conclusions about the total space are made based on the study of a relatively small part of it. The reception for the rejection of the null hypothesis is done with a degree of certainty, as in the same time the possibility of statistical inference error is allowed.

The degree of certainty with which the alternative hypothesis is accepted as true is called assurance probability or confidence level. The risk of making a mistake by accepting the alternative hypothesis as true is called significance level.

In this article, a hypothesis test is presented regarding a difference between the means of two independent samples for quantitative indicators that have normal distribution (Bluman, 2004). Student's t-test for



independent samples is applied. Two samples are used for each major and for each type of study. The first sample considers the results of the exam of the students who studied online and the second sample considers the results of the exam of the students who presented in class. Since both samples are of small size ( $\leq 30$ ), t-test is accepted in this case. The populations are of equal variances.

The null hypothesis holds that by applying both methods (distance learning and present in class), the same results are obtained, assuming a significance level of 0.05.

The empirical values (test values) are computed by the formula:

$$t_E = \frac{|\bar{x}_1 - \bar{x}_2| \sqrt{n_1 + n_2 - 2}}{\sqrt{(s_1^2 n_1 + s_2^2 n_2) \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

where:  $\bar{x}_1$  and  $\bar{x}_2$  are the means of the samples;

$s_1$  and  $s_2$  are the standard deviations;

$n_1$  and  $n_2$  are the volumes of the samples;

The degrees of freedom  $\phi = n_1 + n_2 - 2$

The critical values are taken from the t-Distribution table with one tail and significance level of 0.05.

## Experimental results

The results of the empirical values  $t_E$  and the corresponding critical values  $t_C$  are presented in Table 1 and Table 2.

All empirical values of the t-test, from both tables, are less than the corresponding critical values from the t-Distribution table. Therefore, we can conclude that the null hypothesis is rejected, and the two samples originate from populations with different means, i.e. in both methods are obtained different results.

Table 1. T-test for full-time students

Majors	Empirical values $t_E$	Critical values $t_C$
Major 1	0.067057177	1.75305
Major 2	0.006134321	1.739607
Major 3	0.077879555	1.76131
Major 4	0.331991348	1.812461
Major 5	0.190978986	1.894579

Table 2. T-test for part-time students

Majors	Empirical values $t_E$	Critical values $t_C$
Major 1	0.133816696	1.697261
Major 2	0.381733369	1.76131
Major 3	2.87319E-06	1.697261
Major 4	0.0149027	1.697261

In Table 3 and Table 4 we present the corresponding mean values of the students' results of the majors from Table 1 and Table 2.

Table 3. Mean values of full-time students' results

Majors	Mean value (distance education)	Mean value (in-class education)
Major 1	76.4	88.75
Major 2	40.71	70.8
Major 3	51.36	70.8
Major 4	51.75	57.5
Major 5	59	74.3

Table 4. Mean values of part-time students' results

Majors	Mean value (distance education)	Mean value (in-class education)
Major 1	91.06	88.38
Major 2	61.25	57.08
Major 3	41.56	74.29
Major 4	41.41	55.80

When we compare the mean values of the students' results in the columns of Table 3, it is seen that for full-time students of all majors, the mean values of the students who studied only online are less than the means of the students presented in class. Therefore, we can conclude that for this type of students, definitely, the in-class education is more effective than distance education. Full-time students usually are coming directly from high school where the class-lesson form of education is predominant and they need face-to-face contact with the teacher. To a large extent, they rely on help from their teachers and fellow students in learning the study material.

But, on the other side, for part-time students, presented in Table 4, there are majors (Major 1 and Major 2), for which the mean values of presented in-class students are slightly less than the mean values of online students. These exemptions can be explained by the fact that part-time students already have established self-training habits. Also, many of them are working in companies, where they are using similar software tools and they have

experience with them. Part-time students usually are more mature, more independent, and highly more motivated than full-time students. They cope more successfully with independent learning of new material, based on their accumulated life experience and skills to solve real problems.

## Discussion

Recently, the Covid-19 pandemic created a situation that forced teachers to rethink the class-lesson system and direct their efforts to the development of hybrid education and blended learning. Very often these methods are considered equal but there is a difference between them. Hybrid learning is a form of synchronous learning that happens both physically and remotely. On the other hand, blended learning is a combination of traditional face-to-face education with modern digital technologies. Blended learning describes the introduction of computer labs, interactive whiteboards, and educational software to the learning process. It is used to include online self-study to supplement in-class lessons. Blended learning may involve playing games, working in groups, online quizzes, etc. (Dziuban, 2018).

Although this approach requires a lot of human skills and technology resources, it is worth to invest in such a method of teaching because of its many advantages. For example, students are feeling more flexible and engaged in interactive simulations; it doesn't depend on geographical constraints and provokes the development of students' creative abilities.

The introduction of distance learning directs the attention of teachers to another modern method, which is called flipped learning (Roehling, 2018). In order to activate the participation of students in the learning process, teachers provide students with the opportunity to independently prepare some topics from the study material. This is a type of student-centric pedagogy in which the students are more actively engaged in the learning process. The teachers provide students with some materials – articles, video lectures, tutorials, etc. on which the learners prepare to understand the new topic of the syllabus. In this way, the students have more responsibilities and greater confidence in their own capabilities.

Flipped learning is based on the following pillars (Ozdamli, 2016):

- Flexible environment: Different learning modes are available. Students can choose when and where to learn, in groups or individually.
- Learning culture: The teacher-centered approach is changed by the student-centered approach and the students are deeply involved in the learning process.
- Intentional content: Students develop cognitive understanding and procedural fluency.
- Professional educator: Teachers provide professional feedback, constructive criticism and tolerance to the students.

The most important advantages of flipped learning can be summarized as follows (Ozdamli, 2016):

- Increasing the interactive activities and the discussion period in the class;

- Supporting team working;
- Flexible time of learning, at individual speed;
- Stimulation of inventive research process.

Another good practice in Computer science and Software engineering education is to incorporate unit tests (Semerdzhiev, 2021, a). This method is recommended to intermediate or advanced courses.

The main goals of this method are the following:

- To guide students how to control and improve the quality of their knowledge;
- To provide additional means of students' submissions;
- To automate the tasks;
- To improve the quality of learning tools and materials.

In this way, students become more familiar with the teaching material at the early stage of their learning, as well as, they feel themselves more comfortable with the process of testing.

## Conclusion

The results of this study confirm the need for face-to-face education but enriched with the advantages of online learning.

Electronic lectures and videos can provide more options for students who are working or engaged by other activities, as well as for slow learners. Also, they ensure independence of the learning process from the time and place of learning. On the other hand, nothing can replace the experience and skills of a good teacher to direct students' attention to the essence of the studied material, its diversity, and its application in different fields and for different purposes. The ability to quickly react and answer questions that arise during training, as well as to discuss problems with peers, is a great advantage of attending training.

The main challenge of the modern education is to prepare students to work in rapidly changing environment, with multiple sources of information, to analyze and to make their own conclusions. It is important to stimulate students to develop their own research and to acquire lifelong learning skills. Combining the advantages of classroom-based learning, the possibilities of modern technologies for remote communication between participants in the learning process, and the availability of numerous educational sources in an electronic environment, significant results can be achieved in modern education.

## Recommendations

Similar research can be done to compare the exam results of students trained in different methodologies, for

example, blended or flipped learning and traditional education.

Modern education must be oriented toward the rapidly developing digital world. Technology becomes a key factor for effective learning. We can outline at least five levels at which technologies may be used: presentation, demonstration, drill and practice, interaction, and collaboration (Haddad, 2002). Nowadays, the learning process should be based on cloud computing, virtual reality, augmented reality, etc. (Madini, 2017).

Students are increasingly turning to mobile technology because of its flexibility of location and time. They have the opportunity to download, upload and work online via wireless or mobile networks. The main platforms for such connectivity include smartphones, PDAs, MP3/MP4 players, tablets, mini notebooks, gaming devices, etc. (Kukulska-Hulme, 2009). They are accessible and easy to use by students. That's why the teaching process should be also connected to such devices.

Another direction of development is the emphasis on the team work, both in class and online, as well as in the development of course projects (Usher, 2020). The competition between the teams motivates the students to demonstrate their full capacity and to feel satisfied with their efforts. During online education, working in teams is facilitated by mobile applications, such as Viber, WhatsApp, Kahoot, etc., that can be used for tutorials, homework or course projects.

Only the combination of different forms of education - present in class, remote, hybrid, blended, and flipped, can provide a modern education aimed at the sustainable development of society.

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## A Framework of Universities' Smart Campus to Detect and Mitigate Vulnerabilities for IoT Devices

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**Abstract:** One of the most persuasive technologies in developing universities' smart campus applications is the Internet of Things (IoT) technique. Deploying thousands of readily available devices connected to IoT systems by ignoring device vulnerabilities and threat strategies in smart campus infrastructure is exacerbating security challenges. Moreover, unreliable sensing, transmission, or processing of IoT devices, false observations, long delays, and data reports reveal the vulnerability of efficient smart campus infrastructure. Some transient errors or attacks also occur here due to many vulnerable device memory, processing power, soft errors, and battery imperfections. The need to overcome significant challenges, including advanced training-rich IoT devices, credible designers, reliability, scalability, interoperability, availability, and performance, has motivated our aim to implement intelligent platforms for university campuses. In this study, we propose an operational framework for smart campuses to detect and mitigate vulnerabilities aimed at processing a comprehensive security certification of IoT devices, including introducing a smart model for university campuses. We discuss challenges, detection, and mitigation of vulnerabilities associated with smart campuses. From the literature exploration, we found that machine learning and DNN are capable of being used to detect malicious behaviour and vulnerable sources. Thus, the proposed framework is expected to provide better security and be capable of meeting the compliance of existing university services.

**Keywords:** Sustainability, Green Technology, IoT, Smart Campus, Vulnerability

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## Introduction

Currently, there are various challenges in education and educational institutions across the world, including student competitiveness, competency, institution building, education delivery infrastructure, improving teacher skills, relational infrastructure, digital technology enthusiasm, and so on. From this context, the concept of creating a smart model for university campuses has emerged. IoT technology is one of the dominant technological skills in the smart university campus (Jabbar et al. 2021), (Ahmed and Majid 2019) which has risen vigorously in popularity commencement in 2016. An adopted IoT platform can drive efficient resource utilization and enable the evolution of academic campuses. All the interconnected intelligent equipment (things) of this platform help construct smart universities, which promise sustainable development and transition to green campuses. Many educational institutions in several countries around the world have started building smart campuses. These include several universities in Malaysia, Vietnam, and Singapore that have allocated a large portion of their budgets to education with the aim of creating smart campuses.

However, to contact thousands or lots of pieces of equipment projected to make up the IoT on academy campuses, developers will have to overpower consequential undertaking challenges, including security, trust, scalability, reliability, availability, interoperability, mobility, and performance. Among these challenges, reliability (Azghiou et al. 2020) has been determined as the first of the required matters for well-organized IoT. Inconsistent transmission, body perceiving, and processing due to insufficient reliability can generate inaccurate monitoring reports, lose data, and cause long delays, leading to vulnerabilities across intelligent university campus applications. The more harmful behavior of the untrustworthy smart campuses (Anagnostopoulos et al. 2021), for instance, transient imperfections that emerge in IoT appliances (also apprehended as soft errors), unlike design or manufacturing flaws, do not happen coherently. Rather, all intermittent errors are generated by outward circumstances to smart IoT applications, such as energized particles hitting the chips. These affairs do not provoke endless outward impairment to the IoT devices but can adjust accumulated values or signal transfers and consequently induce faulty smart campus application implementation.

Although several studies have analyzed and evaluated the reliability of IoT, various approaches have been suggested to mitigate the arising soft errors in IoT founded on software (Alsariera, Majid, and Zamli 2015b) determinations and hardware. For norm, the IoT's reliability problem from the matter of the idea of the transcendent strategy of reliability appraisal utilizing MIL-HDBK 217 has discoursed. With the suitable process of reliability (Nagowah, Ben Sta, and Gobin-Rahimbux 2020) evaluation operating MIL-HDBK 217, only the reliability of hardware can be evaluated, whereas the circumstances in IoT are more complex because thousands or millions of individual devices (things), human users, and software programs (Majid, Zain, and A. Hermawan



n.d.) are engaged in the network. System reliability in IoT components (things) is a concern not only for data failure rates in smart campuses but also for human factors and software, which makes implementing IoT in smart campus-sensitive applications challenging.

Although several studies have been carried out before, this problem is still insufficiently explored, prompting attention to research gaps, and a new approach is therefore needed. Therefore, the objective of this study is to construct an operational framework capable of mitigating IoT (device) error vulnerability, maintaining reliability, and evaluating the performance of smart campuses. Likewise, to maintain the safe reliability of urban big data and security in its transactions, this study introduces a desired smart campus model for university campuses. model using the access network principle of IoT to build a smart city. The contributions of this paper are as follows:

- This work will cooperate with developing and researching a smart campus framework.
- We introduce an operational framework and present its process.
- This paper proposes a reliability-enabled smart campus model by mitigating the vulnerability of IoT devices.

The residue of this study is arranged as follows. In Section II, this study presents the problem exploration and arising research question. Then Section III introduces the literature review based on smart campus. In Section IV, this study demonstrates the methodology with an operational framework according to the review. Section V presents a research discussion based on the proposed smart campus model. Finally, Section VI concludes this study.

## **Problem statement and research questions**

### **Problem Statement**

Smart campus implementation is incorporated using the things internet. IoT is a network that interconnected intelligent appliances supplying rich information, but it can also be a safety nightmare as it mostly has issues with reliability and quality (Imbar, Supangkat, and Langi 2020). The current IoT devices are the retail type, not including specified reliability and no failure rate data, such as the mean time to failure (MTTF) or mean time between failures (MTBF). The reliability of IoT networks is the primary concern in IT today as vulnerabilities on the devices could resulting various fault responses, including incorrect decision-making that potentially be life-threatening for end-users on campus (Adam, Mohamed, and Ibrahim 2021), (Ibrahim et al. 2020), (Ardiansyah, Majid, and Zain 2017), (Sultan Mahmud, Islam, and Rahman 2017).

Reliability for electronic devices has been estimated mostly using reliability prediction standards called MIL-HDBK-217. In 1961, the first version of MIL-HDBK-217 was designed and had not been updated since 1995. Despite its constraints, MIL-HDBK-217 is yet utilized by more than 80% of manufacturers for assessing

trustworthiness. There are different commercial and industrial standards for computing reliability on electronic devices, such as RIAC's 217Plus<sup>TM</sup> methodology and tool. RIAC's 217Plus<sup>TM</sup> is more complex in calculating reliability compared to MIL-HDBK-217 standards. To overcome the limitation of the existing hardware reliability standard, IEEE constructed a standard named IEEE Std.1413 in 2009 (Masitry et al. 2013), (Alsariera, Majid, and Zamli 2015a) based on the standard model for hardware reliability prediction. Reliability for IT components is not only calculated from the viewpoint of hardware but also software.

There are existing standards for software reliability, such as ISO/IEC 25000 (software and data quality) and IEEE 1633-2016 (IEEE instructed approach on software reliability). Standards for reliability prediction for IoT devices are available both for hardware and software, but such prediction is mainly conducted for single checking without considering the ecosystem of IoT as a whole in one place, such as a smart campus. The ecosystem of IoT covers hardware, software, network, personnel, and physical and organizational ingredients. Increasing the reliability, detection, and mitigation of the vulnerabilities of IoT devices is significant from the viewpoint of the IoT ecosystem. In order to focus on research issues and gaps, the vulnerabilities of IoT devices in the smart campus scheme are presented in Figure 1 IoT authentication designs typically secure smart applications by building reliability into connected IoT devices and their designs. Unauthorized IoT devices and the inadequacy of their design pose a major challenge in maintaining authentication in building smart campuses.

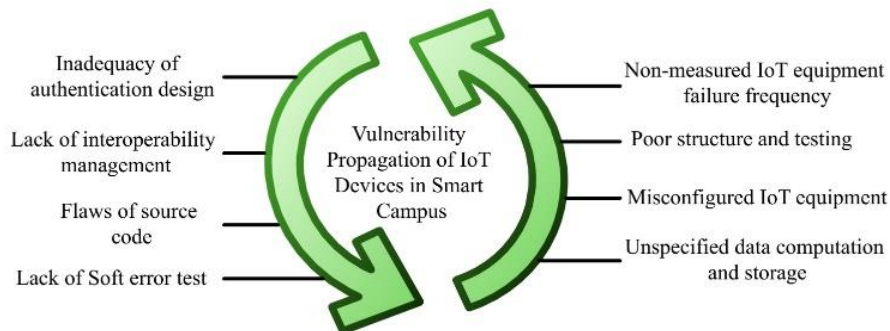


Figure 1. Propagation of IoT Device Vulnerabilities in Smart Campus

IoT interoperability can emerge as a major concern in smart campus applications. Overlapping or non-standard connectivity in IoT devices and their systems creates a lack of interoperability, which is a major obstacle to achieving reliability in smart applications. The risk that source code flaws pose in connected networks of IoT devices undermines the reliability of smart academy infrastructure. Achieving the expertise available in IoT devices to remove source code flaws can be a significant concern. Further, how well IoT's resource-constrained devices, internal and external networks, and software are working depends on soft error (transient in nature) test parameters to achieve the objectives and reliability of smart applications. Smart campus applications involve all types of data collection, computation, processing, and storage through all types of IoT devices. In this regard, the unspecified large amount of data computation and storage can be another constraint in IoT-enabled smart campuses.

However, the failure frequency rate in non-metered IoT equipment settings determines the evaluation of all

parameters, such as network performance, stability, and reliability. The strategies of non-measured IoT equipment failure frequency mitigation are key challenges in achieving reliability in smart campus applications. Poor infrastructure and testing of IoT equipment can hinder the functioning of a proper smart campus. Consequently, fundamental security and reliability issues are faced with challenges regarding smart campus services for users. Achieving good system security and reliability requires identifying thousands of device configuration vulnerabilities and irrelevant issues. Mismanagement and misconfiguration of IoT devices will weaken the security and reliability functions, which will lead to the collapse of the smart campus access network system. Thus, this study aims to improve reliability by proposing a framework to detect and mitigate the vulnerabilities of IoT devices from the smart university campus.

### Research Questions

- What are the implications of vulnerabilities of IoT devices in smart campuses from the reliability concern perspective?
- What are the parameters that contribute to the vulnerabilities of IoT devices for smart campus infrastructure in terms of reliability concerns?
- How to mitigate the vulnerabilities of IoT equipment to ensure reliability in smart campuses?

### Literature Review

#### Smart Campus and IoT

The rapid development of IoT is leading universities to become smart campuses. Executing IoT operates to skillful resource use and fosters the evolution of academy campuses, where connected intelligent things (devices) are supporting to make the smart campus, which promises to acquire sustainable development and change into green campuses (Elerath and Pecht 2012), (Min-Allah and Alrashed 2020). Thus, this segment supplies an overview of the smart campus implemented IoT, the demeanor of the IoT reliability, and techniques being used to efficiently mitigate the faults. Due to the mission-critical or safety-critical character of IoT schemes, the IoT devices must conduct reliably during the determined mission period. In addition, reliability is an important requirement for IoT adoption in intelligent applications (Zaballos et al. 2020), (Pokorni 2019). Failures in assisting IoT appliances, transient faults (soft errors), failures to grab vital data, data corruption, any network outage, or failure during broadcast or repository may generate destructive impacts, for instance, economic loss, mission failure, and disservices to environments and people (Adam et al. 2021), (Majid 2022). Thus, reliability analysis and design are necessary for researchers, developers, and even consumers prior to IoT can be extensively employed on academy campuses.

#### Existing Prediction Standard/ Method

Several studies have been proposed on IoT's fault tolerance to overcome the reliability problem. Earlier research

papers have utilized MIL-HDBK 217 as a standard method for reliability appraisal (Adam et al. 2021). However, the reliability of IoT is not merely a matter of the IoT failure rate but also of human and software aspects in smart universities. Various studies aim for sustainable development and/or smart campus to support teaching activities, water, transportation, energy, and other resources (Chagnon-Lessard et al. 2021), (Valks et al. 2020). In (Nguyen, Le, and Dao 2021), it introduces an IoT-enabled university campus platform for people and environmental flow observation. In (Fortes et al. 2019), a comprehensive work was demonstrated, where a smart campus named SmartUMA is implemented by the University of Málaga and aims at smart parking, intelligent space, and smart education utilizing the IoT to operate it. Hence, a mobile application of SmartUMA named UMA allows students to boldly access learning materials while watching videos and doing distance learning activities that are developed by teachers. However, the issue of reliability was not taken into consideration while developing the UMA Smart Campus framework to conduct education programs using IoT on this platform.

Khajenasiri et al. (Khajenasiri et al. 2017) executed an observation on the IoT solutions for intelligent energy management to amenities smart city applications. They have remarked that, at current, IoT has been deployed in significantly few application dimensions to benefit people and technology. The scope of IoT is quite vast, and in the nearest future, IoT will be capable of capturing nearly all application sites. They referred that energy conservation is one of the critical parts of the community, and IoT can assist in designing an intelligent energy management scheme that will preserve both money and energy. They represented an IoT structure regarding the smart city thoughts. The authors also explained that one of the demanding works in acquiring this is the imperfection of IoT software and hardware. They instructed that the issues must be settled to provide an efficient, reliable, and user favorable IoT design. Another concerning aspect regarding contrivance trustworthiness in IoT is the inclination for existing sensing devices to 'fail dirty' (Rico-bautista and Medina-c n.d.). This phenomenon involves a strategy where a sensor persists in sending inaccurate readings afterward, having suffered the deficiency. It is a prominent, still little-apprehended issue that is infectious in IoT domains. Mainly this point is challenging to analyze since the sensing devices emerge to be usually performing.

The impact of a misreading transmitted in an IoT scheme can be essential when we consider that functionality generally has a physical impact on people's lives (Rico-bautista and Medina-c n.d.). Table 1 shows the summary of the associated literature on the smart campus. The studies cited in the table provided the impetus for the review process of this work. However, these studies did not consider the reliability, dependability, or soft errors of constructing smart campuses. The issues of Identifying the vulnerabilities of IoT devices and determining the failure rate of IoT in smart campuses are not clarified. Furthermore, some transient malfunctions of IoT devices, unreliable sensing processing, false data reports, battery imperfections, and long delays expose the vulnerabilities of efficient smart campus infrastructure. Therefore, the goal of this study is to construct an operational framework capable of mitigating IoT devices' error vulnerability, maintaining reliability, and evaluating the performance of smart campuses.

Table 1. The Summary of Findings from Related Literature

Ref.	Focus study	Key contributions	Similar findings in review studies	Additional findings in review studies
(Rico-bautista and Medina-c n.d.)	Explicated the emerging technological concepts of smart university with IoT	Presented the development of conceptual success frameworks concerning problem circumstances, motives, and features of smart universities based on scientific publications.	Overview of smart campus with IoT from the technical perspective	<ul style="list-style-type: none"> <li>- Detail of ideas, technologies, and architectures of smart universities</li> <li>- Express socio-technological and educational paradigms in IoT evolution</li> <li>- Basic components and the "smartification" process of a university.</li> </ul>
(Wigati n.d.)	Conducted Systematic Literature Review (SLR) on the impact of smart campus implementation	Offering a virtual smart campus with literature review approaches and techniques to make student interest and enthusiasm in higher education.	Synopsis of the smart campus	<ul style="list-style-type: none"> <li>- Explicit the smart campus impact and qualities on higher education</li> <li>- Represent the enabling technologies and evaluations of smart campus</li> </ul>
(Malatji 2017)	Motives to focus on the smart transitions and shortcomings in the context of African universities.	As case studies, it emphasized the development and implications for becoming a smart campus from the perspective of African universities.	Synopsis of smart campus development	<ul style="list-style-type: none"> <li>- A detailed discussion of the structural model with the identification of features and key performance indicators for a smart campus.</li> <li>- Expressed smart initiatives based on the case study for South African universities.</li> </ul>
(Anagnostopou los et al. 2021)	Choose the socially acceptable surveillance approach in IoT-enabled smart campuses.	Provides a comparative assessment of selected systems and their resulting outcomes on existing smart campuses in terms of surveillance systems.	Synopsis of the smart campus with IoT core empowering technologies	<ul style="list-style-type: none"> <li>- Details of the surveillance systems and conceptual infrastructures for IoT-enabled intelligent campus.</li> <li>- Comparative valuation in the dimensions of surveillance procedures for smart campus</li> <li>- Solution method of surveillance schemes in the smart campus</li> </ul>
(Imbar et al. 2020)	Conducted the literature review on indicator dimensions of the smart campus environment	Providing a review of terminology and structure of the intelligent campus so that stakeholders can accumulate better understanding and knowledge.	Overview of the smart campus terminology	<ul style="list-style-type: none"> <li>- Detailing a paradigm alteration from outmoded to smart campus, including terminology and framework</li> <li>- Exposition of interactive iCampus design and UMA Smart Campus in terms of relevant areas</li> </ul>
(Ujang et al. n.d.)	Aims to focus on the future vision and cover all components of the smart campus.	Elucidates a framework for how IoT can be employed on an innovative university campus to manipulate daily educational activities and welcome novel visions.	Recap of the smart campus with sustainability	<ul style="list-style-type: none"> <li>- Description of the concept of the smart city and smart university with elements.</li> <li>- Exposition of E-JUST as a smart campus model.</li> <li>- Benefits and challenges of sustainable smart campuses</li> </ul>

## Gap Analysis

Typically, standards or approaches for reliability prediction for IoT appliances are unrestricted for all types of software and hardware. But such prediction is primarily accomplished for single checking without assessing the ecosystem of IoT as an entirety in one area, like as a smart campus. The ecosystem for the IoT domain covers hardware, software, network, personnel, physical, and organization, where these can face vulnerabilities. In these smart sectors, the improvement of detection and mitigation of the vulnerabilities of IoT devices is significant from the perspective of the IoT environment using reliability analysis.

## Research Objectives

The study aims to develop a framework that is able to mitigate the vulnerabilities' fault in the IoT (devices), maintain the reliability in the smart campus that operate under fault effects on an IoT, and evaluate the framework performance. The following objectives have been formulated to achieve these objectives of the university smart campus framework.

- Identifying the appropriate parameters that contribute to the vulnerabilities of IoT devices in smart campuses.
- Developing a framework that is capable of detecting and mitigating the vulnerabilities' faults in the smart campus.
- Evaluation metrics will be used to design the framework in terms of reliability.

## Methodology

### Operational Framework

The Smart applications interrelated with IoT systems require the modernization of existing systems to make them more dynamic and efficient. Moreover, existing smart applications reveal some vulnerabilities of IoT devices, such as transient faults, unreliable sensing, imperfections, and long delays that need to be identified and mitigated. In accordance, this study illustrates a well-defined methodological research operational framework through Figure 2 for detecting and mitigating fault vulnerabilities in the smart campus setting. This scheme consists of a literature review, fault injection, identifying the most vulnerable part of the smart campus, developing a framework to reduce the faults, evaluating the most vulnerable part's reliability, and analyzing the result. Each phase in this methodical process will be partitioned into various steps that can be attained in an appropriate time frame.

In the first phase, the study sets a plan before implementing the work to determine all aspects of the research. The central sub-component in this phase is collecting and analyzing the literature review from the works of smart campuses, which is regarded as one of the maximum vital phases of the research framework. In this fact,

the study determines the limitations of existing studies and defines the problem statement of the research. Moreover, the objectives, significance, and scopes of the study will also be determined in this component. In this context, identifying fault injection and formatting methods needed that will be used to measure the proposed framework.

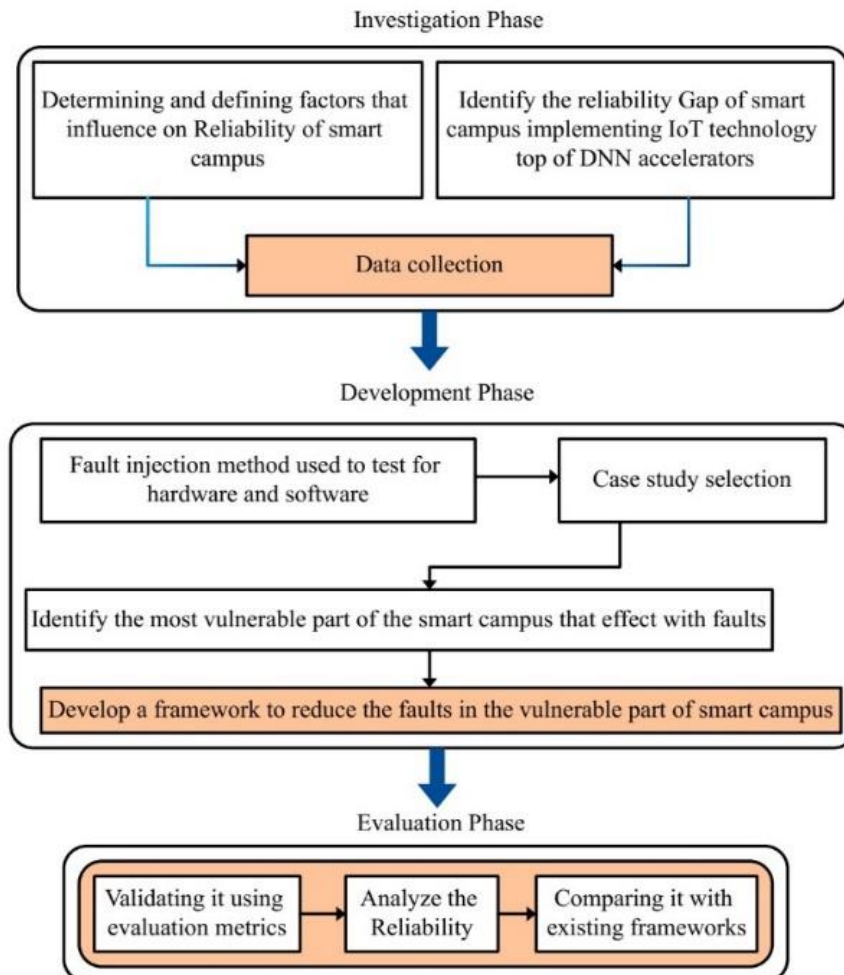


Figure 2. Proposed Operational Framework

In the second phase, this study comprises data collection, case study selection, main interview, faults injection, and reliability analysis. This phase answers the research questions, namely, what are the implications of vulnerabilities of IoT devices in smart campuses? How can it be confirmed that decision is engaged by the IoT devices based on vigorous data, specifying the challenges at lower layers of IoT device vulnerabilities? How to mitigate the vulnerabilities of IoT devices on the smart campus model? This phase involves faults injection and case study.

In the third phase, it is incorporated the development of the framework. The framework will develop to evaluate and reduce the faults and vulnerabilities that occur due to the IoT elements (things), software, and human factors. To accomplish the third objective, we will measure two factors: (1) Architectural Vulnerability Factor

(AVF) that makes the possibility that a solo fault on IoT devices (things) will consequence in error. It is employed to explore how smart campus applications respond to errors in IoT devices. (2) Program Vulnerability Factor (PVF), which is the possibility that a solo fault modifies the decision-making and propagates to other smart campus applications. Therefore, to assess the stability of the smart campuses, we accomplish described model sensitivity studies from various views by assessing three evaluation metrics as follows; IoT devices (things) vulnerability analysis, software vulnerability analysis, and human vulnerability analysis to identify the vulnerability parts of the smart campus. Next, the framework to reduce the faults in the vulnerable most vulnerable parts of the smart campus, which reduces the fault, thus enhancing the reliability of the smart campus applications.

In this final phase, we evaluate the proposed framework, based on the previous result, in typical smart applications of the smart campus, online survey data by validating the reliability based on a set of follow-up questionnaire questions. This research is in the domain of smart campuses, which is in its early stages and has a profound theoretical background. Also, the nature of this research is exploratory. The data for this survey will be based on a minimum of 100 or more respondents from institutions of higher learning based in Malaysia, such as mainly the education sector and industrial IoT applications or IoT companies. The survey instrument will be prepared by considering the exploratory nature of the study.

### **IoT-enabled Smart Campus Model**

This section discusses the relevant tasks of smart city construction as a proposal. Figure 3 shows smart campus model that introduces intelligent urban policies. This model will employ sensors, actuators, network devices, and so on. It can enable surveillance systems for monitoring purposes. For information communication, this scheme will work using the access network and store it in cloud storage. Besides, reliability prediction standards or methods for IoT devices in a smart campus can be applied to this model. This system will detect and mitigate the vulnerabilities using the mitigation technique and DNN approach. According to the operations of the operational framework mentioned in the previous section, this smart campus model will i) apply AVF for exploring the responses from IoT device errors, ii) embed PVF for decision-making based on explored responses in terms of errors, iii) employ evaluation metrics for vulnerabilities analysis and detection, and iv) mitigate vulnerabilities for enhancing the reliability. This model will involve detection and mitigation methods to assess and mitigate errors and vulnerabilities caused by IoT elements (things) such as hardware, software, and human factors. The campus users such as staff, students, teachers, or officers can obtain quality services.

We have only presented this model in this paper, and our next task is to improve and implement it. Furthermore, intending to build smart cities can reform a critical role in maintaining the secure reliability of big urban data and its transaction security, including monitoring. In this consideration, this smart campus design will ensure service availability and mobility to participants by eliminating data reports, long delays, inefficiencies, processing errors, and infrastructure vulnerabilities from the perspective of intelligent university services.



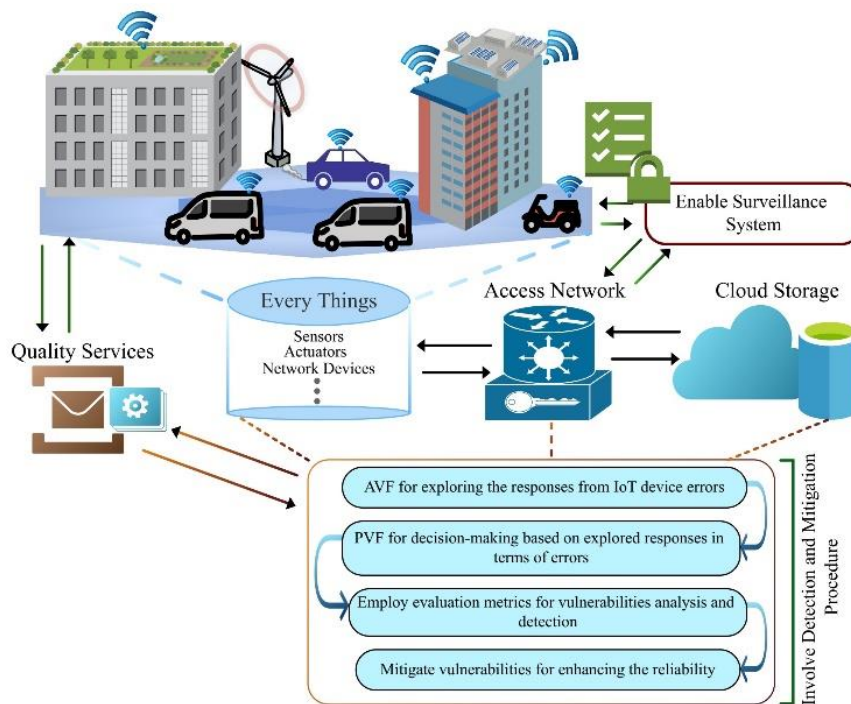


Figure 3. Smart Campus Model

## Conclusion

For an educational institution or university to come under smart campus, all the indicators of smart structure should be addressed. Implementing smart campus applications by providing knowledge study criteria and intelligent services is essential to enhance the quality of the university's learning environment. It has been focused on building a smart campus for practical and acceptable management of universities. Emphasis is placed on studying and formulating appropriate motivational methods to identify the most vulnerable parts of IoT-enabled smart campus devices. In this case, we have proffered the operational structure of a smart campus and an intelligent campus model by looking at all the indicators to bring an educational institution or university under an intelligent campus. Adequate procedures have been presented to overcome the real impact of unknown vulnerabilities, errors and security situations in advanced educational institutions. The well-defined methodological research mentioned in the paper should take into account the operational framework where the assessment and analysis of vulnerable IoT devices related to smart campus deployments and reliable IoT devices are essential. Our future work is to improve IoT-enabled smart campus infrastructure for a safe education system by assessing device vulnerabilities and improving its quality based on follow-up and survey data.

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# An Enhanced Simulation Model using Integrated Agent-based Simulation and Social Force Theory for Modelling Human Evacuation in Close Building: Implementation and Development

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**Abstract:** Crowds, emergencies, and traffic evacuations are examples of social systems. These complex, dynamic systems are challenging to analyze and comprehend. Two well-known techniques for modeling and simulating social systems are the agent-based (AB) model and the social force (SF) model. Whereas social force modeling focuses on the physical factors that influence how individuals move and communicate in a crowd while agent-based modeling focuses on the behavior of individual agents. Although each technique has its own advantages and disadvantages, combining them is a significant ability to capture both the social and physical components of human behavior. This work aims to combine both of these techniques, AB and SF and to capture the interactions between individual agents and the elements of the force that influence their behavior, leading to more realistic simulations of social systems. Nevertheless, there are difficulties involved in combining agent-based and social force modeling, such as choosing the appropriate system complexity and making sure that the simulation faithfully replicates the real-world system being represented. Hence, in order to overcome these obstacles and present a more precise and thorough knowledge of social systems, the creation of a conceptual framework for combining various methods is crucial. This paper presents the implementation and development of a simulation model with integrated AB and SF techniques. More complete and accurate knowledge of social systems as well as improved decision-making across a variety of disciplines is the expected outcome of combining agent-based and social force modeling.

**Keywords:** Simulation model, crowd evacuation, indoor evacuation, social force, agent-based model

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## Introduction

In the past several decades, there has been a lot of study on crowd behavior simulations and modelling. Industries, researchers, and academics are now attempting to better understand crowd behavior for a variety of purposes, including entertainment (including movies and video games), architectural design, crowd planning and management, traffic flow, and other related fields. A simulation model is similar to real time applications that is based on the general principles. "What-if" scenarios (consider the possibility) are used in simulation modelling of any case, and they are either in discrete or continuous time, a few states, or space, and normally they are used for modelling human behavior (Hanly et al., 2022). Furthermore, the simulation model is an instrument that be used for examining the space and flow of objects such as people or traffic during both normal and emergency crowd circumstances, but in the prevention of injury or even loss of life due to unanticipated events. Therefore, with the use of specialized software tools and testing scenarios, simulation models may aid in gaining a deeper knowledge of an existing system.

In recent years, studies on emergency evacuation have given careful consideration to modelling mass evacuation as well as modelling escape panic behaviors. It is still the subject of open debate and research on how to simulate panic in an individual and try to get through a crowd faster. The escape panic is unexpected and unsafe, which may avoid crowding disasters such as instances of damage or passing for crisis situations, e.g., fire and flood. Hence, under conditions where the typical distance scale between pedestrians is significantly less than the rate at which the pedestrians move, crowd evacuation in a fire emergency scenario can generally be treated as a continuum or it's called spectrum or continuation (Lyu, 2018).

On the other hand, a simulation analysis can be utilized as a part of requirement to enhance the performance and upgrade the system in the prediction of decision making. For instance, the traffic flow of human pedestrian is important for developing or redesign projects in the building such as in a close building for simulating the intricate and complex human behavior. Therefore, the variety of human behavior makes it challenging to model the evacuation of a crowd. Additionally, it is unsafe and expensive to use the actual evacuees to validate evacuation plans. In these situations, crowd modelling and simulation may substantially help authorities create effective and secure public areas (Bakar et al., 2022).

This study is focusing on the crowd evacuation of pedestrians, including their evacuation behavior in a close building, which is a complex problem to be modelled. Thus, the appropriate techniques are important to compare, especially from the characteristics, analysis results and collected data from the developed simulation model and simulation run, which is a tool capable of replicating realistic conditions such as those in the close building. In order to model the crowd evacuation for an emergency scenario such as fire, flood and disaster, thus this study aims to develop evacuation simulation model by adapting the potential techniques such as agent-based (AB) and social force (SF).

In order to model the mass evacuation of pedestrians for emergency circumstances in the close area, AB and SF modelling can be employed as a hybrid technique (integration of AB model and SF concept in one simulation model). AB and SF will be employed for this proposed work, for modelling the human evacuations, which will be able to mimic emergency circumstances, as detailed in the next section, and for the phase of development of the simulation model. It is based on each technique's features and concepts to simulate the situation where pedestrians must be evacuated safely so that the outcome can be more precisely compared to either the AB or SF technique as a whole and a realistic scenario can be modelled (Yuan et al., 2019).

At the moment, because few modelling approaches have the advantage of being able to manage the uncertainty and unpredictability of the system, simulation is utilized in system dynamics (SD), discrete event simulation (DES), and agent-based (AB) (Bakar et al., 2018). Several buildings, including stadiums, nearby buildings, and schools, are used to hold large gatherings of people. It is essential to carry out and test various scenarios in a building with adequate building design, by utilizing simulation modelling to ensure people's safety during emergency evacuation. A previous researcher claimed that there are seven approaches that can be used for modelling the human evacuation, including scenarios that happen in a building such as lattice gas (LG), cellular automata (CA), agent-based simulation (AB), social force (SF), animal experimentation (AE), fluid-dynamic (FD), and game theory (GT) (W. Liu et al., 2018). Therefore, which technique can be utilized for developing an evacuation simulation model?

The primary goal of this study is focuses on the development and implementation of a simulation model for human evacuation in close buildings using an integration of agent-based model and social force concept. Thus, the following is the organization for this paper. The introduction to the proposed study is covered in the first part. Consequently, the rest of the paper is structured as follows: The related work on the model of simulation, evacuation, and simulation techniques of agent-based (AB) and social force (SF) will be covered in Section 2. The approach that will be utilized for this planned work will be described in next section. The specifics and explanation of the development and implementation methods for the crowd evacuation simulation model (in a near building) are covered in Section 4. The results and expected results from the designed and tested simulation model are further explained in Section 5. The conclusion and discussion are covered in the final section.

## **Related Work**

### *Crowd Simulation*

Crowds can be referred to as groupings of people, populations of animals, colonies of insects, and transportation flows in a similar physical setting. A frequent occurrence, crowds display fascinating and unsettling spatial, biological, cultural patterns physical, and social. Frequently, the collective actions vary from the actions they would take if they were to operate isolated. The crowd's behavior in various circumstances, such as disaster evacuations, urban planning, or public events, may be predicted using the model. Therefore, crowd simulation approaches can aid researchers and professionals in better understanding and controlling crowd behavior in various contexts. On the other hand, crowd simulation comes in a variety of forms, including pedestrian crowds,

swarm simulation, crowd formation, and traffic simulation. In addition to panic escape, crowding, clogging, lane formation, kin behavior, arching, obstacle effect, jamming, panic, congestion, and egress behavior, other frequent phenomena include following behavior; choking flow, herding, side effects, sidestepping, walk and crawl, exit selection, and fluid behavior (Yuan et al., 2019).

For instance, according Nguyen et al. (2020), their work provided an overview of current work on crowd simulations and deep reinforcement learning for multi-agent systems. Z. Liu et al. (2020) stated that, in order to forecast crowd flow patterns, this research suggests a crowd simulation model that makes use of deep learning techniques. A past study investigated on a hybrid method to crowd modelling that simulates pedestrian behavior in large buildings during emergency evacuations.

Mahmood et al. (2019) used the model to replicate multiple emergency situations in order to assess the efficiency of various evacuation techniques. They experimented with several approaches to evaluate how they influenced the speed and security of evacuation, such as opening alternative exits, putting in place different communication protocols, and employing different crowd control measures. The outcomes of the simulation demonstrated that panic behavior may considerably affect how well evacuation plans work. Other than that, Liu et al.'s studied and proposed a crowd simulation approach that creates dynamic path planning for pedestrian crowds using spatiotemporal environment data.

Throughout literature, it can be concluded that this type of study is categorized as a crucial case study because it relates to human behaviors and because an emergency situation may have an impact on people's safety, health, and ability to avoid fatalities. It comes to light at the most tragic events, including emergencies like fire or flood. For instance, the tragic fire that broke out on December 28, 2021, at a 19-floor apartment near to Bronx in New York, USA. According to reports, the fire broke out on the third level of the structure and soon spread to the top stories, trapping the occupants. Firefighters fought valiantly to extinguish the flames and save the inhabitants as soon as the fire service arrived on the scene. Sadly, the fire claimed the lives of 19 individuals and wounded many more, including a few rescuers (Southall et al., 2022). Thus, research on emergency evacuation is important since it has a big impact on people's safety. Effective evacuation can be the difference between life and death in circumstances like fires, natural disasters, or other crises.

#### *Evacuation Simulation Model*

Simulation and modelling have lately attracted the interest of several academic disciplines, which are not limited to computer graphics and simulation, due to their broad variety of applications in numerous sectors. For example, the incorporation of urban planning, traffic engineering, entertainment, sociology, robotics, physics, architectural design, computer culture, psychology, and safety science. There are five different types of crowd simulation, including swarm, pedestrian crowds, traffic, crowd creation, and crowd evacuation. While, there are various ways to use a simulation model as a behavioral technique, especially in crowd evacuation. For the concept of the human in operational research (OR) and simulation models, three main techniques are often used



for simulation such as discrete event (DES), system dynamic (SD), and agent-based (AB) (Oh et al., 2021).

On the other hand, numerous methods exist for modelling evacuation, particularly for human pedestrians. One such method is pedestrian evacuation behavior (a case study of a nearby building). In order to model the human behavior especially during evacuation, there are seven techniques, according to a previous researcher, that can be used to simulate the evacuation of people from a building, including lattice gas (LG), cellular automata (CA), agent-based simulation (AB), social force (SF), animal experimentation (AE), fluid-dynamic (FD), and game theory (GT) (W. Liu et al., 2018; Bakar et al., 2022).

Other than that, simulating and modelling crowd evacuation, especially for pedestrians, is challenging because to the interactions between people and objects, people and buildings, and people and their surroundings. It is believed that a crowd evacuation simulation that "looks a lot like reality" and is reality is more reliable. It will evaluate traffic needs and improve efficiency and safety protocols. It is feasible to evaluate various crowd evacuation scenarios using simulation, especially in emergency situations. A crowd is a social system since it is a linked group of individuals. A group of two or more individuals is referred to as a "crowd" when they interact and communicate together at the same time, same location, and for the same purpose. Based on the cognitive and social processes involved, crowd movement may be divided into three levels: physical, physiological, and social. If two or more people are conversing and interacting with one another at the same time and place, there is a crowd. The crowd will endanger human life when disasters like fires, bomb threats, or poisonous gas releases in nearby buildings occur. The timely removal of human pedestrians or shoppers from dangerous situations is a significant problem. Because of how it will affect the populace should it fail, perhaps. Thus, in order to model the conditions and scenarios that occur when catastrophes occur in the buildings, we concentrate on a crowd evacuation simulation model for pedestrians (Yan Yang et al., 2019).

Simulators that estimate pedestrian movements can be used to assess architectural designs and operational plans. During the planning stage, simulation modelling and visualization are frequently used to improve construction and performance efficiency. In quantitative modelling, the statistic and simulation model are deemed to be the two most crucial components by prior research. The simulation model may be divided into many categories, such as static or dynamic, deterministic or stochastic, continuous or discrete. For example, various human behaviors during the check-in service at the airport has been performed using a simulation model with a set of variables in each state of the discrete model that will vary at each discrete point in time (Bakar et al., 2018). Since this process is quite small, a simulation model is needed to make the investigation easier. Another definition of simulation is the process of simulating a system using a symbolic model that is easy to change and produces numerical results (Musolino et al., 2020).

While some modelling techniques are continuous, others are discrete for both space and time. The scenarios are divided into two categories: normal and emergency. Human pedestrians can be either homogeneous (locked together by the members of the group) or heterogeneous (based on identifying traits like gender, age, and so on). Force-based, rule-based, grid-based, example-based, sociological, velocity-based, biomechanical, distance

maps, least-effort, particle system, behavior system, visibility, artificial life, and particle system are the strategies for the customers' crowd evacuation, and the selection is based on the case study (Shah et al., 2019).

One of the top choices of simulation technique is social force (SF). The Helbing et al. and Helbing and Molnar (1995) developed the social force model, a theory of pedestrian behavior based on physical and sociopsychological factors. The real force and motivational factors are explained using force vectors, with the assumption that each pedestrian conforms with the laws regarding movement as a particle. While, AB is a new technique, and it is not as widely explored as the other techniques. Therefore, the propose work intends to utilize AB for modelling the human behavior during evacuation. A previous study claimed that autonomous or self-directed agents make up AB model systems. AB is flexible and able to capture the emergent phenomena. These agents interact with one another and their surroundings while according to a set of established rules to achieve their objectives. The agents in AB systems each have their own behavior and are categorized as active in contrast to the entities' behavior such as in an SF model, which is determined by the system (Yuhan Yang et al., 2022).

Other than that, to simulate large-scale heterogeneous crowds, researchers are now engaging in the investigation of hybrid models that combine the advantages of both traditional techniques (Asgary et al., 2020). The hybrid model is capable of simulating pedestrian or human pedestrian interaction well, which might improve evacuation planning tactics. Given that they must provide a range of behavioral elements for a population, hybrid models' implications on scalability and simulation execution effectiveness must be evaluated.

This hybrid approach can simulate the complicated behavior of evacuation in the event of an emergency by developing a simulation model of pedestrian behavior with statistical result analysis. However, operation research (OR) only is less useful, particularly when it comes to the mass evacuation of pedestrian during an emergency. In order to improve the effectiveness and realistic of simulations, the experiments used to study evacuation specifically the human behavior. Therefore, the comparison of the single technique with the hybrid technique for modelling human evacuation is expected to have a significant influence on the simulation's results (Hassanpour et al., 2022).

## Methodology

This section describes the methodology for this proposed work; a simulation model of pedestrian crowd evacuation specifically in a closed building. Figure 1 depicts the research activities for this work, which contains six phases in order to complete the research work. It will be started with case study description and will end with experimentation and result analysis as the final phase.

Provide the following activity descriptions: First, simulate the massive evacuation of pedestrians during emergencies that occur in nearby buildings or other close-by areas, such as fire emergencies. Close building has

been selected as the focus of the study, which was done in the following steps: explaining the case study such as in a building in Malaysia, collecting data, constructing a conceptual model, developing the simulation model with the proposed techniques, verifying and validating it, running an experiment, and analyzing the results.

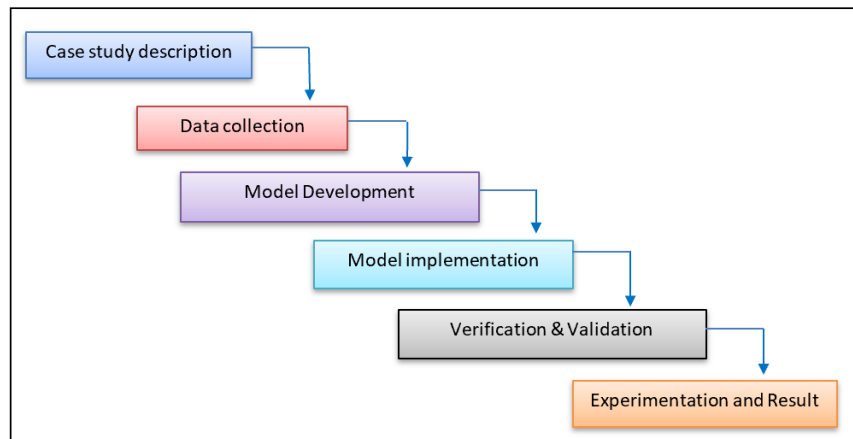


Figure 1. Research activities

Then, obtain the real data and then determine which data are required according to the chosen case study and the data collection. Next, a conceptual model can be constructed, which the selected techniques for evacuation simulation model are described as follows; of SF, AB, and hybrid AB/SF, which will be developed in order to develop an evacuation simulation model, compare its efficacy, and make improvements. The level of detail for SF and AB have been established once the model implementation has been created. After choosing a simulation tool, building and programming the evacuation model using the proposed techniques begins.

## Findings

### *Development and Implementation of Crowd Evacuation Simulation Model*

#### Phase 1: Description of Case Study

It is required to conduct case studies that provide an adequate quantity of data involving human behavior in order to compare the capabilities of AB, SF, and hybrid AB/SF to mimic human behavior in emergency cases (i.e., pedestrian crowd evacuation in a close building). The creation of a simulation run for simulating human behavior in emergency situations is one of the main goals of this research. Based on the chosen case study on modelling the pedestrian for emergency situations like indoor or in a building on fire is the main subject. People's behavior changes to anxiety and panic in emergency circumstances, and they are less able to behave rationally and independently to make judgements. This case study will sample data using a real-world system.

The crowd evacuation during an emergency scenario for pedestrians in a close building, can be modelled after

the case study has been chosen. The researcher employed systems from real-world environments to model this case study. Data for the case study is gathered using a range of research methods: quantitative methods are used to gather data that has been counted (for example, the number of pedestrians, records of customer arrival time, evacuation time, etc.), while qualitative methods, such as interviewing and observation, are also can be used. Quantitative data are utilized as input to our simulation models, and qualitative data are used to construct conceptual models.

### Phase 2: Data Collection

The researcher investigates the issued area to identify what should be done during the data collection phase, doing preliminary inquiry and observation while carrying out comprehensive analytical tasks (to collect the data regarding the systems); Analyze the present system and monitor real human behaviors (pedestrians) in typical situations at the nearby building to forecast the simulation model for crowd evacuation. The next step is to suggest a model for the computer simulation of this evacuation model. The researcher then takes into account the attribute of panic circumstances for the design methods for the simulation model for modelling pedestrian behavior for an emergency situation in a building. In addition, the feature of obstruction or any obstacles in the building during evacuation or while using the escape door to leave the panic circumstances also should be considered. The previously described impediment will be taken into account, along with the quickest route, by the intelligent agent as well. Following are the evacuation behaviors and processed for the pedestrian (Dema Moreno et al., 2022): -

1. People become anxious in escape panic situations, which is why they often do blind actions.
2. People attempt to move far more quickly than usual
3. People start shoving one other, and exchanges between people start to take a physical turn.
4. Moving through a bottleneck, in particular, frequently becomes uncoordinated
5. At exits, crowds are congealing and occasionally arching and clogging are seen
6. Dangerous physical encounters can result from congealed crowds' cumulative physical contacts.
7. People who have fallen or been injured becoming impediments delay down escape attempts.
8. People frequently exhibit herding behavior, which is the tendency to copy what other people do.
9. Alternative exits are frequently disregarded or ineffectively employed in emergency circumstances.

### Phase 3: Model Development

In the development of the evacuation model using the hybrid technique AB/SF, each individual people or agent and their interaction are represented using an individual-centric approach. The simulation software has been chosen which is Any Logic tool. Using this tool, for the SF model, the DES concept has been performed, which is based on a discrete approach in terms of time and space, while for the AB model, a state chart is utilized to represent the individual-centric approach. State chart diagrams for the agents depict the few states that an entity could be in and list the circumstances that lead to a change in status.

Phase 4: Model Implementation

The implementation design of hybrid AB/ SF simulation model is shown in Figure 2, along with the interactions between agents and technical infrastructure. The simulation findings are utilized to do the sensitivity analysis, and it supports the emerging system. The OptQuest Optimizer algorithm, a search optimizer built inside the Any Logic simulation tool, will be used to find the optimal search method solution. Having the ability to vary the goal function, needs, restrictions, and parameters (variables) and replications are used to support optimization under uncertainty. The choice of the next move in the parameter space (the next iteration) is made based on the aggregate output of several replications of a stochastic model with the same parameter values.

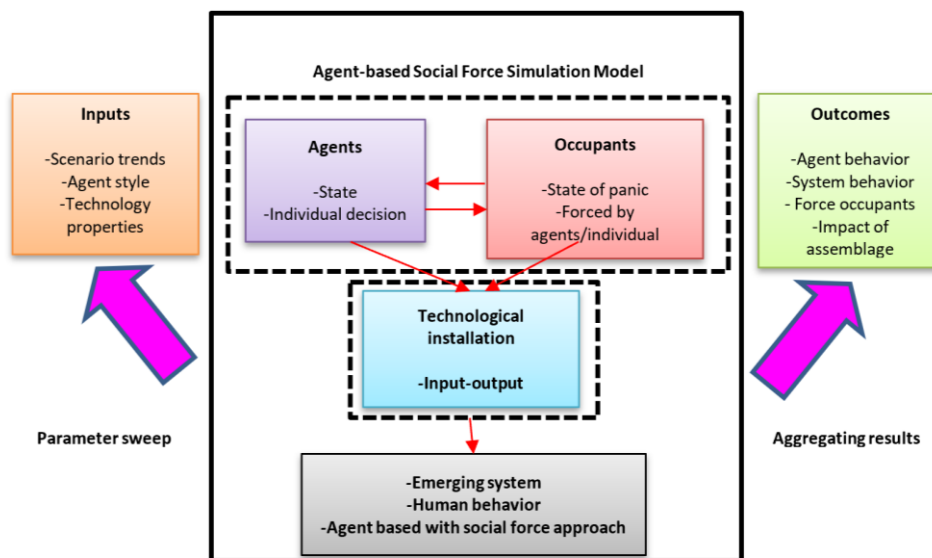


Figure 2. The implementation design of hybrid AB/SF simulation model

Three techniques will be utilized namely SF, AB, and hybrid AB/SF for the evacuation model. This evacuation model is considered; pedestrians or people safely evacuated in an emergency such as fire or earthquake and should concern on the simulation input and the simulation runs will keep going with experimentation along with model difficulties and outcomes. Then, each model (three proposed techniques) will be compared and validated. The creation of simulation runs for simulating human behavior in emergency situations is one of the main goals of this research. In this case on microscopic modelling, the unique person for the pedestrian is highlighted for emergency situations like a fire in a building. When emergency situations happen, people’s behavior change to panic and nervous and they lose to logically acting to make decisions on their own. The real-life system will use for sampling these circumstances.

The evacuation simulation model will use the Any Logic tool. This tool was chosen because it enables 3D animation, offers a visual model development environment, and is easy to build models with. Building a model in Any Logic is quick and easy to use with few functions such as drag-and-drop capabilities with many

application-specific libraries, Java environment for endless model feature development, and potential to create agent-based model. This tool supports mix or combination of few techniques such as system dynamics, and discrete event and agent-based models. 3D animation ensures a better understanding of their intricacies specifically the graphics to observe the human behaviors, movements and interactions. With Any Logic, the models may be exported as fully functional standalone Java program that can run from any place and by any user, regardless of whether they have or without installed Any Logic software. Then, there are several reusables "design patterns" that make it easier to develop simulation models, and Any Logic natively supports them. These trends or features of this tool are present: -

- Architecture of model
- Agent organization (with the steps process)
- Mobility, space (discrete, continuous, and GIS-map) as well as spatial animation
- Agent communication and connections (e.g., social networks)
- Dynamic conception and agents' destruction

AB may be used for restricted analyses, prototyping fundamental agent behaviors, and learning agent modelling. A single computer-literate modeler may create straightforward agent-based models in a matter of days utilizing techniques that can be picked up in a matter of days or weeks. In particular, if one is already familiar with the technology, agent modelling may be utilized to investigate the possibilities of AB with relatively few effort and training expenses.

The following are the primary consequences of SF which can be modelled using Any Logic tool: -

- Everyone wants to their preferred place or destination
- Each pedestrian maintains a set distance from the other pedestrians.
- Everyone maintains a set distance from boundaries or impediments such as walls.
- Every individual is occasionally drawn to another person, such as friends or items.

The Monte Carlo algorithm can be used for AB in simulation model using Any Logic tool, which is a randomized method which running time is predictable and it simulates the behaviors of the systems. It is a heuristic technique rather than an accurate one. Typically, it employs randomization and statistics to get a result. It is used in conjunction with the random walk generator.

As illustrated in Figure 3, the evacuation behavior model of the people is made up of two modules: planning the evacuation route and moving or movement of people. If the pedestrian is in a panic, they aim to flee by a recognizable exit. It is based on the nearest and shortest path, as well as time considerations and impediments, for regular or normal movements. These evacuees' modules are appropriated to be utilized in these three techniques; SF, AB, and hybrid AB/SF.



Figure 3. evacuees' modules

Simulation models may be made after the combined scope and level of AB/SF models have been determined. Phase 4 will outline the process for model implementation and validation. Any Logic™ Educational Edition is used to construct simulation models since the application can combine SF and AB models in a single tool. This simulation model has to be created and coded after the simulation software has been selected. In order to effectively depict human reactive and proactive behaviors in the combined SF and AB models, it was essential to provide a variety of contexts for each case study. Numerous configurations have been utilized to better understand how effectively both simulation models can mimic human behavior. The flowchart for the evacuation simulation model is shown in Figure 4.

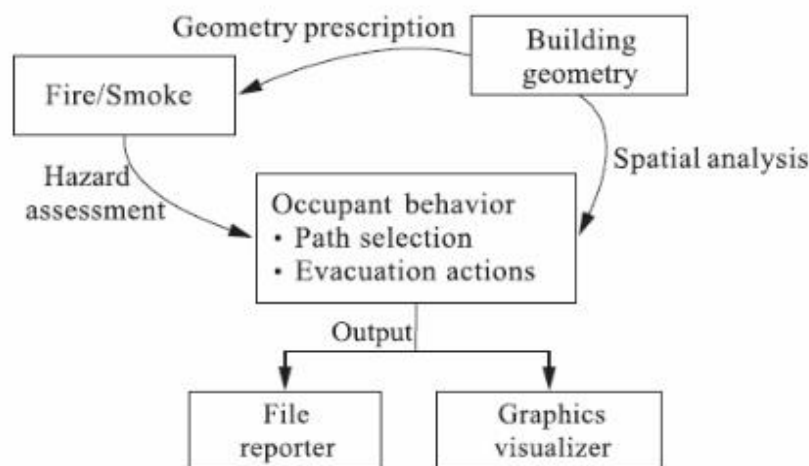


Figure 4. Model flowchart

Source: (Almeida et al., 2013)

#### Phase 5: Verification and Validation

Divide the actual or experimental data into two separate sets: an adjustment set of data and a validation dataset set, since this is one method of testing a model. While the measurement dataset is used to derive the model parameters, the validation dataset is used to evaluate the goodness of suitable measurements using the parameters of the model created within the calibration step. The whole process should be operated on both for all possible sections into validation and calibration datasets or for a sample of statistics that is a good representation of all conceivable subdivisions in order to perform these testing and validation processes

regardless of which way the initial data set is divided.

The model's parameters are distributed in a way that is consistent with the data as a result of the calibration step's requirement that each of these subdivisions provide a distinct set of values. In the end, the average or most likely model parameters and confidence intervals may be determined using these distributions.

Table 1. Summary of parameters, data type/ description of the simulation model

Parameter	Performance measure	Data type
<b>Operation</b>		
Evacuation time	Mean and standard deviation (sd)	Time (minutes)
Waiting time (for exit)	Mean and total	Time (minutes)
Total distance	Shortest path and obstacles	Distance (meter)
Flow rate	Flow rate at the exit for time versus	Time (second)
Number of people	Number of pedestrian	Person
Cost	Cost of time, difficulty and cost of tools	Time, description and cost (RM)
Velocity	Distance versus time	Ms-1 (meter/second)
<b>Modeling- development</b>		
Building time	Based on result value (RV) and difficulty value (DV)	Time (hours)
Execution time	(The deviation result of RV/ DV X Total scales number which is based on model difficulty (10))	Time (seconds)
<b>Attribute/ Scenario/ Factors</b>		<b>Description</b>
Occupant load	Per meter <sup>2</sup> for each person based on time and ratio of waiting time over total evacuation time	
Number of exit	Number of occupants escaped from number of exits	
Building design	Building or public space, crowd behavior, and building design with normal and panic situation	

The range of fit goodness values acquired during the appropriate validation rounds also demonstrates the model's predictive capability.

#### Phase 6: Experimentation, Data Analysis and Result

Three sets of experiments (SF, AB, and the hybrid AB/SF); will run the experimentation in order to achieve the research's objective. Investigating the effectiveness of the simulation results for the three sets is the goal of model findings. Three performance metrics for model difficulty are produced by the simulation model developed in experiment such as model creation time, model execution time, and model level of complexity (LOC). The three performance measures are examined similarly for the SF, AB and hybrid AB/SF model.



In order to provide a good approximation of real systems of service, verification and validation procedures are carried out concurrently with the development of the SF, AB and hybrid AB/SF models. Visual inspections by the modeler and code checker by a simulation expert are the two methods of verification. The simulation code is reviewed by an expert with knowledge of the designated simulation program (Any Logic), with a focus on the decision making. Any simulation code flaws are identified, and any required corrections are done.

When performing the visual inspections, the modeler runs the individual SF and AB models as well as hybrid AB/ SF models while keeping an eye on the component behaviors in the models. Both the expert's verification and the modelers' visual checks are continuously conducted until the simulation model operates as intended. This experiment is used to test how sensitive simulation outcomes are to changes in model parameters. Developers must choose the parameter to change and the desired results while using the experiment wizard. The "output vs. parameter" chart is displayed for outputs that only have one value. A chart with a variety of curves is shown for comparison if the simulation's output is a dataset (such as the dynamics of a certain process over time) (*Any Logic*, n.d.).

Any Logic automatically created the user interface for the optimization experiment, which includes the current and best solutions and the dynamic chart of the optimization progress. Researcher or developer may run simulations, enter model parameters, and add the simulation output to the charts to compare it to the results of earlier runs. This experiment is interactive in this way. A Monte Carlo algorithm for an experiment can be used to run a (stochastic) simulation several times. After that, the outcomes may be gathered and shown as a histogram. If the model were stochastic, each run would provide a different outcome even if the input values were constant. For each simulation run, you can also create a random parameter value.

#### *Hybrid AB/ SF Simulation Model*

The hybrid AB/SF technique has been introduced to provide more precise findings and properly model scenarios that are as near to reality as possible. If the effective time can be observed during the simulation and is identified and confirmed by analysis, a wise decision can be taken to facilitate the effectiveness and efficiency from the simulation findings. The main objective is to develop a better simulation model for the emergency evacuation using a hybrid SF and AB techniques to forecast the safety crowd evacuation. The following is a description of this work's sub-contributions: -

- A constructed simulation model of safe human evacuation using an enhanced technique which is hybrid technique; combine SF and AB techniques in a simulation model.
- Crowd evacuation simulation utilizing a simulation tool for an emergency scenario with the pedestrians' movements and behaviors
- A model that produces data to assess the influence of parameters (such as injury and other factors).
- A simulation model using simulator software that may replicate and model in real time the behaviors and movements of people as well as the ability to simulate different situation involving mass

evacuation while taking alternative strategies

- Expected to have the precise outcomes and a model that accurately represents the actual/real system
- It also offers the possibility to simulate an emergency scenario in pedestrian evacuation while taking different approaches into consideration as well as with three different techniques in a simulation model of evacuation

## Discussion and Conclusion

Since it's crucial to the researchers to understand how SF, AB and hybrid AB/SF can mimic human behavior at different levels of granularity, users of simulations can benefit from knowing how these few models can be compared. To solve the any kind of problems or issues using simulation model, the researchers should identify and compare models of human behavior, a careful selection of simulation techniques and thus it can be developed. This knowledge is essential because it illuminates the benefits and drawbacks of both simulation models in connection to the problem under investigation. The recently obtained data is helpful for users of simulation and OR research, as well as for comparing few techniques including the hybrid technique for simulating human behavior during emergency evacuation specifically in a close building.

Every simulation technique has benefits and drawbacks, but in the case study of the crowd evacuation for pedestrians during a fire emergency, using a combination of the two techniques of AB and SF (modelling using AB based on SF) is to obtain a more realistic, dependable simulation results that are concentrated on socio-psychological attributes and physical forces. Theoretically, SF is acknowledged as a great technique to investigate human behavior in services since it provides simulation outcomes that are equivalent to those produced when SF and AB are combined, but with less modelling challenges. Additionally, AB is regarded as a flexible and suitable entity. Because autonomous agents were utilized, coupled SF/AB models were the only ones that could represent more flexible and realistic behaviors, making them suited for emergency simulations like population evacuation.

In SF, it contains the faster-is-slower element, so the researcher can develop a simulation model using hybrid AB based on SF, therefore the realistic representation of evacuation behavior can be improved. While, the flexibility of AB to allow each pedestrian or people have distinct behavior makes modelling the diverse human much easier. As the SF is a popular crowd evacuation simulation model that better depicts the phenomena of pedestrian traffic, but it is hard to adaptively determine and cannot tackle a dynamic crowd environment such as individual characteristic with proactive behavior. Thus, this limitation will be covered by applying AB based on SF.

However, this study has several limitations such as the sociology elements have been ignored as we are focusing on the simulation techniques together with the evacuation procedure as significance for the evacuation governance and strategies and perhaps will be discussed as our future works. This hybrid approach was

proposed to gain a better simulation result and it was chosen because since it is well-known, strong, and adaptable. In order to have a better simulation model for a emergency scenario's safety crowd evacuation, we have studied pedestrians' behaviors in the closed area. This work offers a comparison of human behavior modelling utilizing SF, AB, and combined AB/SF for simulating the actions and judgements of the actor or agent in the simulation model. The comparison of human behavior modelling is based on the evidence of simulation effects and the difficulties of SF, AB, and combined AB/SF performances. Both simulation models are looked at to reflect human behavior for different sorts of service-oriented systems.

Conclusively, the implementation and development of a simulation model for crowd evacuation in a closed area that utilizing combined SF and AB approaches was the main goal of this study. The researchers next looked at the literature or conducted existing exploratory research on agent-based and social force models to ascertain their advantages and disadvantages. Researchers provide an integrated model that incorporates the benefits of both treatments based on this examination. Each agent in our simulation model, which represents an individual, has a particular set of characteristics, such as a preferred speed, direction, and social group. While the social force model is used to mimic interactions between agents and their environment, the agent-based model encompasses individual decision-making processes and social behavior.

Furthermore, the simulation techniques were implemented and utilizing real-world data from an indoor setting. We tested our simulation model's accuracy in capturing people's movement patterns using the collected data to calibrate it. Researchers observed at how people moved, including their speed, direction, and interactions with other people and their surroundings. Researchers also conducted sensitivity experiments to explore the influence of various model parameters on simulation results. The expected outcomes from this built integrated simulation model seek to precisely depict the behavior of people in close building, encompassing the interactions with other people and decision-making processes. Incorporating more specific illustrations of the physical surroundings and individual traits is one of the prospective study areas that the researchers highlighted.

Overall, this research's design and technique show how well agent-based and social force models can be utilized as well as integrated in order to simulate people's behavior in indoor spaces and provide the groundwork for future studies in this field. In conclusion, future research may focus on acquiring more data to validate and improve the integrated model. This can require utilizing fresh data sources, such those from social media or mobile devices, or collecting data on social systems that are not yet completely understood. Other than that, the collaboration across disciplines can be proposed for the future work such as to build a more holistic and thorough knowledge of social systems, combination of few fields including computer science, sociology, and psychology. This may lead to the development of fresh research topics and new perceptions of social behaviors. Furthermore, the integrated model may assist with the implementation of policies in a variety of fields, including urban planning and emergency management. Thus, future studies can concentrate on determining additional areas where the model might be used to guide decision-making as well as assessing the efficacy of policy initiatives informed by the model for the evacuation policies and governance (Rahman et al., 2019; Bakar et al., 2022).

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## IoT-Driven Sustainable Green Energy Systems in an Organization: Issues and Challenges

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**Abstract:** Sustainable energy harvesting from renewable sources such as solar, wind, or water power leads to a significant challenge in managing IoT applications. Utilizing renewable energy combined with optimized system energy has become a major concern across IoT-based large-scale systems for obtaining a reliable and energy-efficient eco-infrastructure system. A green technology-operated IoT (G-IoT) has been introduced as part of energy efficiency solutions for IoT-based systems to address the aforementioned issues. Many researchers have explored various solutions related to energy-efficient G-IoT approaches for eco-infrastructure systems in an organization such as a university campus. As there are various existing approaches to G-IoT, the question here is how to produce a reliable, real-time, and energy-efficient system to ensure sustainability for replicating a city like a university. This paper intends to explore existing works on G-IoT-based approaches in terms of energy efficiency issues and challenges from various authors' perspectives. The key goal of this study is to conduct a comprehensive overview to identify the parameters involved in developing a real-time and energy-efficient G-IoT system from existing works. Accordingly, an operational approach is introduced to review and analyze the work, factors, and techniques of G-IoT-related existing articles. From exploration and analysis, this study affords an in-depth description based on current trends, related parameter identifications, and capable approaches to bridge existing strategic gaps for future research. Thus, this study is expected to develop an IoT-powered sustainable green energy system replica for an organization.

**Keywords:** Energy Harvesting, G-IoT, Green Technology, Renewable, Sustainability

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## Introduction

Nowadays, sustainable energy procurement has become very important due to the definition of new digital technologies or services day by day. Moreover, the growing population of today's world relies on a variety of technologies, such as the Internet of Things (IoT) and its applications, to meet their digital needs. Nevertheless, increasing global climate change can be accelerated by harnessing sustainable energy from renewable sources in digital technologies or services. The IoT is a system and innovative technological paradigm of billions of interconnected objects through the internet around the world (Zhang et al., 2020). In addition, IoT devices and applications play an essential role in developing some innovative applications in any country where various activities are involved, such as data collection, data sharing, data storage, data monitoring and testing, and data transfer without human intervention. Also, the real advancement of IoT has opened up opportunities for infrastructure development that is gaining worldwide acclaim. However, these infrastructures consume vast amounts of energy to accomplish their functions. With the increasing number of IoT devices like sensors, actuators, RFIDs, computers, and mobiles in IoT applications, the demand for energy in each sector is constantly increasing (Park et al., 2020).

Thus, it is creating a shortage of energy sources and increasing energy expenditure, wasting energy in the form of heat, and the resulting crisis with uncertainty is deepening day by day. As a result, emissions of carbon dioxide (CO<sub>2</sub>) are rising day by day. Due to increasing energy demand, it will be very complicated to achieve high-quality services with greater energy efficiency. Also, uninterrupted renewable energy sources will be required when renewable energy sources are used as substitutes for non-renewable energy sources. Even energy demand and supply equilibrium, energy optimization, and cost analysis are important factors for attaining energy efficiency and achieving sustainability for any infrastructure (Martínez et al., 2021). Thus, these are considered as main issues and challenges in any IoT-driven sustainable infrastructure for the green energy system.

However, in order to reduce energy costs and achieve sustainability, it is essential to build the structure of energy-efficient IoT, called green IoT (G-IoT). Although several studies have analyzed the reliability of sustainable green energy systems through IoT, the need to conduct a comprehensive overview to identify the parameters involved in developing energy-efficient G-IoT systems is considered challenging. In this regard, an adopted IoT platform-driven sustainable green energy system can drive efficient resource utilization in an organization and promote the environmental sustainability transition (Butt et al., 2020). Many organizations in different countries around the world have started researching and building this type of G-IoT-based sustainable

green energy system. The existing articles for this issue still insufficiently explore G-IoT-related tasks, factors, and strategies, which points to a research gap and requires a new approach. Therefore, this study aims to identify the parameters involved and develop an operational framework to ensure sustainable green energy in an organization and evaluate its performance.

This configuration can certainly save costs and assist in keeping the balance of the environment as well as help in the longevity of human beings. For sustainable green structures, initially, renewable energy sources can be used as energy sources instead of fossil fuel or electric energy sources for any type of organization like university, company, campus, or industry (Amran et al., 2020). Consequently, green energy can be harvested from renewable sources for IoT-controlled energy systems, and optimization strategies can be applied to obtain energy efficiency and sustainability of IoT-driven infrastructure. Thus, the objectives of G-IoT-based sustainable real-time infrastructure should be energy-efficient, green, and sustainable for any type of application of an organization. Researchers need to be concerned enough about what issues and challenges are considered for the green energy system to achieve the objectives of the proposed framework. To be inspired to meet the goal of achieving the G-IoT model of sustainable energy harvesting, the topmost contributions in this study are described as follows:

- This study will support in acquiring sustainable green technological knowledge and concepts to develop a sustainable IoT-enabled green energy system for an organization.
- This study explores existing related works based on sustainability, energy efficiency, and G-IoT-based approaches in terms of issues and challenges.
- This work presents an operational approach, including strategies to promote an IoT-driven sustainable green energy system.

The rest part of this paper as follows: Section II describes the literature review based on sustainability, energy efficiency and IoT, and G-IoT. Section III expresses details of the issues and challenges of G-IoT associated with reliable, sustainable infrastructure for energy-efficient systems. Section IV represents the methodology with an operational approach of this study. Finally, section V concludes the last part of this study.

## Literature Review

### Sustainability

In recent years, sustainability on organizations has led to the implementation of technologies that support reducing the environmental impact of organization activities, lessening resource usage, boosting the interconnectivity of everyday objects, and enriching sustainable behaviour within the organization like a campus communities. In this context, IoT can be a promising technology for achieving the goals of organization sustainability initiatives that observe and optimize energy usage leading to efficiency gains and savings. Sen et al. suggested that higher education institutions need to adopt transformational plans and develop long-term



strategic approaches to overcome the complexities of achieving sustainability goals and carbon neutrality. In this regard, prioritizing efficient use of resources throughout the education process by ensuring a balanced, equitable, and integrated socio-economic sustainability in education, research, and sound management (Sen et al., 2022). Yadav et al. opined that using green and clean energy sources can be the best way to set up an eco-friendly, sustainable educational campus in Nepal (Yadav et al., 2021). In this regard, the authors analyzed the daily, monthly, and annual load data of solar PV power plants to meet 100% of energy demand to make them economical and environment-friendly in the feasibility domains of several university campuses in Nepal. Yaser et al. discussed the anaerobic digestion and composting processes for managing various levels like food waste and sewage sludge at the university campus, which can contribute to achieving campus sustainability (Yaser et al., 2022). In one instance, Villegas-Ch et al. conducted small-scale testing to integrate big data and the Internet of Things to find an efficient and reliable resolution for the performance of universities as a smart domain based on sustainability (Villegas-Ch et al., 2019).

In addition, Whitley et al. assessed the sustainability behaviours of university students based on socio-psychological factors such as electricity usage, recycling, transportation choices, food preference, and strengthening environmental approaches using the theory of Value-Belief-Norm (VBN) (Whitley et al., 2018). Gu et al. introduced a conceptual nexus analytical scheme for a sustainable campus based on interrelated environmental footprints (Gu et al., 2019). They used Keele University as the domain to quantify footprints through this interconnected nexus analysis to explore the relationship between water, solar, and wind energy resources, food supply, waste dumping, and associated carbon emissions. Kim et al. discussed and quantified the impact of different sustainability information sources and their user behavioural variations by exploring 12 communication factor analyses as three clusters (Kim et al., 2018). In one case, Moura et al. presented the consequence of energy sustainability based on an IoT infrastructure by using integrated renewable generation sources that ensure the desired monitoring of a university campus and support the control of ventilation, heating, lighting system, and air conditioning (Moura et al., 2021).

### **IoT and Energy Efficiency**

IoT creates interconnections between embedded devices, sensors, and software on sustainable organizations like a university and allows stakeholders to collect and exchange data. Energy efficiency is an important consideration in the development of IoT frameworks to implement sustainable features, where environmental impacts of the organizations are mitigated while stakeholders use digital technologies. In this context, using renewable energy sources in smart organizations and applying energy efficiency strategies can reduce energy consumption in IoT structures and operate in a more sustainable and cost-effective manner. To address the issue of energy consumption in IoT structures, several energy efficiency strategies have been used to measure energy efficiency in recent years. Santos et al. discussed energy efficiency measures in IoT to identify energy consumption patterns and sustainable energy conservation measures in most buildings (Santos et al., 2019). Faritha Banu J et al. introduced an IoT-based smart classroom to digitally attach to campus for sustainability learning and enhance the efficiency of regular activities (Faritha Banu et al., 2020). This paradigm integrates the

technologies of IoT and cloud computing, where a software module is used to process the sensor information. Silva et al. described a software toolchain to manage and integrate the ICT-centric approach-based sustainable campus (da Silva et al., 2021). They demonstrated that such schemes could relieve energy usage, increase energy efficiency, and reduce greenhouse gas emissions from general services and resources of sustainable campuses under an online energy performance simulation, monitoring, and evaluation tool. In this context, Geetha et al. proposed the GEQCC-FLP method to predict the energy consumption in IoT networks by which nodes in the network can meet the required energy demand (Geetha et al., 2022). Furthermore, their approach uses Deep Random Vector Functional Link Network (DRVFLN) and Satin Bowerbird Optimizer (SBO) for green energy-aware clusters to predict future communication and renewable energy load in the IoT networks. Humayun et al. introduced a green IoT model to achieve energy efficiency by optimizing energy in smart cities, which are evaluated using mathematical modeling in terms of street billboards and lights, intelligent parking, and smart homes (Humayun et al., 2022a). Consequently, Sharma et al. examined the carbon footprints in IoT-enabled smart devices to save energy and achieve sustainability by emphasizing the use of G-IoT (Sharma & Panwar, 2020). Also, the usability and recyclability of smart devices have been promoted in the environment as well as in reducing costs and GHG emissions.

### **G-IoT**

IoT-enabled sustainable organization system can be represented as a green IoT (G-IoT) model that supports different organization like universities to optimize energy use, reduce waste, and enhance sustainability in IoT technologies and applications with the aim of facilitating eco-friendly operations and knowledge transfer. Researchers have presented various green internet of things (G-IoT) based model which incorporates the adoption of IoT with green operations for gaining sustainability using a number of techniques. Mago has selected green IT to develop sustainable policies in the organization using the GITAM model (Mago, 2016). Nevertheless, there remains a complication regarding applying G-IoT to achieve sustainable policies with low energy consumption in buildings, organizations, industries, corporations, cities, and worldwide. Gotovtsev and Dyakov introduced G-IoT in City to achieve sustainable development using photo-bioreactors and biosensors for building and water management as well as peaceful environments (Gotovtsev & Dyakov, 2017), respectively. Ahlgren et al. developed a smart city regarding G-IoT using heterogeneous sensors for getting open access and interoperability data to meet the needs of citizens (Ahlgren et al., 2016).

Energy efficiency in G-IoT is a potential and significant global issue for our day-to-day life towards sustainability. Any manufacturing product in the industry is facing a huge problem due to the depletion of fossil fuel and the increase of population in world. So, Jagtap et al. introduced EPE framework-based IoT sensing technology to raise energy efficiency with the help of optimized energy in the beverage industry as well as to obtain environmental sustainability (Jagtap et al., 2019). Moreover, Chithaluru et al. presented less energy consumption to reduce energy depletion using the I-AREOR algorithm for G-IoT and also provides greater energy efficiency in smart cities (Chithaluru et al., 2020). Liu and Mishra discussed the technological challenges of G-IoT for the achievements of sustainable development and proposed an integrated policy of additive ratio

estimation and stepwise weight evaluation ratio exploration under the Pythagorean fuzzy set to execute G-IoT technologies (Liu & Mishra, 2022). Baldini et al. demonstrated an analytical design to evaluate the environmental influence of IoT deployment. They used solar energy harvesting operations in their proposed scheme to determine the green solution (Baldini et al., 2023). Besides, Kinelski et al. expressed different aspects of sustainable management for a smart city based on energy consumption and energy savings, including pollution reduction from the usage of energy sources, heat, or transport (Kinelski et al., 2022). They assessed the feasibility of implementing an automated thermal control design in cities of the Polish metropolitan zone.

### Consequences from recent literature

In summary, green practitioners have recently focused on developing various analytical and mathematical strategies and technologies to manage a sustainable organization and reduce environmental impact using the G-IoT model. Table 1 exhibits the comparative consequences of recent literature on sustainability and energy-efficiency strategies. The consequences cited in the table can provide us with motivation for a sustainable management evaluation process of an organization using an energy-efficient G-IoT model. In the cited studies, researchers have tried to achieve the sustainability of an organization through IoT using some mathematical, analytical, and simulation techniques. However, they did not consider a realistic representation using the simulation model by identifying the parameters of promoting an energy-efficient, sustainable G-IoT model for an organization in their related studies, which can be important to improve the performance of these sustainable systems.

Table 1: Comparative consequences from recent literature regarding energy-efficiency strategy

Ref.	Approach	Parameters	Simulators	Domain	Strengths	Limitations
(Moura et al., 2021)	IoT-based platform	Energy consumption	Testbed	University Campus	ensure energy savings, increase matching between generation and demand of energy.	Only for local energy generation from PV system
(Baldini et al., 2023)	Baseline Green Solution	electronic components, battery, solar energy	Analytical model	IoT deployment	Assessed environmental impact	Only work on small solar panel for energy harvesting
(Yadav et al., 2021)	Campus solar PV plant	Solar Energy consumption	PVSYST V7.0	Campus	Cost effective based on environmental and economic Energy Saving	Not consider for battery backup and higher system capacity
(Humayun et al., 2022b) (Said et al., 2020)	Green energy model EMS	Energy consumption Energy consumption rate, IoT nodes	Mathematical model NS2	Smart home and cities IoT environments	Control the energy consumption in IoT	Not consider for real-life case study Questionable Energy source type
(Bebortta et al., 2022)	Edge-enabled green IoT	Energy-efficient processing	Analytical	IoT ecosystem	Offloading of intensive tasks to edge servers.	Capacity constraint in the edge server

(Zeng et al., 2022)	EH-IoT	Data Packet Sensor node, energy	Analytical	Not Specified	Pursue zero- carbon IoT network stability	Exclude energy harvesting capability measurement
(Kumar et al., 2020)	Q-EBIoT	Energy consumption , sensor node	NS2, testbed	IoT Environme nts	Prolong network lifetime more	Energy capacity constraint in sensor
(Uddin et al., 2022)	Integrated ABM-SD- BIM	Occupant behaviour	Anylogic	Building	Enhanced energy saving	Only consider a few layout

### Gap Analysis

As quoted in the aforementioned subsections of this section, there are some potential gaps in existing work that need to be identified to achieve the desired results for sustainable organizations. In this case, there is a need to deploy technological infrastructure such as sensors and other equipment as well as improve energy efficiency for the sustainability of IoT-driven green energy systems, which need to be added to several existing structures. For developing a G-IoT-enabled sustainable system in an organization, there is required adequate energy collection from renewable energy sources, reduction of energy consumption, and significant improvements in actual energy savings that are missing in several existing structures. Also, various innovative solutions to reduce carbon emissions need to be explored to ensure the sustainability of an organization model by assessing the compatibility of energy-efficient G-IoT simulation infrastructure with existing technologies. Besides, a realistic representation of an IoT-driven sustainable green energy system in an organization needs to be considered along with parameter identification for achieving energy efficiency and promoting sustainability.

### Issues and Challenges of G-IoT

The most important and fundamental condition of green technology is how to reduce greenhouse gas (GHG) emissions in IoT by reducing energy consumption, saving energy, and gaining energy efficiency so that an organization or a country can benefit socially, economically, and environmentally. G-IoT has many important energy efficiency issues and challenges for an organization. These issues and challenges have social, economic, and environmental implications for sustainability. Among the various issues and challenges, there are some technical issues and challenges; some issues have potentially increased the focus on green energy, some are prerequisites for G-IoT standardization, and some are security and privacy protection from system vulnerabilities. The issues and challenges of G-IoT based framework are shown in Figure 1, which are outlined below:

#### Energy costs

The rising energy consumption costs in G-IoT can be considered a crucial issue and challenge. The IoT has

developed a variety of applications like smart homes, intelligent buildings, smart agriculture, and smart healthcare to make our daily life simple, beautiful, smart, and smooth. These applications contain millions of devices for analysis, control, and sensing data that consume large amounts of energy resulting in high energy consumption and not being consistently stable. In that case, if renewable energy can always be used at a low cost, then it is possible to achieve maximum energy efficiency by using the maximum energy.

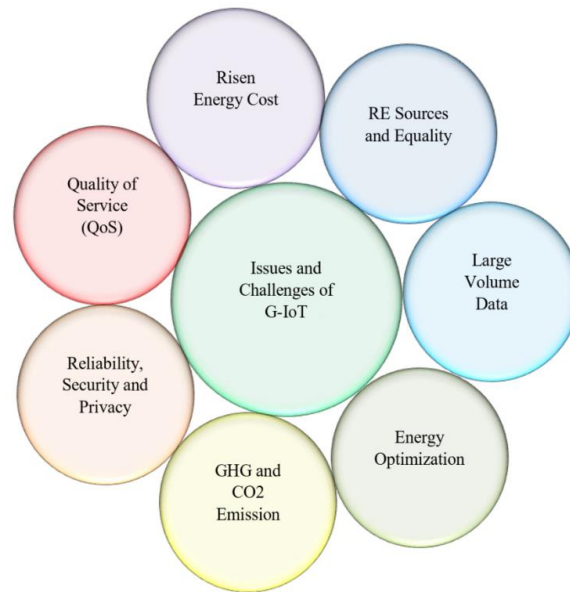


Figure 1: Issues and challenges of G-IoT-based framework

**RE sources and quality**

Maintaining environmental sustainability through renewable energy generation can be a promising concern for future generations. Due to increasing global warming using non-renewable energy, renewable energy resources are rising in today's world in the distribution of power within IoT systems. The energy harvesting distribution from renewable energy sources can be a major challenge in terms of quality, stability, and adjustment level for smart G-IoT systems. Ensuring maximum utilization, demand, and supply equality of renewable resources in the G-IoT scheme can be a key issue for a green city. Besides, renewable energy resources can be a significant matter to associate with industrial development that will positively influence environmental management towards dynamic and standard adoption.

**Large volume of data**

For accomplishing the operations such as transfer, process, and storage in IoT systems, a massive amount of data is generated that is collected by the huge number of sensors of objects and stored in the centralized node. IoT systems have unique features because these schemes have limited computing power to analyze since large amounts of data are generated. Besides, to design an energy-efficient G-IoT for any organization, the data-

driven technique can use a massive amount of data that are transferred over the network using various processors. Thus, the large volume of data is the greatest challenge for managing a G-IoT system for predicting and detecting the functionalities to realize the sensor body and to analyze, store and process information intelligently and efficiently.

### **Energy optimization**

For decades, energy has been an important element in various fields like building, city, manufacturing, agriculture, etc. Globally, energy is considered an expensive and valuable resource in IoT. The demand for fuel oil is increasing day by day to meet the demand of the people of the world. As a result, the effects of global warming and GHG emissions are increasing, which is having an adverse effect on climate change and human longevity. This is why it has become essential to store energy and achieve maximum energy efficiency in existing applications so that the required energy is consumed and further progress can be made towards achieving sustainability. Require energy can be utilized through the implementation of energy optimization, which can help maintain the optimal balance of energy use and development of energy efficiency structure, thus providing a sustainable environment by providing maximum benefits to people and the climate.

### **GHG and Co2 emission**

The various devices and applications of IoT play an essential role in meeting the needs of people's daily life. IoT consumes much energy to handle a variety of applications, increasing emissions of atmospheric CO<sub>2</sub> and harmful GHGs. Therefore, atmospheric CO<sub>2</sub> and GHGs are considered important issues in achieving energy efficiency. If maximum energy efficiency can be achieved by reducing energy consumption by optimizing energy, then the environment can be moved towards sustainability.

### **Reliability, security, and privacy**

IoT-based green energy systems use renewable energy to achieve energy efficiency and sustainability. The generation, optimization, and distribution of renewable energy are deeply involved in achieving energy efficiency and sustainability. Reliable management of the generation, optimization, or distribution of a large amount of renewable energy has become an important issue. Achieving efficiency and sustainability of energy structures involves environmentally friendly, comprehensive reliability management and renewable energy distribution, data availability, ease of data usage, and data accuracy. In the future, various tasks are directed towards ensuring the reliability of the power system to manage the context so that the storage capacity and efficiency of the system can be multiplied, but the sustainability of climate change can be ensured.

Besides, data privacy, security, and interoperability are vital issues and major concerns in energy systems of IoT so that aggregated data are used to minimize communication costs and keep the privacy that has not yet been

addressed. The sensor nodes of networks are vulnerable due to different threads and attacks. As a result, security breaches have happened in the sensor. Data security is essential to impede unauthorized access and unwanted changes due to various attacks and threads. So, the IoT user is concerned about a green and sustainable system's reliability, privacy, and security to achieve a reliable and secured system.

### **Quality of Service (QoS)**

The focus of QoS helps to achieve the core goals of a system. Achieving improved and optimized QoS of green energy systems depends on some parameters such as availability, reliability, greenness, and sustainability. The availability of a system means the sources of the energy, data, and network coverage area are available for any system organization. Reliability provides reliable management of the generation, optimization, and distribution of a large amount of renewable energy data and services across IoT compatible devices and applications, network capabilities that are also the reliable backbone to G-IoT connectivity.

However, greening means achieving maximum energy efficiency from a system so that the minimum energy consumption, maximum energy saving, and optimization are attained. As a result, GHG and harmful gas emissions are reduced due to greenness. Besides, low battery charge and less system energy consumption can lead to sustainability. On the other hand, security and privacy are major concerns for getting QoS. To implement the QoS optimization strategy and get the best performance that is predictable and secure, we need to explore appropriate strategies that consider QoS as a significant challenge over G-IoT-based energy systems.

### **Methodology**

Achieving sustainability in an organization requires a more efficient infrastructure system for renewable energy associated with IoT-enabled systems in existing operations. In this regard, IoT-enabled existing infrastructure systems have some weaknesses in terms of energy efficiency and reliability, which need to be identified to ensure sustainability. In consequence, this study illustrates a well-defined operational approach in Figure 2 for identifying the factors to develop an energy-efficient and sustainable G-IoT model in an organization building. This representation shows the process of exploring the strategies of existing works, including sustainable architecture, through various literature reviews in the context of sustainability, IoT and energy efficiency, and G-IoT-based research. In this case, this way can be accommodating to provide insight into the overall performance of green-based systems. This scheme draws the methodological steps involved in selecting existing literature, reviewing gaps, issues, and challenges, identifying causes, exploring strategies, and building energy-efficient enabling frameworks.

In the initial step, this study arranges a plan to determine all aspects before building an IoT-powered sustainable green energy system in an organization. In this aspect, several literature works related to sustainability, IoT, energy efficiency, and G-IoT are collected, selected, reviewed, and analyzed on existing works, which can be

considered as the most important part of this framework. In accordance, this study determines the gaps, issues, and challenges from the existing works and raises the research problem statement on IoT-driven sustainable green energy systems in an organization. In this setting, it identifies the factors for developing a sustainable G-IoT-enabled organization that will be used to promote energy efficiency.

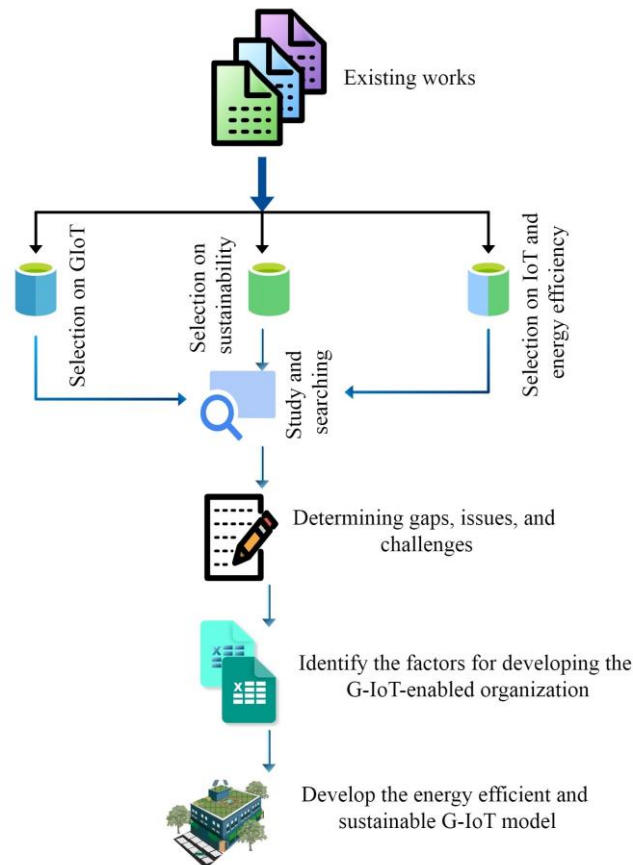


Figure 2: Operational approach

Finally, based on the results of these identified sensitive factors towards reliability and sustainability, energy efficiency can be evaluated for the development of G-IoT-enabled organizations, where only renewable energy sources will be considered. This study explores how to develop sustainability initiatives in an institution like a university campus, which is at its primary level. The nature of this study is profound and exploratory. Furthermore, this approach includes the development of high-performance green structure-based sustainability simulation models, which is demonstrated in Figure 3. Accordingly, this model will support energy efficiency gains and sustainability through the integration of renewable energy and IoT. In the energy management context, this system will confirm the availability of green energy from renewable sources in a continuous manner. In this case, renewable energy will be managed in an optimal way and stored in energy storage devices. Then, this energy will be utilized in green IoT-based organizations, where sensors, actuators, gateway, and many smart devices are incorporated. In addition, realistic representation with visualization will help explore the utility of the proposed concept in an effort to overcome existing work limitations with greater energy efficiency.



Even through the evaluation and validation process of the model will be related to the reduction of energy consumption and carbon dioxide to get improved energy efficiency towards sustainable policy.

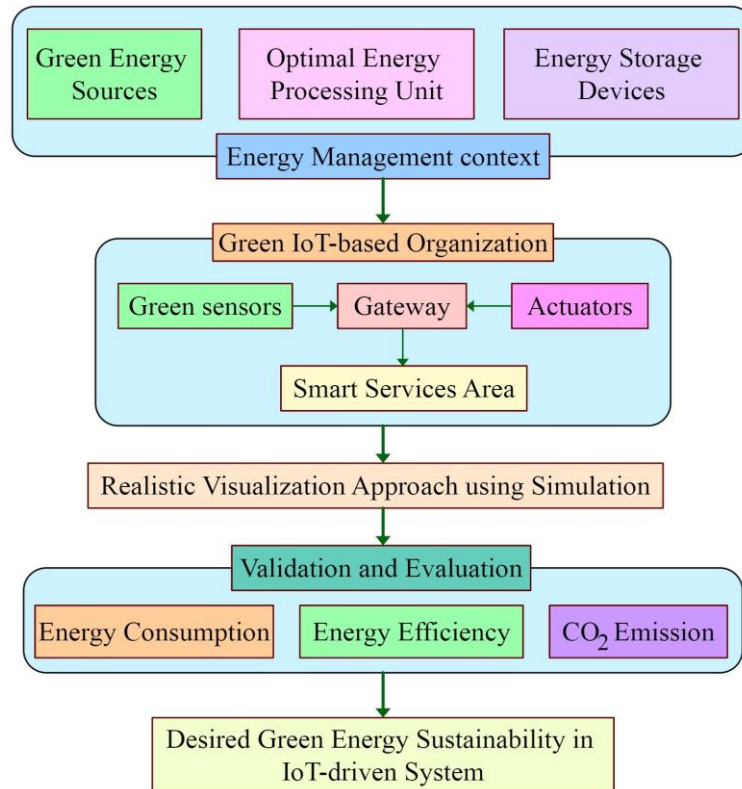


Figure 3: IoT-driven Green Structure based Simulation Model

## Conclusions

Sustainable green technology is currently a desired revolution in the global green industry, and its advances are usually ongoing to be applied in G-IoT applications to be more durable; as well as it needs the intervention of researchers to ensure the reliable, sustainable development of an organization. Meanwhile, many specific functions of G-IoT operations and their technical approaches are being focused due to the appearance of cutting-edge green energy paradigms on its improvement. This study presents a comprehensive overview of recent works, growing issues and challenges, and research gap analysis based on sustainability, energy efficiency, and green IoT for developing a sustainable IoT-enabled organization. Inspired by G-IoT-based recent research, this study's comparative exploration and empirical analysis can contribute to the development of sustainable green technologies and identify the parameters to make the decisions of its development. It presents an operational approach to the concept of reaching the promoted green energy systems based on IoT network modes toward sustainability. In addition, such an operational approach from the perspective of renewable energy towards sustainability can generate a lot of interest in research on G-IoT technology in present times. This paper will allow further research directions for researchers to find faster and more effective solutions for developing IoT-driven sustainable scheme-based green energy systems.

## Acknowledgements

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## An Optimized Virtual Model of Vaccination Centre Operations in Malaysia Using Hybrid Agent-Based and Discrete Event Simulation

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**Abstract:** A number of booster doses and novel vaccinations have been chosen by health scientists in response to the latest pandemic epidemic and the identification of new strains. In light of this, it is essential to build additional vaccination facilities that are flawlessly planned and optimized to boost their agility and effectiveness, particularly in a country with a diverse population and a burgeoning tourist industry like Malaysia. Because only medical facilities, public buildings, and private structures are modified and reconfigured to function as vaccination centers. Based on different factors including population, transmission hazards, vaccination rate, availability of frontliners, and ergonomics at vaccination centers, a more practical, standard, portable, and flexible vaccination center PPV (*Pusat Pemberian Vaksin*) model would be required. In order to promote vaccine administration protocol agility, decrease transmissions, and boost overall performance efficiency of Malaysian vaccination centers, this project aims to create an optimized virtual model of vaccination center operations. The paper is divided into two stages of methodology, namely the literature review phase and the comprehensive descriptions of the proposed simulation model using integrated hybrid techniques. An initial investigation will be conducted to assess the present PPV-related activities in Malaysia. The findings reveal the proposed simulation model by utilizing the integrated hybrid techniques of agent-based and discrete event simulation in order to comprehend how the simulation system, which consists of few important elements and parameters such as vaccine recipients, medical personnel, facility ergonomics, vaccination center agility, and performance efficiency, behaves. In addition to providing the best movement patterns, anti-transmission SOPs, facilities and ergonomics, shorter waiting times, and general agility and efficiency of the PPV, this research will give a thorough analysis of the Malaysian PPVs as one of its future works.

**Keywords:** Vaccination Center, Agent-Based Modelling, Simulation Modelling, Optimization, Discrete Event Simulation

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## Introduction

The disease brought on by the new virus, and its emergence as an unparalleled challenge for humanity is COVID-19. The number of deaths globally in May 2022 totaled 6.28 million. In the middle of 2020, certain substitute vaccinations were found to be effective during the epidemic. Many nations, including Japan, have put in place a halt of economic activity for infection control due to COVID-19. Though it caused significant economic losses, it helped to stop the spread of COVID-19. Today, a number of promising vaccinations have been created and are being made available in various nations (Sunohara et al., 2021).

While the COVID-19 epidemic spreads over the world, vaccination programs have become a critical tool in controlling the spread of the virus. In Malaysia, the national vaccination program is well underway, with the government aiming to vaccinate. There are currently only two effective ways to protect people from an epidemic spreading: vaccines and quarantine. However, a protracted quarantine that covers the whole population would be quite expensive, and immunizations take a long time. By immunizing only, a tiny portion of the population using established methods for selecting recipients, it would be feasible to significantly reduce the economic activity shutdown and limit the spread of viruses (Fanelli et al., 2022).

The government and affiliated organizations are under increased pressure to acquire more vaccines and establish more vaccination facilities as a result of the escalating COVID-19 cases. Additionally, the emergence of new variations has compelled health officials to develop additional mitigation plans in order to finish the booster doses as soon as possible and get ready for newer vaccine vials appropriate for newer variants. Currently, the government leases or outsources public and commercial buildings to establish vaccination clinics (Pilati et al., 2021). A diagnostic and vaccination facility that resembles an emergency room is referred to as a vaccination center. As a result, it is necessary to develop an ideal and typical facility setup and ergonomics taking into account factors such as the movement pattern of the people and healthcare professionals, vaccination procedures and protocols, standard operating procedures, age group of the attendees, and the viability of close contact transmissions, among others (Wong & Lee, 2021).

Due to lengthy lines and heavy crowds, Malaysians have raised worry over crowding at vaccination clinics (PPV). Malaysians have also shared their worries about this on social media. Overcrowding will shorten the vaccination procedure cycle time and raise participants' levels of weariness while also raising the danger of transmission. This scenario will also serve as a source for fresh clusters. The efficient operation of a PPV might also be hampered by poor workplace ergonomics and facility layout. Furthermore, poorly designed PPVs and drive-throughs work inconsistently and with low dependability.

Furthermore, due to poor ergonomics and unfortunate worker-patient relations, the health professional did not

administer the vaccination into the recipient's arms even though the syringe had been placed, according to a report (Freemalaysia.com, 2021). The immunization cycle can be severely disrupted by issues like PPV shutdown. The World Trade Center (WTC) vaccination center (PPV) was shut down as a result of several problems with the facility's usability, congestion, and associated difficulties with the vaccination procedure (Malaymail, 2021). The Covid-19 immunization program in Malaysia has come under fire as worries regarding access in rural regions linger despite the opening of massive vaccination facilities in urban areas (Freemalaysia, 2021).

A well-known newspaper in Malaysia (Straitstimes.com, 2021) has asked practitioners and medical strategists, both private and public, to offer non-traditional, alternative treatments. The use of mega PPV has led to worries about congestion at these facilities. High-risk and disadvantaged populations find it challenging to travel great distances to these larger immunization facilities. Therefore, additional walk-in facilities, mobile outreach programs, small centers, and heavily populated neighborhoods with affordable housing are required. This project will provide a stepping stone for this by first gathering, collecting, and assessing data relevant to this issue and then modelling an ideal PPV center for Malaysia's future by taking into account all the PPV-related process characteristics and variables.

Conclusively, this paper will present the optimized virtual model of vaccination center operations in Malaysia, using a hybrid agent-based and discrete event simulation approach. The aim of our study is to improve the efficiency and effectiveness of the vaccination process for example by identifying potential bottlenecks or inefficiencies and exploring different strategies for optimization. Our study is based on data collected from actual vaccination centers and will be validated and verified using real-world data. We will also conduct sensitivity analyses to explore the impact of different parameters on the vaccination process and identify ways to optimize the overall system based on an optimized virtual model of vaccination center operations in Malaysia, using a hybrid agent-based and discrete event simulation approach

In an agent-based simulation, individual agents with specific characteristics and behaviors are modeled, and their interactions with each other and the environment are simulated over time. This approach can capture the heterogeneity and complexity of the system and how individual agents may influence the system's overall behavior. On the other hand, discrete-event simulation models the system as a series of events that occur at specific points in time. It is suitable for modeling processes with clear start and end times, such as the steps involved in administering a vaccine.

By combining the two approaches, a hybrid simulation can provide a more accurate representation of the system and its components. For example, the agent-based component can model the behavior and decision-making of individual healthcare workers, while the discrete-event component can model the steps involved in administering a vaccine, such as checking patient records, preparing the vaccine, and monitoring the patient after vaccination.

## Related Works

### **Covid-19 Vaccination Operations: Issues, Challenges and Strategies**

The pandemic of COVID-19 has emphasized the value of vaccination as a key measure in preventing the virus' transmission. Numerous nations have started vaccination campaigns in an effort to immunize their populations as soon as possible due to the vaccines' speedy development. However, the successful implementation of these programs is not without challenges. Along with the challenges of vaccine availability, mass immunization is a difficult but necessary duty for the nations. Determining the mass vaccination location is crucial for recovery in this situation, hence a five-step solution is developed in this study to address this real-world issue. The criteria for selecting the mass vaccination sites are first established, and then geographical data are gathered and plotted using Geographic Information System (GIS) software (Çetinkaya et al., 2023). Though their work focused on the mass vaccination sites determination only.

The creation of the COVID-19 vaccine has been a substantial scientific advance. To stop the COVID-19 epidemic from spreading and wreaking havoc, nations from all across the world have pledged to offer licensed vaccinations. Phase II studies have begun for several vaccinations, and the European Union has given its permission to three vaccines (made by AstraZeneca, Moderna, and Pfizer). In order to speed up the COVID-19 response, the World Health Organization (WHO) is working with scientists, international health groups, and non-profit business organizations. To reduce pandemic-related problems, an effective vaccination approach in particular is essential. Governments and academic institutions must thus act and prepare for the use and administration of the vaccine (Bollyky & Bown, 2021). This element, however, heavily depends on the administration and completion of the vaccination phase's obstacles being resolved. Yet, the primary goal is on creating innovative vaccines and demonstrating their effectiveness in people, it is crucial to spot and fix issues with vaccine delivery in order to boost efficacy (Warren & Lofstedt, 2021).

Other than that, previous work reported that large-scale locations, including sports stadiums and conference centers, are converted into vaccination centers to provide vaccinations to a sizable portion of the local population. They complement other locations like primary care and hospital hubs. While hospital-based vaccination facilities focus largely on immunizing healthcare professionals to protect their safety. There are several delays in the vaccination center processes. Inside the vaccination center, there are many bottlenecks caused by queues and process cycle times. There are various uneven process times and queues in the front-end administration process, clinical client assessments, vaccination processes, and post immunization procedures that require adjustment. To comprehend the vaccine-related processes and shorten wait times, several interactions between various departments inside the vaccination center should also be correctly recorded, integrated, and captured (Smith & Smith, 2021). Conclusively, a few issues raised in their work assist the researcher to gain insight and compare with the operations in Malaysia to enhance the vaccination center's operations and procedures.



At PPV, there are few procedures such as they must be checked for symptoms as well as the designated slots, and screening the masses requires special care. This causes a significant delay because forms must also be manually filled out. Several procedures, include inventorying, transferring vaccines both inside and outside the center, and opening vaccines. Spot training exercises for volunteers and medical staff and their impact on performance enhancement also play a significant role. The ideal vaccination rate with a linear patient flow or numerous patient flow stations is governed by all of these factors. Additionally, the vaccination center's internal transportation and storage of vaccines adds to the distinct occurrences (De Boeck et al., 2020). Thus, this issue can be considered for this work as it is significant and related to the problem that has been discussed in the previous section.

Additionally, to complete a vaccine cycle, perfect adherence to national regulations, signed prescriptions, and patient-specific instructions is required. New legal tools called national protocols help immunization programs by enabling a wider range of people to deliver approved vaccinations. To divide the vaccination process into its component sections among diverse teams made up of different clinical and non-clinical experts with varying degrees of seniority, more adaptable procedures are needed (Smith & Smith, 2021). Therefore, their healthcare team with varied levels of experience and skill may deliver vaccinations swiftly and effectively with the use of adaptable protocols. In order to safeguard the general public's health and stop the spread of infectious illnesses, it is crucial to keep vaccination initiatives at the top of the priority list.

A previous work discussed the issue of low pregnancy-related vaccination uptake, which is still low. Their study goals were to outline the creation and adaption of a clinician communication training intervention for maternal vaccinations, and the clinician and staff views from obstetrics and gynecology (ob-gyn) about the intervention's development and suitability for the setting of prenatal care. Methods: The Motivational Interviewing for Maternal Immunizations (MI4MI) intervention's design was based on comparable communication-training techniques for pediatric settings and included presumptive initiation of vaccine recommendations combined with motivational interviewing (MI) for reluctant patients (Cataldi et al., 2022). However, their research was solely mentioned in relation to pregnant women's vaccine uptake.

Due in large part to the several electronic medical record (EMR) systems that are still in use, the present healthcare ecosystem in the United States is beset by inefficiencies in patient care transitions between healthcare providers. The issue of the negative impacts of higher prices, needless administrative load, and duplication of services brought on by the system's data fragmentation, both providers and patients face tremendous irritation. By enabling the transmission of healthcare data that is decentralized, auditable, immutable, and respectful of patient autonomy, blockchain technology offers a viable remedy to reduce or remove these gaps. To create and construct a blockchain application, our interdisciplinary team identified critical activities needed for a handover of care (Abdul-Moheeth et al., 2022). In addition, the widespread issue of data fragmentation in the existing system of healthcare has put a great deal of pressure on both patients and doctors. Recognition, trust, and usability issues appear to be the main obstacles to mainstream use of blockchain technology. For such technology to reach its full potential in the real world and revolutionize the delivery of contemporary healthcare,

more development and scaling are needed (Abdul-Moheeth et al., 2022). Yet, their work has no discussion of the operations of vaccination centres, such as the issues of bottlenecks, lack of resources, wasting of additional resources (healthcare staff), and so on.

Unwarranted variability in clinical practice is a difficult issue in practice, resulting in low-value treatment for providers, payers, and patients as well as poor patient outcomes. The aim of previous study was to evaluate the effectiveness of a novel tool called QualityIQ in assisting primary care physicians in making treatment decisions that are in line with the most recent best practices recognized by the Merit-Based Incentive Payment System. (MIPS). The QualityIQ patient simulation platform was completely automated and features real-time, evidence-based feedback and gamified peer benchmarking. Workup, diagnostic, and management questions were included for every case, along with clear, evidence-based grading guidelines (Burgon et al., 2021). However, they didn't focus on the vaccination center operations, including the procedures, processes, etc.

There are a number of potential vaccinations that have been created and are now being disseminated in several nations. In order to learn how to reconcile economy with infection management in Japan, they assessed several vaccination and intense countermeasure tactics with the constraint of economic loss using a model. Their primary findings were that, assuming a linear link between lockdown intensity and allowable economic loss was assumed, the vaccination plan that prioritized the younger generation was superior in terms of mortality. On the other hand, the old initial techniques worked best in environments with low basic reproduction numbers when a non-linearity relationship was established, suggesting that a powerful lockdown with little economic loss was achievable (Sunohara et al., 2021). Consequently, these findings imply that a number of variables, including as the local transmission rate and the financial consequences of lockdown measures, may affect the efficacy of various vaccination strategies.

A work discussed on the entire globe which is battling the terrifying COVID-19 epidemic, for which there has not yet been a reliable vaccine developed. Researchers and experts are working very hard to create various vaccine tactics that will benefit society. They actually don't know what would work best, therefore it's a fresh concept to pursue a variety of tactics and platforms. With this in mind, they proposed and created a Susceptible-Infected-Removed (SIR) model of the corona virus in their project, using both a continuous and a pulse vaccination strategy in individuals, to demonstrate how vaccination strategy can also play a crucial role in controlling infection and preventing the virus from being produced (Brill et al., 2019). However, this work only focused on examining various vaccine approaches, and it revealed that the experts expect to obtain knowledge about the most effective ways to fight the epidemic and safeguard public health instead of improving the process and procedure in the PPV.

### **Vaccination Operations & Strategies at PPV**

The vaccination center was modelled by the authors as a system with a set number of vaccination stations, each of which serves as a service point. Patients come at the facility and are handled in a succession of steps that may

be compared to a network of service stations. Registration, triage, vaccination, and post-vaccination monitoring are among the network's operations. Patients go from one service point (i.e., vaccination station) to the next as they proceed through the series of activities, and each action is carried out by a separate service point. The authors modeled each service point as a multi-server queue, meaning that each station can process multiple patients simultaneously. Patients arrive at each station according to an arrival process, and the time required to complete each activity (i.e., service time) is modeled as a random variable. Overall, the authors' model can be thought of as a network of service points, where patients are processed sequentially through a series of activities, with each activity performed by a different multi-server queue (i.e., vaccination station) (Wood et al., 2021). Thus, this kind of modelling found to be helpful in improving a vaccine network's operations to increase effectiveness and patient flow.

### **Virtual Model of Vaccination Centre Operations**

Previous work proposed a model that is well suited for evaluating vaccination regimens. In fact, it has been advised that to maximize the likelihood of containing the outbreak, a vaccination program should be carefully chosen if a vaccine is available but in short supply. They analyze and assess several plans, paying particular attention to how shifting the percolation transition point might enable greater mobility without having an adverse influence on the epidemiology (Toledano et al., 2021). Nevertheless, in situations when vaccines may be in low supply, this kind of study is crucial for guiding decision-making on vaccination programs. Instead, then improving the processes at vaccination centers, it may be able to maximize the chance of preventing the spread of the illness by carefully selecting a vaccination program that is optimized for the unique conditions of the epidemic. (PPV).

To demonstrate the efficacy of several adaptation techniques suggested in the literature, a number of fictitious simulations of an H1N1-like pandemic epidemic among the US population will be shown. 100 replications of each simulation set were performed in order to average the stochastic impacts of the parameter(s) uncertainty. In order to help healthcare policy makers, create dynamic, effective health interventions to stop disease outbreaks, the multi-agent model created in this work may be utilized as a decision support system (Kohli et al., 2021). In contrast, their research solely focused on the multi-agent model developed in this study, which may be especially beneficial in guiding decision-making around interventions involving several stakeholders and complicated interactions, such as those engaged in reacting to a pandemic.

When massive mass vaccination drills are planned together with the simultaneous mobilization of large groups of people, the human aspect will also play a significant role. Various factors, including arrival rate, transportation rate, dispatching rate, layout elements, etc., will become available as a result. A great and reasonably priced way to evaluate potential scenario analyses and provide workable answers to issues with vaccine process and layout design is through simulation modelling. In fact, the simulation's outputs—both numerically and visually—display the processing and waiting durations in various contexts. Computer simulations may be thought of as essential tools for modelling various operational fixes for issues that can arise

during any of the crucial vaccination phases inside vaccination clinics. In fact, it is possible to foresee the high level of dynamic uncertainty, which aids planners in imagining what could occur (Gianfredi et al., 2021). As a result, the discussed factors can all have an influence on a vaccine campaign's success and simulation modelling is an effective technique for examining various scenarios and identifying practical solutions to vaccination process and layout design difficulties.

A prior study sought to determine what other nations may learn from China by examining the policies implemented there and comparing them to those in China. Techniques: In Wuhan, they create a system dynamics model of the COVID-19 pandemic. The previous researchers examined the effects of altering factors, such as contact rates, on the emergence of a second wave using a variety of simulations. Results revealed that despite China's health care system being underfunded and ineffective, the epidemic was controlled in a fairly short amount of time, and till now, no second wave was felt in Wuhan. The procedures to stop the outbreak are the same as those used in other nations, but China used them quickly and assiduously. For instance, the subsequent adoption of health regulations and contact-tracking technologies helped to control the spread of the illness and successfully stop the second and third waves. Conclusions: A stringent application of a number of measures, including digital management, is the foundation of China's success in combating COVID-19 (Wang & Fleßa, 2021). However, differences in cultural, political, and economic circumstances must be considered since they may alter the implementation and efficacy of such policies.

A previous work was discussed the use of computer modeling and simulation to improve the operations of COVID-19 vaccination centers. The authors argue that such centers face a number of challenges, including managing vaccine supply, scheduling appointments, and ensuring safe and efficient flow of patients through the center. They suggested that computer modeling and simulation can help address these challenges by allowing for testing and optimization of different operational scenarios. The authors describe their use of a simulation tool called AnyLogic to model a hypothetical vaccination center and explore different operational scenarios using single technique of discrete-event simulation with some form of queueing algorithm to model the flow of patients through the vaccination center. They may have also used optimization algorithms to identify the most effective operational scenarios based on their simulation results. They considered various factors, such as the number of vaccination stations, the rate of vaccine supply, the appointment scheduling system, and the distribution of patients across the center. Thus, simulation model and tools may be quite beneficial in spotting possible difficulties and testing alternative tactics in a risk-free environment before adopting them in the real world.

The results of a previous that focused on the simulations suggest that certain operational scenarios can significantly improve the efficiency and safety of the vaccination center. For example, they find that increasing the number of vaccination stations and implementing a hybrid appointment system (which combines both appointment-based and walk-in vaccinations) can lead to shorter waiting times and improved throughput. Overall, their work demonstrated the potential benefits of using computer modeling and simulation to optimize the operations of COVID-19 vaccination centers. By identifying the most effective operational scenarios, such

tools can help improve the efficiency and safety of such centers, ultimately helping to increase vaccination rates and control the spread of COVID-19 (Wood et al., 2021). The result, the tool may be changed and customized for various vaccination center layouts and circumstances, making it a useful resource for healthcare professionals and policymakers looking to optimize their operations.

### **Modelling Techniques**

To evaluate methods for a vaccination center's operation in the descriptive or predictive modes, the behavior of numerous autonomous systems may be simulated. Their models support research into and explanation of current or anticipated future vaccination-related occurrences. A simulation model is a set of mathematical formulas, computations, and equations that simulates how a system would act and function under various real-world conditions (Kumar et al., 2022). The many components of a system that is essentially characterized by the planned operations it performs in a common environment—the vaccination center—can be broken down into multiple entities. When it comes to solving problems, resolving conflicts, and making decisions, these agents have the intuitive capacity to notice and react to changes in the surrounding environment. In order to assess the design and operation of vaccination centers and to gain an understanding of their emergent behavior and features, agent-based modelling and simulation are used.

The goal of previous project is to model and replicate real-world vaccination facility scenarios using a set of self-governing agents that can be either extremely simple things inside of computer code snippets or extremely complex items. One of the most difficult tasks in the simulation testing is gaining sufficient knowledge about the system in order to build an effective conceptual and logical model. The vaccination center is anticipated to be complicated since it involves several agents or active things interacting with one another and forming associations based on certain intrinsic characteristics, which makes automated reasoning and problem-solving possible. This model will eventually assist in detecting crowd patterns and determining the movement of people and materials inside the vaccination center. Thus, in order to construct a successful simulation model, it is critical to have a solid grasp of the system being modelled (Bank, 2022).

The benefit of integrating discrete event modelling and simulation with agent-based modelling in the design of vaccination centers. The performance and process behavior of vaccination clinics in Malaysia need to be thoroughly examined. This gives individuals and healthcare professionals more ability to influence the immunization process and decide on its effectiveness. In these situations, performance monitoring of every system running within the vaccination center is crucial (Abideen et al., 2020). Therefore, it provides more accurate and complete representations of complex systems, promotes experimentation and optimization in a simulation setting, and enables regular evaluation of performance and enhancement.

A combined strategy using agent-based modelling and discrete event simulation techniques will directly aid in understanding and improving vaccination center-related processes at the tactical and operational levels, which serve as normative models used for decision support. The combination aims to achieve decision automation and

system analysis. Discrete event simulation modelling helps in measuring or quantifying such predictions in the context of a vaccination center since ABM may operate as a system predictor to produce and validate theories and hypotheses about system behavior, but not in a precise way. However, simulations may assist in detecting bottlenecks, projecting system performance under various circumstances, and testing and optimizing various operational techniques to improve the vaccination centers' efficiency and safety.

## Methodology

In order to better understand the obstacles and issues in executing the vaccination process, a study and review of the literature on modelling the operations in vaccination centers (PPV) from 2019 to 2023 has been conducted. This review is then analyzed in tandem with the vaccine process, procedures, and protocols connected to those problems. This report identifies the knowledge gaps and makes recommendations for the next study areas.

### Enhancing A Virtual Model of Vaccination Center Operations with Hybrid Techniques

A simulation model is significant for this study in order to address the issue of staffing and resources at PPVs (Point of Dispensing Vaccination Sites). A simulation model can help identify potential bottlenecks and resource constraints in the vaccination process, and test different staffing and resource allocation strategies to improve efficiency and effectiveness. Thus, the proposed simulation model could be used to forecast the impact of various factors on vaccination operations, such as changes in vaccine supply or demand, staffing levels, or the emergence of new variants of the virus. The main goal of this study is to model a vaccination capsule (virtual prototype for a vaccination facility) with improved performance efficiency and agility through process parameter optimization.

Furthermore, this proposed model could help healthcare providers and policymakers anticipate and prepare for potential challenges and adapt their strategies accordingly. Conclusively, a simulation model of vaccination operations at a vaccination center could be a valuable tool for optimizing the efficiency and effectiveness of vaccination campaigns and improving the ability to respond to emerging public health challenges.

In a virtual dimension, an integrated approach of agent-based modelling (ABM) and discrete event simulation (DES) can assist in understanding, quantifying, and analyzing the movement and behavior of the people, the flow of operations, and their interactions with other systems (agents). Agent-based and discrete event simulation can be used together to model various aspects of healthcare delivery inside the vaccination center. These techniques have been widely used for years to model patient flows, remove bottlenecks, and comprehend how various healthcare system components, such as the vaccination center, work together as a whole. In order to comprehend complex systems' activities and interactions with one another, agent-based modelling and simulation (ABMS) splits and analyses them as individual agents after capturing complicated systems into the vaccine center. It is crucial to take into account aspects like how individuals move about, how they engage with

one another, and how they communicate with one another so that vaccination clinics may make better judgements. In contrast, the DES is integrated here to examine discrete operations and events that occur across the system.

This initiative will also offer various tips on how to organize and set up a vaccination clinic in any location (open or closed), taking into account all of the previously stated factors, as well as contribute to improving the vaccination procedure as a whole. This will only be achieved by modelling and simulating multiple agent interactions across different systems inside a vaccination center, as well as by concurrently measuring the timeline of discrete events connected to the system.

## Results and Findings

There has been a great deal of models to understand the spread of COVID-19, and to help prevention and control strategies. Researchers build compartments according to actual situation, research objectives and complexity of models used. As the COVID-19 epidemic remains uncertain and poses a major challenge to humans, researchers still need dynamic models as the main tool to predict dynamics, evaluate intervention effects, and provide scientific evidence for the development of prevention and control strategies. The compartmental structures reviewed in this study provide guidance for future modeling for COVID-19, and also offer recommendations for the dynamic modeling of other infectious diseases.

A previous research used simulation and data envelope analysis, which reflected the patients' deteriorating states inside the emergency department, to assess the performance of the emergency department in a Jordanian hospital (Al-Refaie et al., 2014). Xu et al. (2018) created an ABMS simulation of an emergency department with the goal of creating a tool that can be used to better understand complicated behavior, assess policy, and run emergency departments more effectively. Using straightforward if/then rules that were primarily concerned with moving, partaking in activities, waiting, and staff scheduling, they simulated the conduct of patients and workers.

In order to evaluate healthcare policies and practice recommendations, simulation on the emergency department using ABS, taking into account patient flows and access to the emergency department. The proposed model also will utilize DES and ABS hybrid model; DES to simulate patient flows and ABS to represent physicians and their delegates and assess the effects of their interactions on an emergency department. Same like a previous work claimed that taking into account an agent-based approach in DES might be beneficial when the model's goal is to attain optimal staff scheduling since the hybrid method enables more accurate representation of scheduled resource utilization and patient throughput (Escudero Marin, 2020). However, none of the experiments described above have fully specified the vaccination center and associated entities. Previous research demonstrates that ABS models provide strong potential to depict normal emergency department activities.

Furthermore, the majority of earlier research in the field of healthcare did not examine the performance and agility of vaccination centers. It would be interesting to trace the activity of the agents inside the vaccination center’s system so that it may be afterwards connected to the waiting times and cycle times of different procedures there. Thus, this research will make a significant contribution to the creation of the ideal virtual vaccination center capsule or cabin prototype, which may then go through an experimental phase. The use of ABM and DES approaches in the design and optimization of vaccination centers might give significant insights into the performance and agility of such centers, which have previously gone largely untapped in healthcare research. It is feasible to relate the behavior of the agents inside the vaccination centers’ systems to waiting periods and cycle times of different operations by tracing their activity within the system. This information may then be utilized to enhance the vaccination centers’ efficiency and efficacy.

The development of a platform-specific model is the main justification for choosing agent-based modelling. Multiple phases that make up an iterative modelling approach define each phase. The employees, vaccine attendees, and other PPV-related authorities are essentially treated as independent systems in an agent-based method, which projects the agent behavior both inside the particular system and with other systems. This agent-based models will provide information on the potential for transmission, the viability of ergonomics, and the enhancement of agility and performance inside the vaccination center in Malaysia. The discrete event model will treat each discrete event that occurs within the PPV as a separate event that is connected to or associated with a specific agent within the system. It also discusses the materials and resources used in PPV and how they interact with people, and it estimates the outcomes in terms of cycle time and lead time for each event. Discrete event modelling uses a bottom-up strategy.

Furthermore, the integration framework of this proposed work will be utilized as depicted in Figure 1 below. This literature review paper summarizes and synthesizes existing research on a particular topic, and presenting the integration framework and proposed research design protocol to be utilized for this work. This framework will assist the researchers in performing this research for the remaining steps or phases, which are important for the methodology.

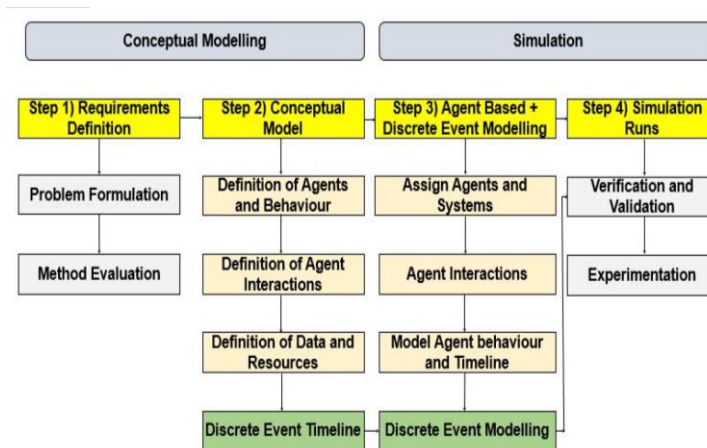


Figure 1. Integration framework of proposed work



Figure 2 presents the proposed research design protocol to utilize for this study. The exploratory study aims to investigate the impact of vaccination center design on the vaccination process the researchers intend to gain a better understanding of how the layout and organization of vaccination centers can affect vaccine operational efficiency. In addition, the study of agent behavior is significant in order to investigate the behavior and interactions of agents in a specific system or environment, with the goal of gaining insights into their decision-making processes and social dynamics. By examining the behavior of agents in different scenarios and environments, we can identify patterns and trends that could inform the development of more effective systems and policies.

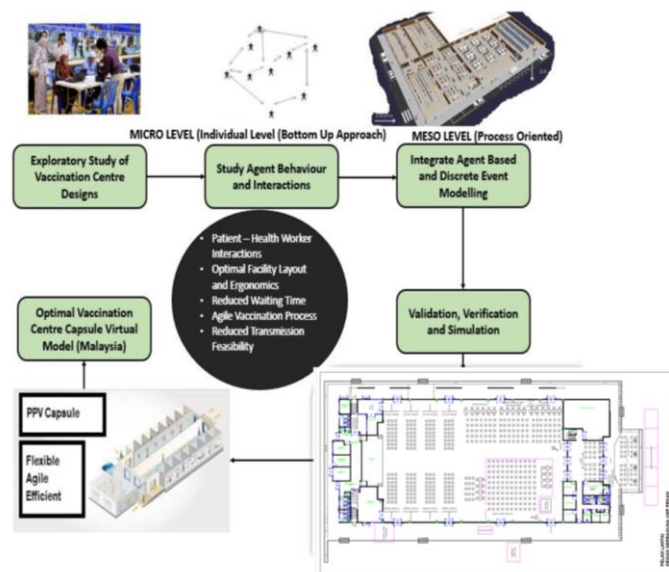


Figure 2. Proposed research design protocol

Furthermore, through this research, we hope to leverage the strengths of both modelling techniques to capture the behavior of individual agents and the system-level dynamics that emerge from their interactions. One of aim for this study is to examine patient and health worker interactions in vaccination centers and identify optimal facility layouts and ergonomics that can improve the vaccination process. Other than that, the proposed work aims to reduce waiting time for patients and develop an agile vaccination process that can adapt to changing circumstances, while also minimizing the risk of transmission based on the investigation of the physical design and layout of vaccination centers to identify areas of inefficiency or congestion that can be addressed to streamline the vaccination process. This research will explore the feasibility of reducing transmission risk in vaccination centers by implementing measures such as physical distancing, enhanced ventilation, and proper hygiene practices.

This study purpose to create a comprehensive and reliable model that can be used to validate and verify the design of the vaccination center, as well as simulate different scenarios and evaluate the impact of various interventions and will leverage advanced computational tools and techniques to develop a realistic and accurate model of PPV operations, which can be used to identify potential bottlenecks or inefficiencies and explore different strategies for optimization.

## Discussion

The COVID-19 breakout has put the capacity of the planet to survive in danger. Even if the virus has been contained to certain regions of the planet after inflicting such damage, the prospect of it reemerging in the future should not be discounted. More than 200 nations and areas throughout the world have been badly impacted by the coronavirus disease 2019 (COVID-19) outbreak, which is regarded as the deadliest global public health disaster in over a century. Researchers have widely used dynamic models to predict and simulate the epidemic's development, comprehend the spread rule, assess the effects of intervention measures, inform vaccination strategies, and aid in the formulation of prevention and control measures in order to effectively prevent and control the epidemic. The compartmental structures employed in COVID-19 dynamic models were sorted out in this study with the intention of serving as a guide for future COVID-19 dynamic modelling and dynamic modelling of other infectious illnesses.

This study is aimed to develop an optimal vaccination center capsule virtual model in Malaysia that can be used to improve the efficiency and effectiveness of the vaccination process with flexible, agile, and efficient features that can be tailored to the specific needs of different communities and populations. Furthermore, this study will leverage advanced virtual modelling and simulation techniques to design a vaccination center capsule that can optimize patient flow, minimize waiting time, and enhance the overall vaccination experience. This study will also explore the feasibility of implementing innovative technologies and processes in the vaccination center capsule to further enhance efficiency, reduce transmission risk, and ensure that vaccines are delivered safely and effectively

Furthermore, this study is going to offer a comprehensive knowledge of how to enhance the design of vaccination facilities in Malaysia, as well as human movement and ergonomics, vaccination process cycle time, and transmission feasibility. The integrated agent-based and discrete event simulation model to aid in comprehending, assessing, and optimizing an entire vaccination center ergonomics of Malaysian PPVs and open up the best opportunities to apply the developed model in actual practical application to improve the PPV design and rubrics in Malaysia taking all the PPV related ergonomics and lead time parameters.

## Conclusion

A simulation model of vaccination operations at a vaccination center could be a useful tool for healthcare providers and policymakers to optimize the efficiency and effectiveness of vaccination campaigns. Such a model could simulate the flow of patients through the vaccination center, the availability of vaccine doses, and the resources needed to administer vaccines, such as staff and equipment. Furthermore, this study intends to develop a simulation model that could be developed using a combination of data from previous vaccination campaigns and input from healthcare providers and other stakeholders. The model could then be used to test different scenarios and strategies for vaccine distribution, such as varying the number of vaccination stations,

adjusting the appointment schedule, or prioritizing certain population groups.

Thus, by using the simulation model to test different scenarios and strategies, healthcare providers and policymakers can identify the most efficient and effective approach for delivering vaccines. This could lead to shorter wait times for patients, better utilization of staff and resources, and more equitable distribution of vaccines. Conclusively, the successful implementation of COVID-19 vaccination programs requires a coordinated and multi-faceted approach. By addressing the issues and challenges facing vaccination operations and employing effective strategies, we can ensure that vaccines are distributed fairly and equitably and that the vaccination process is efficient and effective in controlling the spread of the virus

## Recommendations and Future Works

By using the simulation model to test different scenarios and strategies, healthcare providers and policymakers can identify the most efficient and effective approach for delivering vaccines. This could lead to shorter wait times for patients, better utilization of staff and resources, and more equitable distribution of vaccines. The simulation model could be used to forecast the impact of various factors on vaccination operations, such as changes in vaccine supply or demand, staffing levels, or the emergence of new variants of the virus. This could help healthcare providers and policymakers anticipate and prepare for potential challenges and adapt their strategies accordingly.

In conclusion, adaptability and cost considerations must be taken into account if these strategic protocols are to be effective for all populations across diverse nations. Pandemics like COVID-19 point to the possibility of yet-to-be-identified mutant viral strains and diseases that might still result in outbreaks. There should always be a long-term plan in place to deal with future viral pandemics.

The future study will include a thorough and in-depth review of COVID-19 vaccination center operations and practices in Malaysia. The agent-based and discrete event integration will be used to assess various parametric factors that affect vaccination centers and boost performance agility. It is necessary to develop a PPV design process that is more exact (Bakar et al., 2022; Fernandez et al., 2021). Additionally, the goal of this study is to gather more recent data that will be utilized to reproduce the implications and insights that will be drawn from the study's findings (Mayyagan et al., 2022). This feature directly strengthens the healthcare industry, particularly when looking at the complete immunization process (Rahman et al., 2023).

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## Factor Analysis of Intention to Use Digital Wallet by MSMEs in F&B Sector

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**Abstract:** Since the pandemic hits, we need to adjust specific ways to prevent the spread of COVID-19, primarily due to the enforcement of Social Distancing. In Indonesia, how we purchase things has changed significantly, leading to the growth of Digital Wallet usage in the online and offline sectors. This phenomenon aligns with the government policy and the objective of pursuing a Cashless Society and bringing financial inclusion for MSMEs in Indonesia. To achieve that, the adoption of the technology must be accepted by the Shopper and the Merchant, especially in the more extensive sector such as retail and F&B. This study aims to find the significant variable that influences the adoption of Digital Wallets by merchants in the offline sector by developing a conceptual model based on the Technology Acceptance Model (TAM) and focusing on the outcome of Intention to Use of the technology. A survey of 149 respondents who own a brick and mortar businesses in the F&B sector is collected and analyzed using the PLS-SEM. Out of 13 hypotheses that have been developed, seven were accepted, and six were rejected. The results of the study can be used to help Digital Wallet companies understand the factor that might influence the adoption of the technology by the merchant in the F&B sector.

**Keywords:** Digital Wallet, MSMEs, Technology Adoption, PLS-SEM, Technology Acceptance Model

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### Introduction

In recent years, digital payments have emerged as a popular and transformative technology in the financial sector, revolutionizing the way individuals and businesses conduct transactions. It offer convenient and secure alternatives to traditional cash-based transactions, allowing users to make payments, transfer funds, and manage their finances through mobile applications. Due to the COVID-19 and Social Distancing implementation all over the world, the adoption of digital payment as a contactless payment when shopping has been accelerated. One of the example of digital payment that has been frequently used all over the world because of the pandemic is e-

wallet. The e-wallet or digital wallet is an app-based technology which allows users to make payments of their purchases, receive and transfer funds and top-up funds via their mobile devices, replacing the physical wallet (Andrew et al., 2019). According to Worldpay Inc., e-wallet was the most frequently used payment method globally, in the POS (Point of Sale) sector in 2020, but in Indonesia, cash was the most frequently used payment in the POS sector with 53% of usage compared to e-wallet with 17% of usage (Worldpay, 2021).

Indonesia is a home for more than 65 million MSMEs and many of them still rely on cash-based transactions, limiting their potential for growth and hindering their ability to participate fully in the digital economy. Some of the barriers that might discourage merchants to adopting the technology are technological incompatibility, complexity, the cost of investment, and the lack of critical mass and knowledge (Moghavvemi, et al., 2021). This could be a barrier to achieve cashless society that has been targeted by Bank Indonesia through several program such as National Non-Cash Movement and Indonesian Payment System Blueprint 2025. Through those programs, they are not only encouraging the adoption of digital payment among MSMEs, but they are also contributed to financial inclusion and promote economic development at a broader scale.

Based on the above problem, the aim of the current study is to analyzing factors influencing intention to use digital wallet by MSMEs in F&B Sector in Indonesia, as the sector is one of the biggest sectors contributing to Indonesian Economy by proposing a conceptual model extending a Technology Acceptance Model (TAM) with other factors such as Perceived Compatibility, Awareness, Facilitating Condition, Security, Trust, Perceived Cost, and Perceived Customer Value Addition.

## Literature Review

### Micro Small Medium Enterprises (MSMEs)

As the Indonesian law number 20 of 2008 stated, MSMEs are any company owned by and managed by someone or a group of people that owned certain assets and turnover. Table 1 shows the criteria for MSMEs in Indonesia. The importance of MSMEs in Indonesia also shows from their contribution for Indonesia, according to Coordinating Ministry for the Economics Republic Indonesia in 2022, MSMEs has contributed 60.5% to Indonesia GDP and responsible for 96.9% of employment.

Table 13. Definition of MSMEs

No	Category	Assets	Turnover (yearly)
1	Micro	Maximum Rp50.000.000 excluding land and building	Maximum Rp300.000.000
2	Small	More than Rp50.000.000 to maximum Rp500.000.000 excluding land and building	More than Rp300.000.000,00 to maximum Rp2.500.000.000
3	Medium	More than Rp500.000.000,00 to maximum Rp10.000.000.000 excluding land and building	More than Rp2.500.000.000 to maximum Rp50.000.000.000



## Digital Wallet

Digital Wallet, also known as mobile wallet, m-wallet, or e-wallet is a payment services operated under financial regulations and performed via mobile devices. Mobile wallets enable customers to transact with merchants without using cash, cheques or credit/debit cards. This payment system can store credit card, loyalty card, gift card and sales promotion details (Kuganathan & Wikramanayake, 2014). According to Bank Indonesia, digital wallet is an electronic service for storing payment instrument data including payment methods that utilize cards or electronic money, which can also hold funds for making payments (Bank Indonesia, 2016).

In Indonesia, digital wallet can be a form of extension of financial services to reach the unbanked people, to use it as a buyer, they can choose the brand that available, such as ShopeePAY, Gopay, Dana, or OVO and sign up using their personal identity card. While as a merchant, the providers usually need extra requirements such as taxpayer identification number, business licence, and articles of incorporation.

## Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was introduced in 1986 by Davis, the theory is widely used to predict intention to adopt new technology by organizational users. However, it has an established reputation and has been widely adopted to explain innovative technology adoption by individual consumers (Bailey, Pentina, Mishra, & Ben Mimoun, 2017). The basic TAM model included and tested two specific beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived Usefulness is defined as the potential user's subjective likelihood that the use of a certain system (e.g: single platform E-payment System) will improve his/her action and Perceived Ease of Use refers to the degree to which the potential user expects the target system to be effortless (Davis, 1989).

## Partial Least Square Structure Equation Modeling (PLS-SEM)

Partial Least Square Structural Equation Modeling (PLS-SEM) is one of the Structural Equation Modeling methods that widely used as an exploratory purpose. If the research of the objective is prediction and theory development, then the appropriate method is PLS-SEM (Dash & Paul, 2021). PLS-SEM consists two elements, first is a structural model (inner model) that displays relationships between construct and second is measurement model (outer model) that displays the relationships between construct and the indicator variables (Hair et al., 2021).

## Method

In this study, the research model was developed by extending the TAM model with external factors such as other Perceived Compatibility, Awareness, Facilitating Condition, Security, Trust, Perceived Cost, and Perceived Customer Value Addition. This extension is done based on the literature review of previous study

related to the adoption of digital wallet adoption in the context of merchant perspective. The proposed model consists ten latent variables or constructs with the outcome of intention to use digital wallet as shown in Table 2.

Table 14. Latent Variables Used in Study

Construct	Definition
Perceived Compatibility	The degree of consistency in maintaining existing values, needs and expectations of technology adopters
Awareness	The communication strategy that makes consumers aware about the benefits and utility of a technology and motivate them to purchase and use a new technology such as mobile payment system
Perceived Usefulness	The user's expectation that using a system will improve the performance of a job in the context of an organization
Trust	Emotional state that encourages one to trust another, which is based on the satisfactory behavior of the other.
Perceived Customer Value Addition	The overall benefits and experience perceived or received by consumers, based on the utility and usefulness of a product
Intention to Use	The degree to which a person has consciously formulated plans to perform or not perform some specified future behavior
Perceived Cost	Cost includes cost of payment processes, cost of investment to adopt a mobile wallet system, operating costs and other security related costs
Perceived Ease of Use	The level of complexity associated with using or operating a technology
Security	the belief that provisions for securing sensitive data and preventing data theft or leakage are in place.
Facilitating Condition	the extent to which an individual perceives that organizational and technical infrastructures required to use the intended system are available

We collected the data by conducting a survey of merchants who owns a brick & mortar business in the F&B sector in Greater Jakarta using an online platform and offline visit. The questionnaire contains 42 questions that are considered as an indicator variable. The questionnaire used a 5-point Likert scale, one stands for strongly disagree and five stands for strongly agree. SmartPLS is the software we used to run the PLS-SEM algorithm and analyzed the data for the pilot test and the final model test. Figure 1 shows us the conceptual model of this study and there were 13 hypotheses developed from the model. From the pilot test, there are a total of 12 indicators that were eliminated in order to fulfill the threshold for measurement model evaluation. The eliminated indicators were AWA4, PU1, PU3, PCVA1, PCVA4, SEC5, ITU1, ITU2, FC1, FC2, PEOU3, and TRU4. The next section will explain the evaluation of the final model test using 30 indicators.

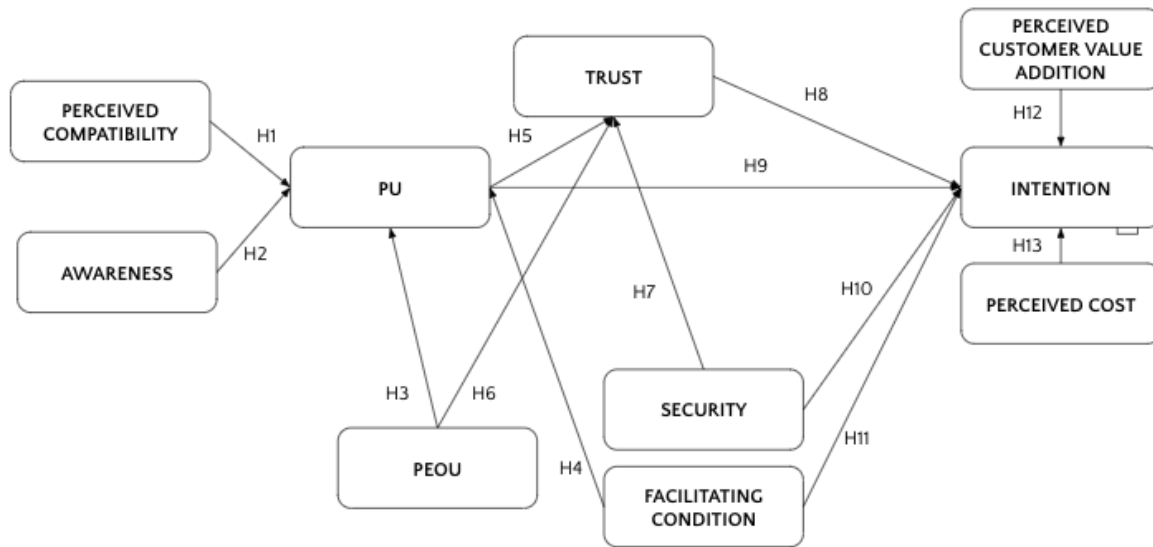


Figure 3. Proposed Conceptual Model

Results and Discussions

Demographic

There are a total of 149 respondents for the final model test. The descriptive analysis of respondent characteristics is shown in Table 3. The respondent profile was that 51% of respondents were female and 49% were male. The age group of 25 – 30 years old dominated the respondents with 27.5%. Most of the respondents is in the micro segmentation of MSMEs with 77.2% and most of the respondents already provided digital wallet payment in their store with 87.9%.

Table 15. Respondents Demographic

		Frequency	Percentage
Gender	Men	73	49.0%
	Women	76	51.0%
Age	18-24	40	26.8%
	25-30	41	27.5%
	31-35	35	23.5%
	36-40	17	11.4%
	41-45	11	7.4%
	46-50	2	1.3%
	51-55	3	2.0%
	Turnover (Yearly)	<Rp300 Million	115
>Rp2.5 Billion		2	1.3%
Rp300 Million - Rp2.5		32	21.5%

	Billion		
Did you provide e-wallet payment method in the store?	Yes	131	87.9%
	No	18	12.1%

### Measurement Model Evaluation (Outer Model)

To conduct measurement model evaluation, we need to confirm the validity and reliability of the model by looking at the indicator reliability, internal consistency reliability, convergent validity, and discriminant validity (Hair et al., 2021).

Indicator reliability indicates how much of each indicator's variance is explained by its construct. Indicator loading above 0.708 are recommended, since they indicate that construct explains more than 50 percent of the indicator's variance which indicates indicator reliability (Hair et al., 2021). From the Table 4 we can see that all indicator has met the threshold.

Internal consistency reliability is the extent to which indicators measuring the same construct are associated with each other. Composite reliability (CR) is the indicator that can be used to indicates an internal consistency reliability (Hair et al., 2021). CR should be more significant than 0.7. Higher value indicate a higher level of reliability (Widodo et al., 2019). From Table 4 we can see that every variable met the threshold for the CR value.

Convergent validity is the extent to which the construct converges in order to explain the variance of its indicators. The metric used The metric used for evaluating a construct's convergent validity is the average variance extracted (AVE) for all indicators on each construct (Hair et al., 2021). The minimum acceptable value for AVE is higher than 0.5, a higher value of AVE indicates that the construct explain more indicator variance that make up the construct (Hair et al., 2021). From the Table 4 we can see that all the AVE value met the threshold.

Lastly, discriminant validity the extent to which a construct is empirically distinct from other constructs in the structural model. The metric used for evaluating discriminant validity is Heterotrait-monotrait ratio (HTMT) (Henseler et al., 2015). Discriminant validity problems can occur when HTMT values are high, therefore the proposed value by Henseler is that HTMT should by lower than 0.9. Table 5 shows the HTMT ratio after eliminating two indicators which was PCOS4 and PCVA5. in order to meet the threshold and all the previous measurement still met the threshold after this process.

Table 16 Measurement Model Evaluation

Variable	Indicator	Indicator Loading	AVE	Composite Reliability
Awareness	AWA1	0.885	0.778	0.913

www.icres.net	May 18-21, 2023	Cappadocia, Turkiye	www.istes.org	
	AWA2	0.865		
	AWA3	0.896		
<b>Facilitating Condition</b>	FC3	0.887	0.776	0.874
	FC4	0.874		
<b>Intention to Use</b>	ITU3	0.942	0.885	0.939
	ITU4	0.939		
<b>Perceived Compatibility</b>	PC1	0.879		
	PC2	0.881	0.781	0.915
	PC3	0.893		
<b>Perceived Cost</b>	PCOS1	0.819		
	PCOS2	0.883	0.706	0.878
	PCOS3	0.816		
<b>Perceived Customer Value Addition</b>	PCVA2	0.884	0.803	0.891
	PCVA3	0.908		
<b>Perceived Ease of Use</b>	PEOU1	0.861		
	PEOU2	0.884	0.761	0.927
	PEOU4	0.88		
	PEOU5	0.864		
<b>Perceived Usefulness</b>	PU2	0.896	0.795	0.886
	PU4	0.887		
<b>Security</b>	SEC1	0.857		
	SEC2	0.871	0.715	0.909
	SEC3	0.796		
	SEC4	0.855		
<b>Trust</b>	TRU1	0.898		
	TRU2	0.896	0.802	0.924
	TRU3	0.892		

Table 17 HTMT Evaluation

Variable	AWA	FC	ITU	PC	PCOS	PCVA	PEOU	PU	SEC	TRU
<b>AWA</b>										
<b>FC</b>	0.706									
<b>ITU</b>	0.659	0.771								
<b>PC</b>	0.729	0.806	0.74							
<b>PCOS</b>	0.652	0.802	0.749	0.762						
<b>PCVA</b>	0.781	0.876	0.848	0.725	0.863					
<b>PEOU</b>	0.711	0.851	0.762	0.835	0.674	0.741				

<b>PU</b>	0.702	0.848	0.858	0.827	0.798	0.837	0.89		
<b>SEC</b>	0.742	0.787	0.784	0.868	0.837	0.848	0.723	0.854	
<b>TRU</b>	0.756	0.796	0.833	0.805	0.829	0.882	0.792	0.812	0.882

### Structural Model Evaluation (Outer Model) & Hypotheses Testing

The first step of structural model evaluation is checking for collinearity issues. The metric that is used for this is Variance Inflation Factor (VIF) value. The VIF value should not exceed 5 in order to avoid collinearity issues. Table 6 shows that all relationships of the endogenous variable have met the threshold.

The second step is to assess the significance and relevance of the structural model relationship. A path coefficient is significant at the 5% level if the value zero does not fall into the 95% confidence interval. In terms of relevance, path coefficients are usually between  $-1$  and  $+1$ , with coefficients closer to  $-1$  representing strong negative relationships and those closer to  $+1$  indicating strong positive relationships. Based on the path coefficient, all the relationship of the endogenous variable are positive. Table 7 showed that PC significantly influence PU, PEOU significantly influence PU, PEOU significantly influence TRU, SEC significantly influence TRU, TRU significantly influence ITU, PU significantly influence ITU, and PCVA significantly influence ITU.

Then, we analyze the model explanatory power by examining the coefficient of determination  $R^2$ . The value of  $R^2$  range between  $0 - 1$ ,  $R^2$  values of 0.25, 0.50, and 0.75 can be considered weak, moderate, and substantial, respectively, in many social science disciplines (Hair et al., 2011). From Table 7 we know that all the  $R^2$  is considered in the moderate category. The variable Intention to Use variance can be explained by the existing variables within this study is 64.3%, The variable Perceived Usefulness can be explained by the existing variables within this study is 58.5%, and the variable Trust can be explained by the existing variables within this study is 67.3%. While the other remaining could be explained by other variables outside the study.

The last step is to use blindfolding procedure to determine the model predictive relevance. A positive value of  $Q^2$  indicates that model have a good predictive relevance. From the Table 7 we know that  $Q^2$  had a positive value which means that the model had a predictive relevance.

Table 18. VIF Value of The Model & Path Coefficient

Hipotesis	Path Coefficient	VIF
<b>FC -&gt; ITU</b>	0.068	2.093
<b>PCOS -&gt; ITU</b>	0.047	2.448
<b>PCVA -&gt; ITU</b>	0.196	2.627
<b>PU -&gt; ITU</b>	0.255	2.288

SEC -> ITU	0.081	3.202
TRU -> ITU	0.282	3.227
AWA -> PU	0.088	1.869
FC -> PU	0.155	2.05
PC -> PU	0.203	2.553
PEOU -> PU	0.418	2.775
PEOU -> TRU	0.327	2.316
PU -> TRU	0.056	2.589
SEC -> TRU	0.525	2.064

Table 19 Hypotheses Testing

	Hipotesis	T Statistics	P-Value	Status
H1	Perceived Compatibility -> Perceived Usefulness	2.495	0.02	Accepted
H2	Awareness -> Perceived Usefulness	1.306	0.238	Rejected
H3	Perceived Ease of Use -> Perceived Usefulness	3.952	0	Accepted
H4	Facilitating Condition -> Perceived Usefulness	1.708	0.078	Rejected
H5	Perceived Usefulness -> Trust	0.79	0.51	Rejected
H6	Perceived Ease of Use -> Trust	3.409	0.001	Accepted
H7	Security -> Trust	5.513	0	Accepted
H8	Trust -> Intention to Use	2.06	0.041	Accepted
H9	Perceived Usefulness -> Intention to Use	2.64	0.007	Accepted
H10	Security -> Intention to Use	0.602	0.557	Rejected
H11	Facilitating Condition -> Intention to Use	0.772	0.484	Rejected
H12	Perceived Customer Value Addition -> Intention to Use	2.069	0.037	Accepted
H13	Perceived Cost -> Intention to Use	0.618	0.603	Rejected

Table 20 R Square and Q Square Value

Variable	R Square	Q Square
Intention to Use	0.643	0.534
Perceived Usefulness	0.585	0.447
Trust	0.673	0.524

## Conclusion

In conclusion, this study identifies that Perceived Usefulness, Perceived Customer Value Addition, and Trust can directly influence the intention to use digital wallet by MSMEs in F&B sector in the Greater Jakarta, Indonesia. While Perceived Compatibility, Perceived Ease of Use, and Security indirectly influence their

intention to use digital wallet. The Q Square value also indicates that the model had a predictive relevance.

## Recommendations

This study is limited to identifying factors of a intention to use digital wallet by MSMEs in F&B sector in Greater Jakarta, Indonesia. Future study is needed to analyze and compare the condition between the rural and urban area in Indonesia. Also, to improve predictive relevance, future study could add more variables such as performance expectancy and social influence.

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## Understanding User Acceptance of Fintech Mobile Payment Services in Indonesia: A Strategy to Increased Usage Using UTAUT and TTF Model

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**Abstract:** The COVID-19 pandemic has transformed the way people interact with technology and conduct transactions. As cashless transactions become increasingly important, digital payment applications have experienced a significant surge in usage worldwide. The objective of this study is to identify the factors that influence user acceptance of fintech applications in Indonesia using UTAUT and TTF. The findings indicate that usability, ease of use, perceived self-control, and perceived trust have a positive and significant impact on users' intention to use fintech applications. However, perceived security does not appear to have a significant influence on users' intention to use fintech applications. Data were collected from active users of digital payment app. Findings indicate that app experiences generate usability, ease of use, perceived self-control, and perceived trust among active users of the app. This research provides a valuable contribution to understanding the factors that affect the acceptance and use of fintech applications in Indonesia. For fintech businesses, this research may assist fintech application developers in enhancing application features and functionality to better suit user needs and preferences.

**Keywords:** User Experience, Unified Theory of Acceptance and Use of Technology, Digital Payment, Product Designer, Product Management

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### Introduction

The use of e-money in Indonesia has experienced significant growth in recent years. Based on data from Bank Indonesia, e-money transactions in Indonesia increased from IDR 71.4 trillion in 2018 to IDR 121.3 trillion in 2020. The growth in e-money usage indicates that Indonesian society is becoming more interested in and using e-money services in their daily lives. The e-money market in Indonesia holds great potential for further development. This is due to Indonesia being the fourth most populous country in the world, with stable

economic growth and a population that is increasingly familiar with technology. The use of e-money is also supported by various innovations and government programs that encourage e-money adoption as a safer and more efficient payment method.

The measurement of e-money application adoption is crucial in understanding the factors that influence public acceptance of e-money applications. The UTAUT (Unified Theory of Acceptance and Use of Technology) model and the TTF (Task Technology Fit) model are two commonly used models for measuring technology acceptance and usage. These models have been tested in various contexts, including the use of e-money applications in different countries.

This research focuses on the e-money application within the AstraPay app using the UTAUT (Unified Theory of Acceptance and Use of Technology) and TTF (Task Technology Fit) methods to understand the factors influencing the intention and usage behavior of e-money users in the AstraPay app. By understanding these factors, this study can provide insights into how to enhance e-money usage in Indonesia and promote broader technology adoption.

### **Problem Formulation**

- What is the influence of technological performance, ease of use, perceived usefulness, perceived ease of use, perceived risk, and social support on the intention to use e-money in Indonesia?
- To what extent is the usage of e-money in Indonesia influenced by the fit between the task of using e-money applications and the technology used (TTF)?
- How do social factors influence the usage of e-money in Indonesia, and do these factors reinforce or weaken the influence of technological factors (UTAUT) on the intention to use e-money?
- Are there differences in the factors influencing the intention and usage behavior of e-money among different user groups in Indonesia (e.g., based on age, gender, or technology experience)?

### **Method**

#### **Types of Data in the Research**

The data used in this study is primary data, obtained through direct collection from respondents using questionnaires. Primary data is used to address the research variables being observed (Creswell, 2003). Data collection was conducted online from respondents. In this study, the respondents are active users of the AstraPay application, where active users are defined as the number of users who conduct transactions on a monthly basis, in accordance with the data collection process. The survey of these respondents was conducted to obtain data related to users' perceptions of continued usage of the application. The questionnaire was developed based on relevant studies (Huang et al., 2017; S. Kumar & Shah, 2021; Yang et al., 2020) that have been conducted in the UTAUT and TTF models.

### Conceptual Model Design

The design of the conceptual model serves as a reference for the data collection and analysis process among the variables within the model. In this study, the conceptual model is built based on previous literature reviews. Several variables used in the model are taken from previous UTAUT and TTF studies. These variables include Technology Characteristic, Task Characteristic, Task Technology Fit, Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Condition. The analysis of variables in the developed model serves as a reference for the conceptual model development in this research.

J. K. Hsieh et al. (2014) conducted a study on smartphone usage and its impact on daily life. This study explored the relationship between smartphone usage, stress, and daily productivity. Additionally, the study found that excessive smartphone usage was negatively associated with daily productivity, as participants who used their smartphones more frequently and for longer durations reported lower levels of daily productivity.

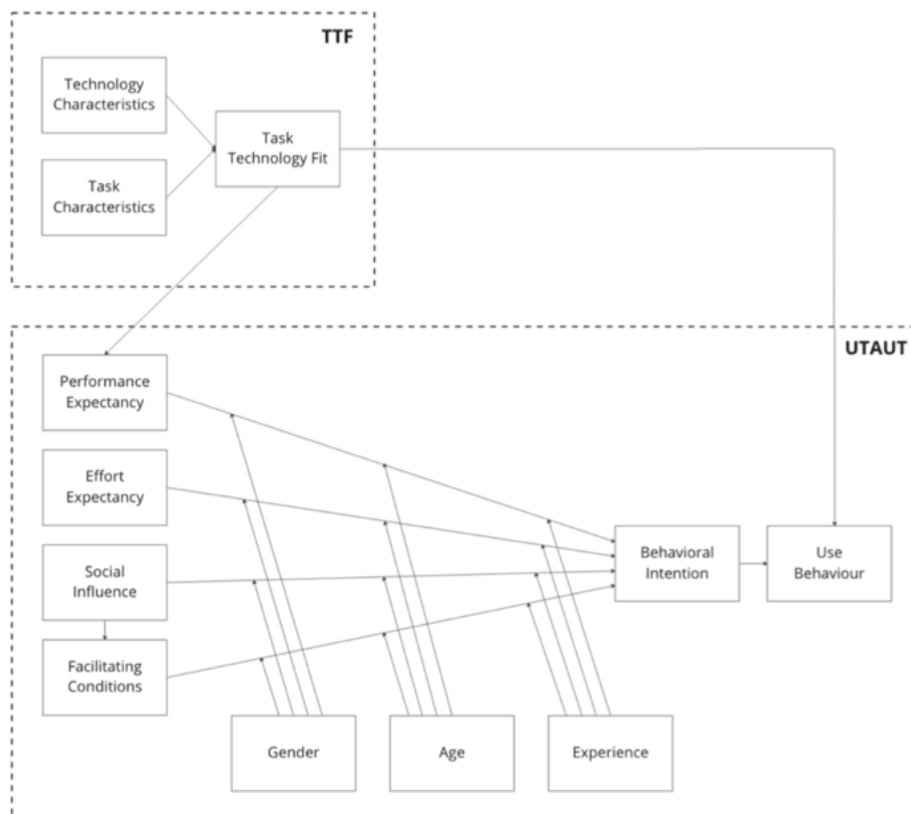


Figure 1. Research Model

- H1. Technology characteristics have a positive influence on Task Technology Fit.
- H2. Task characteristics have a positive influence on Task Technology Fit.

Task technology fit is a rational perspective on what a new technology can do to optimize a task. It is influenced by the nature of the task and the practicality of the technology to accomplish that task.

Therefore, TTF influences the user's attitude towards e-money and its adoption. Hence,

- H3a. Task Technology Fit has a positive influence on user adoption of e-money.

UTAUT states that the user's attitude towards technology translates into performance expectations (Venkatesh et al., 2003). In other words, users may adopt e-money because of the expected benefits such as the ability to control personal finances remotely and conduct instant and secure fund transfers. Therefore,

- H3b. Task Technology Fit has a positive influence on e-money's performance expectations.
- H4a. Performance expectations have a positive influence on the behavioral intention to adopt e-money.
- H4b. Performance expectations have a positive influence on the user's initial trust in e-money.

Effort expectancy is defined as the perceived ease associated with system use (Venkatesh et al., 2003). This construct reflects the user's perceived ease of use (TAM) of an IS (Kuo & Yen, 2009; Luarn & Lin, 2005; Martins et al., 2014; Miltgen et al., 2013; Wang, Lin, & Luarn, 2006) and has a positive impact on behavioral intention. The user interface, content design, and functional capabilities (Kim et al., 2009; Venkatesh et al., 2003) of e-money can influence its adoption.

- H5. Effort expectancy has a positive influence on the behavioral intention to use e-money.

Social influence is a direct antecedent of behavioral intention. Venkatesh et al. (2003) defined social influence as the extent to which an individual perceives it important for others to believe that they are using the new technology or meeting others' expectations. This is the idea that individual behavior is influenced by how peers or family members perceive the use of mBanking. The individual may feel trendy and professional by using new technology services like e-money.

- H6. Social influence has a positive influence on the behavioral intention to use e-money.

Facilitating conditions are UTAUT constructs considered to have a direct influence on technology adoption. It is defined as the extent to which an individual believes that the organizational and technical infrastructure is in place to support system use (Venkatesh et al., 2003). Various e-money promotion methods and organizational support eliminate usage barriers and influence adoption.

- H7. Facilitating conditions positively influence e-money adoption.

As theorized by UTAUT, age and gender have a positive influence on behavioral intention due to their moderating effects on performance expectations, effort expectations, and social influence. Additionally, age also has a positive influence on adoption due to its moderating effect on facilitating conditions. The aim of this research is to determine whether the intention to adopt e-money leads to the decision of adoption.

- H8. Behavioral intention to use e-money has a positive influence on user adoption.

## Object Research

Object of this research is an e-money application used for transactions, particularly in the Astra environment. AstraPay is among the top 10 e-money applications in Indonesia. AstraPay is a digital wallet application by Astra that has 5 main functions: Installment Payments, Digital Product Purchases, QRIS Feature, Paylater, and

Points Exchange. As of 2023, AstraPay has 8 million users across Indonesia. The AstraPay application was launched in 2019. The average number of active users of the AstraPay application is 657,350 individuals. The number of active users represents the users who engage in transactions on a monthly basis.

### Research Questionnaire

Questionnaire is divided into three main sections. The first section collects demographic information about the respondents to understand their profile. The second section consists of statements aimed at understanding their preferences and usage tendencies regarding the application's attractive features. The third section includes the survey questions about the application usage, with the 15 statements based on previous research. The questionnaire utilizes a Likert scale, where a value of 1 represents the lowest or strongly disagree, while a value of 5 represents the highest or strongly agree.

### Research Respondents

The research respondents are individuals who have used or are currently using the AstraPay application in the past 6 months. A total of 61 responses were obtained, and 60 of them were considered valid. The demographic information collected in the questionnaire includes respondents' names, gender, age, education level, occupation, and a selection question to determine their willingness to participate in the survey. If respondents choose not to participate, they will not have access to the entire questionnaire and will be directed to the end of the study, ensuring that they do not provide random statements.

### Results

From the validity test results on the 15 questionnaire statements, it was obtained that the Kaiser Meyer-Olkin (KMO) measure had a value of  $\geq 0.05$  and the Bartlett's test had a value of  $\leq 0.05$ . In other words, the questionnaire used is considered valid as a measurement instrument for each construct variable in the model.

Table 1. Validity Test

Variabel Laten	Jumlah Pertanyaan	Validitas		Keterangan
		Nilai Kaiser- Meyer-Olkin (KMO)	Nilai Sig. Bartlett's Test	
Technology Characteristic (TE)	2	0,500	0,001	Valid
Task Characteristic (TA)	2	0,500	0,001	Valid
Task Technology Fit (TT)	3	0,680	0,001	Valid
Performance Expectancy (P)	2	0,500	0,001	Valid
Effort Expectancy (E)	2	0,500	0,001	Valid
Social Influence (S)	2	0,500	0,001	Valid
Facilitating Condition (F)	2	0,500	0,001	Valid

From the reliability test results on the 15 questionnaire statements, it was obtained that the overall Cronbach's alpha coefficient value was  $\geq 0.07$ . In other words, the questionnaire used in the research is considered reliable as a measurement tool for each construct variable in the model.

Table 2. Reliability Test

Variabel Laten	Jumlah Pertanyaan	Nilai Cronbach's Alpha	Keterangan
Technology Characteristic (TE)	2	0,766	Reliabel
Task Characteristic (TA)	2	0,849	Reliabel
Task Technology Fit (TT)	3	0,809	Reliabel
Performance Expectancy (P)	2	0,868	Reliabel
Effort Expectancy (E)	2	0,731	Reliabel
Social Influence (S)	2	0,858	Reliabel
Facilitating Condition (F)	2	0,866	Reliabel

Based on the Fornell-Larcker criterion, the results indicate that each construct has higher values compared to other constructs. Therefore, it can be concluded that the Fornell-Larcker criterion for each endogenous and exogenous variable is met in this stage.

Table 3. Fornell-Larcker Test

	Technology Characteristic (TE)	Task Characteristic (TA)	Task Technology Fit (TT)	Performance Expectancy (P)	Effort Expectancy (E)	Social Influence (S)	Facilitating Condition (F)
Technology Characteristic (TE)	0,949						
Task Characteristic (TA)	0,774	0,932					
Task Technology Fit (TT)	0,688	0,489	0,821				
Performance Expectancy (P)	0,503	0,353	0,532	0,942			
Effort Expectancy (E)	0,716	0,575	0,694	0,565	0,916		
Social Influence (S)	0,551	0,596	0,638	0,658	0,654	0,886	
Facilitating Condition (F)	0,612	0,502	0,520	0,556	0,648	0,809	0,974

Based on the analysis, it is found that some construct variables have a moderate effect, while others have a high effect. This indicates that the relationships between the exogenous and endogenous variables have a significant impact based on the perceptions of the e-money application users.



Table 4. R-Square Test

	R <sup>2</sup>	Keterangan
Technology Characteristic (TE)	0,352	Moderate
Task Characteristic (TA)	0,809	High
Task Technology Fit (TT)	0,809	High
Performance Expectancy (P)	0,660	Moderate
Effort Expectancy (E)	0,660	Moderate
Social Influence (S)	0,747	Moderate
Facilitating Condition (F)	0,747	Moderate

## Discussion

The results of the study revealed several key insights regarding user acceptance. Firstly, the analysis of the UTAUT model showed that the characteristics of e-money technology had a positive influence on Task Technology Fit (TTF). This suggests that users perceive e-money as a practical and efficient tool for completing financial tasks, leading to a favorable attitude towards its adoption.

Additionally, the study found that task characteristics significantly impacted TTF. Users were more likely to accept and adopt e-money services when they perceived them as aligned with their task requirements, such as the ability to remotely manage personal finances and perform instant and secure fund transfers. This highlights the importance of tailoring e-money services to meet users' specific task needs, which can enhance user acceptance and adoption.

Moreover, the findings revealed a positive relationship between TTF and users' adoption intention towards e-money. When users perceived a good fit between the technology and their tasks, they were more likely to develop positive attitudes and intentions towards using e-money. This emphasizes the crucial role of TTF in shaping users' behavioral intentions and promoting the adoption of fintech mobile payment services.

The study also examined the impact of performance expectancy on adoption intention and initial trust towards e-money. The results indicated that users' expectations of the benefits and performance of e-money, such as user interface design, content, and functional capabilities, positively influenced their adoption intention. This highlights the importance of delivering a user-friendly and functional e-money application to meet users' performance expectations and foster their trust in the system.

Furthermore, the analysis revealed the influence of social influence on users' adoption intention. Users' perception of social norms and the opinions of peers and family members played a significant role in shaping their intentions to use e-money. This suggests that users may view the adoption of e-money as trendy and professional, influenced by the behavior and judgments of their social circle.

The facilitating conditions were found to positively influence the adoption of e-money. Users perceived the support and infrastructure provided by organizations and promotional efforts as instrumental in eliminating usage barriers and facilitating adoption. This underscores the importance of creating a conducive environment and providing necessary support to encourage the adoption of fintech mobile payment services.

Lastly, the study examined the moderating effects of age and gender on users' behavioral intentions. It found that both age and gender had positive moderating effects on different variables, such as performance expectancy, effort expectancy, and social influence. These findings suggest that age and gender play a role in shaping users' perceptions and behavioral intentions towards e-money, highlighting the need for targeted strategies and customized approaches to address the unique preferences and concerns of different user segments.

Overall, the findings of this study provide valuable insights into user acceptance of fintech mobile payment services in Indonesia. By employing the UTAUT and TTF models, the study contributes to the existing literature by identifying the key factors influencing user acceptance and proposing strategies for increasing usage. The findings suggest that optimizing technology characteristics, task alignment, performance expectations, social influence, facilitating conditions, and considering demographic factors can enhance user acceptance and adoption of fintech mobile payment services. These insights can inform the development of more effective strategies to drive the widespread adoption and usage of fintech mobile payment services in Indonesia.

## Conclusion

This research aimed to understand the user acceptance of fintech mobile payment services in Indonesia using the Unified Theory of Acceptance and Use of Technology (UTAUT) and Task-Technology Fit (TTF) models. The findings provide valuable insights into the factors influencing user acceptance and suggest strategies to increase usage of these services.

The results showed that the questionnaire was a valid and reliable instrument for measuring the constructs in the conceptual model. The Kaiser Meyer-Olkin (KMO) and Bartlett's test indicated the validity of the questionnaire, while the Cronbach's alpha coefficient confirmed its reliability.

Furthermore, the analysis of the outer and inner models demonstrated the predictive nature of the variables and manifest indicators, indicating their ability to measure user perceptions accurately. This provides a clear understanding of the variables that need attention for improving the user experience (UX) of the observed e-money application.

Based on the Fornell-Larcker criteria, each construct variable showed higher values compared to other construct variables, indicating that the variables met the required standards. This confirms the suitability of the UTAUT

and TTF models for understanding user acceptance of fintech mobile payment services in Indonesia. The results also revealed that certain construct variables had a moderate effect, while others had a high effect. This emphasizes the significant impact of these variables on user perceptions and acceptance of e-money applications.

In conclusion, this study contributes to the understanding of user acceptance of fintech mobile payment services in Indonesia. By applying the UTAUT and TTF models, valuable insights into user perceptions and acceptance were gained, leading to the identification of strategies to increase usage. These findings provide a foundation for future research and the development of improved strategies to enhance the adoption and usage of fintech mobile payment services in Indonesia.

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## Analysis of Vocational Education and The Role of The Teacher

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**Abstract:** Technical, economical, and social changes place great demands on the qualification of professional forces in all areas of the national economy. The decisive foundations for these qualifications are built in vocational education. Vocational education is an investment in the future and one of the decisive pillars of the prosperity of every state in the future horizon of competitiveness. From that follows that the topic of professional dual education is becoming more and more relevant in all countries of the world. Economic experts at the moment state, that overall unemployment among young people is higher compared to other years, and at the same time, there is a lack of qualified personnel for professional positions in various work areas. Many states see the solution to this problem in the implementation of dual education, so individual countries have begun to take the necessary measures. The advantages of adapting curricula to the demands of the economy and business are obvious and transparent, so the public and private sectors, as well as non-profit and non-governmental organizations support this agenda. The article analysis the elements of dual education in individual European countries with a special focus on dual education in Slovakia. A meaningful motivating factor for its qualitative rise can be the comparison of the vocational education system in individual European countries.

**Keywords:** Vocational Education, Employment, Professional Skills

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### Introduction

*„Those who see the existence of all mankind in their own person are miserable. Obviously, that man will disappear as an individual. The need for any person to be satisfied and happy to live is to work not for himself but for the future. An insightful man can only act this way. Full enjoyment and happiness in life, but the honor, presence, happiness of future generations can be found.“*

*Mustafa Kemal – Atatürk*

Vocational education has a unique and irreplaceable place in the education system of each country. On the one hand, vocational education is based on the pillars of general basic education; on the other hand, its natural outcome is to reflect on the world of work and to cooperate consistently with it. The world of work needs feedback for training. The meaningful and desirable transition of vocational education graduates to the world of work and their effective application in professional life depends on the degree of sensitivity and readiness with which vocational education is able to respond to developments in the world of work. Dual education is one of the most effective ways of education in vocational education. Formally, this education directly enshrines the principle of theoretical education in schools in combination with the performance of practice directly on the premises of companies and industrial enterprises.

At present time, which is characterized by rapid changes in science, technology and society, the role of vocational training is increasingly needed. The quality of education is checked only in the future. Therefore, forecasts of development in the world of work as a whole and in individual professions and on the labour market for vocational education are very important. The content of the curriculum and teaching methods have to be adapted to what graduates will need in the transition from the world of education to the world of work and in their application. Education has to provide them not only with immediately applicable knowledge and skills, but also with such equipment that will not allow them to stagnate at the achieved stage of development, but will enable them to continue their education, develop their skills, know how to solve problems, etc.

The private sector and employers in Slovakia have already been stating for several years that vocational schools do not adequately prepare students in the required fields. They also point to the fact that practical teaching is not sufficient and in such conditions that would prepare them for post-study practice. Although the dual education is gradually being introduced in Slovakia at this time, it is not possible to speak about a new type of vocational education, because the dual education had a significantly excellent qualitative background in our education in the second half of the twentieth century.

Contact with the world of work, which should lead to the acquisition of adequate competences and skills, is a professional matter and cannot be provided to the necessary extent only by schools within their teaching. Therefore, in most countries, this role is performed by special institutions that deal professionally with the issue of vocational training. At present, these institutions mainly cover the issue of dual education. The scope of their tasks is not the same in all cases. However, they always find out, collect and process knowledge about what are the qualification requirements of individual professions and how these requirements develop. They use several hundred external collaborators to collect these data. Depending on their position among other actors involved in vocational training, these institutions then either pass on their findings to other bodies that propose the concept of vocational training and create vocational training programs, or implement these themselves or in cooperation with others.

In most cases, they also assess the effectiveness of vocational education, which is reflected in the employment opportunities of graduates and their success in employment. In this context, they monitor the situation on the

labor market and often process statistics on vocational training and its results, including data on the costs of such training. Some institutions also pay attention to the issues of the process of vocational education, elaborate its didactic and methodological concepts, and propose suitable teaching aids. According to national traditions and the organization of the education system, they also intervene in the field of teacher training, especially for masters of vocational training.

### **The meaningfulness of dual education**

The meaningfulness of dual education lies primarily in its connection to the current needs of the labour market. The labour market itself and the dual system are very closely linked. In a society where there is cooperation between schools, companies and social partners, schools may teach theoretical and practical subjects directly according to the needs of individual companies. Dual education graduates have the opportunity to use the acquired competencies and skills in practice. The importance of dual education can be defined in terms of the elements involved as follows:

#### **The importance of dual education for pupils**

Dual education is beneficial for students because they get to know their future profession directly in the company or company active in the labour market. Students have at their disposal real machines and equipment, which they will later use in the performance of their profession. They may work with the latest modern technologies that companies use in production. Usually, these machines and equipment would not reach schools as teaching aids until later. In addition, they will become familiar with work practices, acquire work habits, and the transition between schooling and working life after school will be natural for them. An important factor is the motivation of students with financial evaluation. In the labour market, they will be interesting candidates for companies immediately after finishing school. In countries where the dual education system has been in operation for several years, the average monthly earnings for dual system graduates are higher than for graduates whose education is based only on traditional schooling.

#### **The importance of dual education for employers**

Labour market surveys in European Union countries (e.g. Germany, Austria, Denmark, Norway) show that dual education has a positive impact on the private sector, trading companies and their employees. From the company's point of view, this means a benefit for the whole economy and the financial stability of the company. The main benefit for companies is the fact that the offered opportunity of study places for students, the companies will gain in future quality workers who can bring to the company new knowledge they gained during their studies. Pupils can bring new ideas or stimulus to the company to improve, simplify and increase work efficiency.

In some countries, companies that cooperate with schools within the dual system may reduce their income tax base for each pupil.

### **The importance of dual education for secondary vocational schools**

An important factor is the cooperation between the school and the employer. The aim of this cooperation is to adapt theoretical education and practical training to the requirements of practice, the labour market and the employer. Vocational study may thus be described as more effective. It is clear that the study therefore reflects the needs of society in real time and can respond flexibly to its needs.

### **The importance of dual education for society and the country**

In the current setting of a society that has been claiming the adjective "knowledge society" since the beginning of the millennium, it is clear that economic growth directly affects the quality of education. This dependence has a two-way effect. Qualified staff, graduates who can easily find employment, the interconnection of the public and private sectors, lower unemployment, efficiency and work productivity due to skills acquired during their studies - these are all factors that directly underline the importance of dual education for the whole society and the state. Dual education is a system of vocational education and training for the pursuit of a profession, which acquires the knowledge, skills and competences necessary for the profession. It is characterized in particular by a close connection between general and vocational theoretical education in secondary vocational school with practical training at a specific employer.

The system of dual education is unique by the fact that it creates a partnership between the employer and the pupil, which is defined in the form of an apprenticeship contract, which regulates the rights and obligations of the parties in relation to the practical teaching of the pupil. Another important aspect of the dual education system is the relationship between the employer and the school concluded on a contractual basis in the form of a dual education contract, which regulates in particular the scope, conditions and coordination of vocational education with the apprenticeship contract, i.e. coordination of theoretical and practical teaching. The employer is responsible for all practical training, and also bears all costs.

### **Institutions responsible for the development of dual education in selected EU countries**

This subsection describes the most important institutions covering dual education within vocational education and its activities in individual countries of the European Union and Europe

#### **Austria**

*The IBW Institute for Economic Education Research* (Institut für Bildungsforschung der Wirtschaft) deals

with the related fields of education and economics. All the institute's projects are usable in practice and relevant for the economy. It publishes periodicals available on the website: IBW-Mitteilungen (in German and English); IBW-research Brief (brief, four-page, thematically focused studies in German and English); Berufsinformation Newsletter (bimonthly internet magazine).

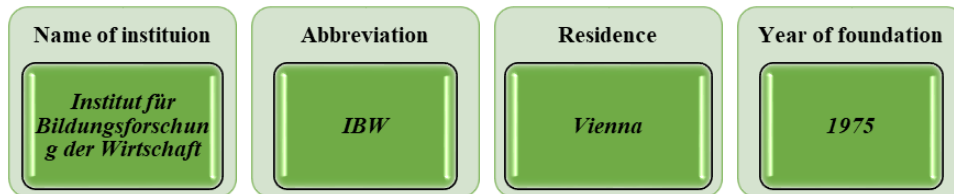


Figure 1 Institution of dual education in Austria

**Belgium**

The Walloon Office for Vocational Training and Employment (Le FORMY, Office wallon de la Formation professionnelle et de l'Emploi) has offices in 12 towns. It provides personalized services to individuals (advice in professional preparation, job search, support for geographic mobility, validation of competences, and specific help for young people), provides professional support to businesses (finding suitable qualifications, advice in education and hiring, assistance in human resources management), and creates partnerships with public and private institutions.

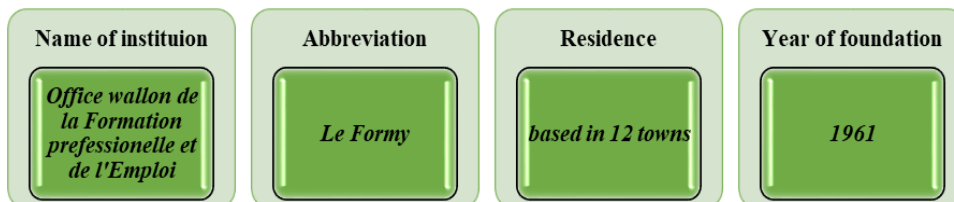


Figure 2 Institution of dual education in Belgium

**Bulgaria**

*The Center for Human Resource Development* (Център за развитие на човешките ресурси) is based in Sofia. It deals with education, vocational training and professional training. It has expert, coordination, information and consultation functions.

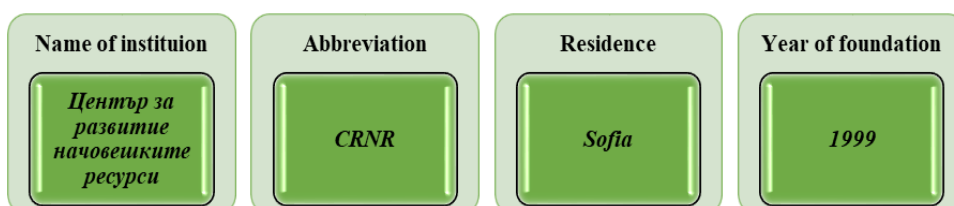


Figure 3 Institution of dual education in Bulgaria



**Czech Republic**

*The National Institute of Vocational Education* is located in Prague. The institute includes a department of market needs analysis, as well as a center for fictitious companies. Its dominant activities are ensuring the quality of professional education. The institute not only improves the quality of educational programs, but also tries to involve employers directly in their creation, which is very progressive from the point of view of the dual education system.



Figure 4 Institution of dual education in Czech Republic

**Denmark**

*The Danish Office for International Education* (Styrelsen for International Uddannelse) is based in Copenhagen. It falls under the Ministry of Science, Technology and Innovation and is responsible for the internationalization of education and training in Denmark.

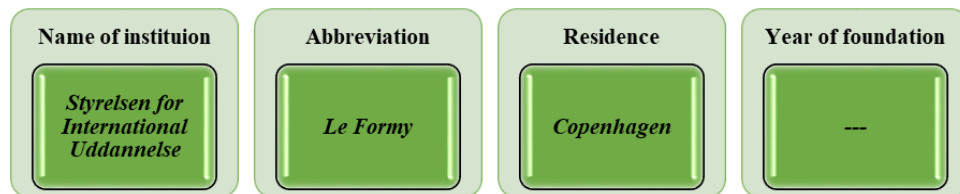


Figure 5 Institution of dual education in Denmark

**Estonia**

*The Foundation for the Development of Lifelong Learning* is based in Tallinn. The role of the Innova Foundation is to support lifelong learning initiatives and activities through Estonian and EU programs. The foundation offers experience, advice and support to organizations promoting vocational and lifelong learning.



Figure 6 Institution of dual education in Estonia

## Finland

**Government Board for Education** (OPH, Opetushallitus/Utbildningsstyrelsen), OPH is responsible for designing the basic national curriculum for primary and secondary general education and the framework for vocational and competence-based qualifications; it evaluates educational systems (evaluates the results of education and improves the effectiveness of professional training); provides information services (coordinates information networks and services in the education sector), produces indicators and information for predicting education needs; manages financial system of the education sector and publishes guidance manuals on vocational training options. Provides support services for education: manages the register of student selection for secondary vocational education and training and for polytechnics; organizes language tests; organizes and finances further education of teachers; is responsible for the recognition of qualifications obtained abroad.

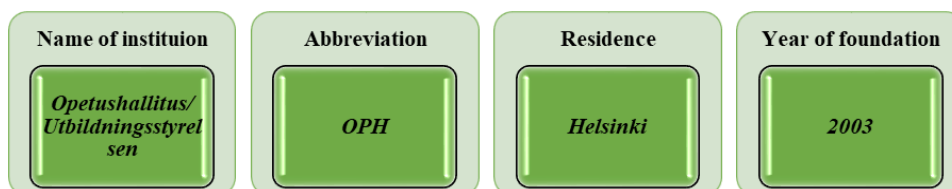


Figure 7 Institution of dual education in Finland

## France

**Center for the development of information on lifelong learning** (Centre Inffo, Center pour le developpement de l'information sur la formation permanente) based in Paris. The centre's activities are divided into three sectors:

1. **informative:** report on the activities of European, national and regional institutions; participate in information campaigns for public authorities and social partners; design information support and create a database.
2. **expert:** create and expand analyses and syntheses about education (law, practice and environment); processes works and studies commissioned by experts from the public and private spheres; develops the exchange of experience in Europe and the world.
3. **educational:** helps the professionalization of actors from the industry - pedagogical education, open and distance education (2500 trainees annually). The center has been an expert in the field of professional training and employment for 40 years. It provides three tasks: processing studies and conducting research on qualifications and practice.

France's educational system has the so-called professional lyceums, where sandwich vocational training is implemented. It is a form of education in which theoretical training is connected with professional training in the company. The participants of such a study are thus preparing themselves for skilled worker occupation.



Figure 8 Institution of dual education in France

## Hungary

*The National Institute for Vocational and Adult Education* NSZFI (Nemzeti Szakkepzési es Felnőttkepzési Intézet), is also known in the professional public under the abbreviation from the English translation of the name - Nivea. It deals with regional and national research on vocational and adult education and the creation of professional structures: a national register of qualifications and national module maps. The development of the content of vocational education and training of adults concerns: professional and examination requirements; central programs; textbooks; teaching aids; documents for education and professional training of socially and medically disadvantaged people; development support at the national, regional and local level; analyses of the effectiveness of professional training in educational institutions; creating and disseminating effective procedures and methods; vocational school development program; of the national development plan; comparison and harmonization of national and international qualification requirements, quality assurance.



Figure 9 Institution of dual education in Hungary

## Italy

*The Institute for the Development of Professional Training of Workers* ISFOL deals with study, research, experiments, documentation, evaluation, consultations and technical assistance in the field of professional training, social policy and employment. It cooperates with the Ministry of Labour (Ministero del lavoro e delle Politiche sociale), with the Ministry of Education, Universities and Research (Ministero dell'istruzione, dell'universita e della ricerca), with the government office, with the regions and with social partners.



Figure 10 Institution of dual education in Italy

**Ireland**

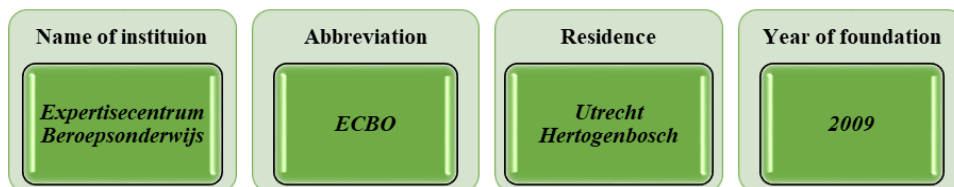
*Office for Vocational Training and Employment.* Through a regional network of 66 offices and 22 vocational training centers, it manages vocational training and employment programs, provides services to jobseekers and employers, an advisory service for industries and supports municipal enterprises. FÁS operates throughout Ireland, divided into 8 regions according to the structure of the corporation.



**Figure 11 Institution of dual education in Ireland**

**Netherlands**

*Expert Center for Education and Vocational Training* (Expertisecentrum Beroepsonderwijs). ECBO was created by merging the CINOP and Max Goot centers. It started functioning in 2009. ECBO is supposed to create and disseminate scientific and practical information about vocational education and training. The tasks and ambitions of the center are independence, research intended for vocational education and training and VET research, compliance with the standards of scientific work, creation and transfer of knowledge.



**Figure 12 Institution of dual education in Netherlands**

**Lithuania**

*Center for Qualification and Development of Vocational Education and Training*, KPMPC (Kvalifikacija ir profesinio mokymo plėtros centras). Efforts are being made to ensure that the Lithuanian system of qualifications meets the needs of the economy as well as national and international initiatives. Key activities: create professional standards and VET standards; conduct applied VET research, including forecasts of demand for professionals; monitor the supply of qualifications and the demand for them; administer the system of qualifications; evaluate formal VET programs; assess the readiness of formal OVP programs for implementation; externally evaluate the activity of educational facilities and implement formal OVP programs; increase the quality of self-evaluation of educational institutions, external evaluation and related methods; provide recommendations for improving teachers' qualifications; organize the creation of module programs and their updates; create a credit system in OVP; compile, analyse and disseminate information about OVP; monitor

the creation of textbooks and other teaching materials; monitor competitions in knowledge and skills; to organize the activities of central and sectoral professional commissions; cooperate with national and international actors in OVP in national and international projects; function as the National Reference Center for Quality Assurance in OVP, as the National Coordinating Element for the Implementation of the European Qualifications Framework and as the coordinator of the Refer Net network in Lithuania.



Figure 13 Institution of dual education in Lithuania

**Luxembourg**

*The National Institute for Continuing Professional Education* INFPC (Institut national pour le developpement de la formation professionnelle continue) is a state institution managed by the Ministry of Education and Professional Training (Ministère de l'Education nationale et de la Formation professionnelle - MENFP). The INFPC sets a strategy for promoting the concept of further professional training at conferences, seminars, in the press and by conducting projects on the subject of further professional training in conjunction with businesses, social partners and government authorities. He is responsible for processing applications translated by the company, for promoting further professional training and creating its concept.

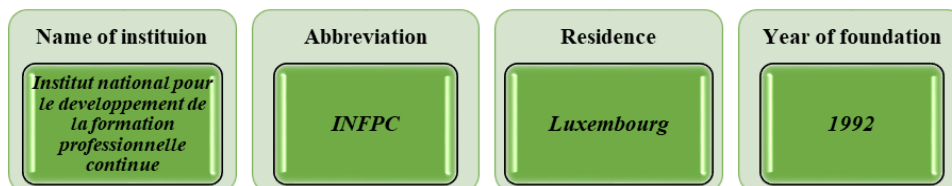


Figure 14 Institution of dual education in Luxembourg

**Malta**

*MQC, Kunsill Malti għall-Khalifiki, Malta Qualifications Council* (Malta Qualifications Council) was established in 2005 and its main role is to guide the development of the National Qualifications Framework (NQF) for lifelong learning and to oversee vocational training and certification leading to qualifications that they are not provided in compulsory education. It is responsible for defining the level of qualifications and competences, for setting standards. The MQC's main tasks are to: provide information about the qualifications that are available; to help people access learning in a lifelong context; to assist vocational training providers in the creation of qualifications, their evaluation and certification in accordance with the national qualification framework.

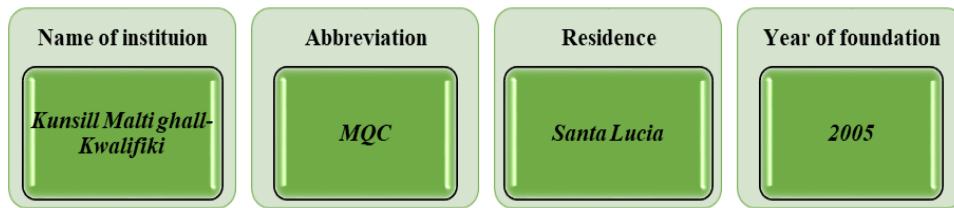


Figure 15 Institution of dual education in Malta

**Poland**

*The Office for the Coordination of the Education of BKKK Workers* (Biuro Koordynacji Kształcenia Kadr) was founded in 1990. After 27 years of operation, it has evolved from a small organization into a large institution that responds flexibly to the needs of the development of Poland, is open to cooperation with various partners at the local and international level. The programs carried out by the office dealt with the development of business and civil society.



Figure 16 Institution of dual education in Poland

**Slovenia**

*Center for Vocational Education CPI* (Center RS for Vocational Education) deals with increasing flexibility on the labour market, increasing quality and strengthening social partnership. New goals are achieved through various vocational education and training activities: basic vocational qualifications with the possibility of further education for all, connection of education with the labour market, diversity of employment, lifelong learning and equal opportunities. CPI includes: National Reference Center, Slovenian Reference Center for Quality Assurance in Vocational Education and Training (SIQAVET).



Figure 17 Institution of dual education in Slovenia

**United Kingdom – England**

*The Qualifications and curriculum Development Agency*, QCDA, (Qualifications and curriculum

Development Agency) is based in Coventry. The Qualifications and Curriculum Authority (QCA) was created in 1997 by the merger of the National Council for Vocational Qualifications (NCVQ) and the School Assessment and Curriculum Authority (SCAA). Later, it was transformed into an agency and curriculum development was added to it.



Figure 18 Institution of dual education in United Kingdom – England

**United Kingdom – Scotland**

*Scottish Qualifications Authority SQA* (Scottish Qualifications Authority). The office's function was established by the Education Act of 1996. As an awarding body, the office cooperates with schools, vocational schools, universities, the world of work and the government and provides high-quality, flexible and relevant qualifications. The office has two tasks: accreditation (authorizes all professional qualifications in Scotland, except university ones) and assessment (creates qualifications, validates qualifications, checks whether qualifications are up-to-date).



Figure 19 Institution of dual education in United Kingdom – Scotland

**Sweden**

*The Education Authority* (Skolverket) manages, supports, monitors and evaluates the work of municipalities and schools in order to improve quality and ensure equal access to education for all. In April 2004, the government submitted to the parliament (Riksdag) a draft law entitled Knowledge and quality - eleven steps for the improvement of gymnasiums (Kunskap och kvalitet – elva steg for vyvelenje av gymnasieskolan), which contained a strategy for improving the work of gymnasiums. Swedish grammar schools also provide initial vocational education and training. The school office was entrusted with the evaluation of the framework documents of the gymnasium so that more people could graduate and have access to higher education. The reformed gymnasium focuses on emphasizing knowledge in context, promotes in-depth and contextual study, and also removes negative stresses.

Name of instituion	Abbreviation	Residence	Year of foundation
<i>Skolverket</i>	--	<i>Stockholm</i>	<i>1996</i>

Figure 20 Institution of dual education in Sweden

## Dual education in Slovakia

In Slovakia, the State Institute of Vocational Education is responsible for the quality of dual education. (ŠIOV) The State Institute of Vocational Education is based in Bratislava and it was established from the Institute of Youth Training by transforming activities and competencies in the field of secondary vocational education. The Institute of Youth Training operated from 1 February 1991 to 31 November 1994. During this period, the subject of activity has changed. According to the charter of 29 January 1991, its main activities consisted in providing tasks related to the management of secondary vocational schools and practical training centres established by the Ministry of Education, Youth and Sports of the Slovak Republic. The Institute cooperated with individual economic departments and their educational institutes in the creation of concepts for the preparation of youth for the profession in the secondary vocational schools of that period, in the organizational provision of basic pedagogical documents for teaching and study departments, in further education of pedagogical staff, in coordinating cooperation with domestic and foreign entities. in order to equip schools with technology and ensure current tasks, especially in the field of retraining. By the addition to the charter of 24 May 1993, the scope of activities of the Institute of Youth Training was extended to include the methodological provision of tasks in the field of apprenticeship (vocational) education. This Institute performed tasks related to the pedagogical and organizational provision of education and training in secondary vocational schools, practical training centres and practical training workplaces.

The activities of Institute were focused on the elaboration of documents and opinions on draft conceptual materials, laws, standards, regulations and basic pedagogical documents for vocational education, the elaboration of methodological materials, the provision of advisory, consulting, methodological and information services in the field of practical teaching and activities related to with international activities, coordinated and managed by the then Ministry of Education of the Slovak Republic.

According to the Charter of 29 January 1991, as amended, the Ministry of Education of the Slovak Republic changed the name of the Institute for Youth Training to the State Institute of Vocational Education with effect from 1 December 1994, thus expanding and modifying the subject of its activities and competencies. The Slovak National Observatory (SNO) was established at the Institute by the European Training Foundation (ETF) in Turin, supported by the Ministry of Education of the Slovak Republic and the Ministry of Labour, Social Affairs and Family of the Slovak Republic. The aim and main task of the SNO was to collect and analyse information on vocational education in the Slovak Republic and to confront it with the situation in the European



Union. At present, the intention of ŠIOV is to concentrate initiatives and initiate proposals for the sphere of vocational education, which would help to manage the transformation of vocational education in accordance with the current effort for dual education.

#### *National project Dual Education*

In the years 2016 – 2021, the State Institute of Vocational Education is solving the National Project Dual Education and increasing the attractiveness and quality of vocational education and training. Basic characteristics of the project:

Operational Program: 312000 – Operational Program Human Resources

Implementer: State Institute of Vocational Education

Project title: Dual education and increasing the attractiveness and quality of Vocational Education Training (VET)

Call code: OPLZ-PO1/2016/NP/1.2.1-01

ITMS code: 312011C789

Total eligible costs of the project: 31 711 257 Eur

Place of implementation: the whole territory of the Slovak Republic

Duration of implementation: 01/2016 – 09/2021

Slovakia has long been an advanced country in the field of industry. We are among the leaders mainly in the automotive industry. However, as in other countries, as well as in Slovakia, the industry is advancing; more and more informatization, automation and robotics are coming. This also changes the job positions and qualifications of employees. While in the past, many welders were needed, today companies need mechanics-mechatronics capable of working with welding robots. Without quality knowledge and young people who find top education and employment at home, Slovakia will not be able to remain competitive. Already, they are losing young people who are going abroad to work. However, the goal is for young people to develop and live in Slovakia. At the same time, companies state that they feel the lack of a qualified workforce that can work with robots and automation technology. Thanks to dual education, students will be ready for practice immediately after graduating from secondary school. Currently, therefore, the issue of dual education is very important.

The main parties in a relationship in the dual education system are the pupil, the educational institution – secondary vocational school and the future employer. A pupil in the dual education system is a pupil of such secondary vocational school who has signed up and concluded a dual education contract with another party - the employer. As a rule, the employer operates in a sector that is the same as or related to the field of study taught at the school. The contract regulates the rights and obligations of the student in the field of safety and health at work in exactly the same way as has an employee of the company. The contract also deals with the form of remuneration for the student as his right to a motivational scholarship. The pupil may also receive a scholarship for good study results from the state budget. Pupil may also get the so-called corporate scholarship, which is tied

to the work performed for the employer in the framework of practical training. The standard is that the work itself and its quality, benefits, as well as attendance and results, as well as student behaviour, are evaluated. The contract must also consider the case where it is proven that the pupil intentionally caused damage to the property of the school or the employer. If the damage is not remedied, the school or company has the right to demand compensation. In this case, as in the case of a legal relationship with an employee, the compensation cannot be higher than four times the minimum wage. The contract is further defined in the chapter Legal background.

The employer is another entity. After fulfilling the conditions stipulated by law, the so-called a dual education contract with the relevant secondary vocational school. It is also an obligation to provide premises for the purpose of practical training. The employer provides protective work equipment, opinions from the field of health care, if such a law requires, as well as the cost of food during the internship in the amount specified by the Labor Code. The law does not define this obligation, but the employer may provide students with accommodation and pay travel costs from their permanent residence to the seat of the secondary vocational school and the place of practical training or accommodation in the school dormitory. The last of the three partners is an equally important educational institution – a secondary vocational school. In this relationship, secondary school becomes an important part of the whole system, because it connects the student and the employer. From a legal point of view, the secondary vocational school ensures the fulfillment of the obligations arising from the dual education contract as well as the apprenticeship contract concluded by the employer with the pupil of school.

Dual education is characterized mainly by a direct connection between theoretical and practical education both in secondary vocational school and in a specific company - with the future employer of pupil. The uniqueness of the system is also that it creates a partnership between the employer and the pupil. The relationship must be defined in the form of so-called learning agreement. The contract regulates the rights and obligations of the contracting parties. The learning agreement also defines the practical teaching of the pupil in more detail. Equally important in the dual education system is the relationship between the employer and the school. The relationship describes the so-called dual education contract. The main points of the contract are the conditions, scope, as well as the coordination of professional practical training with the apprenticeship contract. The employer is responsible for practical training in its entirety. It also bears all implementation costs. These facts can be summarized as a whole, that, dual education is carried out based on two contracts.

## **Conclusion**

By supporting dual education, employers in industry are responding to the unflattering situation on the labour market. Dual education is generally considered a promising model, shifting not only the quality of vocational education, but also the quality of professional performance of school graduates. In order to maintain and improve it, it is necessary to respect and strictly observe the following measures:

- early professional orientation already in primary schools – emphasis on vocational subjects already during studies at primary school so that the pupil has the opportunity to build a positive relationship to professional skills and has the desire to further develop them during secondary school in the dual education system;
- cooperation with pupils' parents – meaningful cooperation and communication between parents and teachers, mutual analysis of pupils' abilities and skills and recommendation of a suitable type of study;
- elimination of confusion in the transition system between school and place of vocational training - clearer communication in general and in regional understanding of the process of transition between study and working life, especially with emphasis on communication of job guarantees after successful completion of studies, which can be a fact parents and pupils decide in the choice of schools;
- transparent graduation of the possibility of entry and the level of requirements of vocational training according to performance while maintaining the professional principle;
- broadband occupation profiles – setting up such a system of study that will prepare graduates for the whole area or to groups of positions and professions, which is especially important in manufacturing companies, where qualified staff is also expected to be substitutable as well as a broader focus, e.g. competence to control a group of machines and technology, not just one specific;
- nationwide uniformly regulated permeability and possibilities of transfers within similar professions – flexible study options, mutual exchange stays within Slovakia as well as within European countries, and related interconnected study fields within regions, which allow students to transfer even before completion study at a specific school;
- crediting of achieved education – possibilities for professional and academic growth, possible crediting of additional education, practice, retraining courses, language stays at all levels of study;
- strict respect for and adoption of the European Qualifications Framework;
- systematic cooperation with the private sector – creation of an association and appointment of representatives of dual education schools, who will systematically negotiate with representatives of the private sector, monitor the requirements in the field of dual education;
- communication and marketing – an overall effort, first of all, to expand knowledge about the possibility of dual education throughout Slovakia, and in smaller towns, and secondly, to popularize dual education - by pointing out study outcomes for pupils, schools and employers.

While maintaining the quality of vocational education and increasing the quantity of entities involved in the dual education system, it is clear that the importance of introducing dual education will positively affect society as a whole.


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## Sub-District Government Institutional Capacity of Jakarta Province


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**Abstract:** Sub-districts have a strategic role as a liaison institution between provincial and the ward level. However, the weak institutional capacity of the sub-districts has resulted in a span of control of the government administration and public services barrier. The study aimed to analyze the level of institutional capacity of a sub-district institutional and formulate some efforts to strengthen sub-districts. The research was designed a quantitative approach and survey method. Collecting data using questionnaires, interviews, and focus group discussions. Descriptive statistical techniques were used to analyze sub-district institutional capacity and its supporting dimensions. The results of the study show that the sub-district institutional capacity is in the moderate category (average score 73.38). The five aspects of institutional capacity are as follows, leadership is in the high category (score 80.37), while the four dimensions are in the medium category, namely authority (score 70.96), organizational structure (score 72.76), readiness management (score 63.45) and digital service (score 67.40). Strengthening sub-district institutional capacity through, delegation of authority from the governor to the administrative mayor and the mayor sub-district head, the application of agile organization by establishing functional official, analysis the need of human resource, and mapping ICT human resources to develop government digitalization.

**Keywords:** The Local Government, Institutional Capacity, Sub-District, Jakarta Province

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## Introduction

The sub-district is an important institution in the Indonesian government system (Khairi, 2018). The existence of the sub-district has been known since the era of the XII-XIII Kediri Kingdom named "wiyasa." in the Pasundan area was known "cutak" which is similar to the sub-district head (Camat). During the Dutch East Indies colonial period, the sub-district was called "onder district" to assist the district head. The number of sub-districts is 7266, coordinating 74,961 villages and 8506 sub-districts as well as 16,722 islands. Sub-district played a strategic role, namely as a liaison between the village government and the government "over the village", namely the district, province also central government (L. Kolopaking, 2010).

However, since the reform era, the role of the sub-district has weakened, as part of the district/city government bureaucracy, Head of Sub District called Camat assisted the regent/mayor in administering government and synchronizing sectoral development in the sub-district area (Wasistiono, 2021). Factually, the role of the sub-district is broader than just assisting the regent or mayor, but also carrying out government activities, public services, and maintaining security and public order 24 hours per day and 365 a year (M. L. Kolopaking & Dharmawan, H, 2010). Sub-districts play important role as representatives of the central government, specified represent the policy of the central government towards the population in its territory.

There is different Jakarta compared the other regions in Indonesia. Jakarta is the national capital that implements special autonomy. In Jakarta, regional autonomy is placed at the provincial level while in other areas it is placed at the district and city levels. The consequence is that if there is single autonomy at the provincial level, autonomous regions will no longer be formed in the Jakarta area, but administrative regions (Administrative City and Administrative District). that the sub-district becomes a work area (werk'ring), not a government area (amsk'ring) (Ramses Marpaung, 2019). The single autonomy option implies that there is a microcentralization phenomenon in which almost all important policies are centered at the Governor's City Hall and the DPRD, including the design of the APBD and regional regulations. Meanwhile, public services, although organized up to the Kelurahan level, authority remains in the provincial bureaucracy which controls the resources (Jaweng, 2012).

The special characteristics of Jakarta as the nation's capital affect the implementation of government administration. Jakarta Province is different when compared to other provinces. Regional autonomy of Jakarta is placed at the provincial level while in other region it is placed at the district and city levels. The consequence of implementing single autonomy at the provincial level is that there are no autonomous regions but administrative regions (Administrative City and Administrative District). So that the sub-district becomes a work area (werk'ring), not a government area (amsk'ring) (Ramses Marpaung, 2019). The single autonomy option implies that there is a microcentralization phenomenon in which almost all important policies are centered at the Governor's City Hall and the DPRD, including the design of the APBD and regional regulations. Meanwhile, public services, although organized up to the Kelurahan level, authority remains in the provincial bureaucracy

which is controls the resources (Jaweng, 2012).

Recently, many opinions emerged to eliminate sub-districts after government policy removed the national capital from Jakarta to East Kalimantan(Djohan, 2019). The main reason is the sub-district does not carry out public service functions, public services carried out by the kelurahan government that closer to the residents. The weak of the sub-district is due to the limited authority delegated by the regent and mayor. However, the empirical facts showed that sub-districts play a significant role in overcoming community problems and working out 24 hours per day and 365 a year. Sociological expectations of the sub-district head in the past, which were difficult to erase, until now, the community considers the sub-district as a place where the community proposed complaints about all the problems they faced.

This study analyzes the institutional capacity of the sub-district and formulate some efforts to strengthen the institutional of sub-districts. The Research considers that the sub-district plays a significant role as aliason between province and ward level and its role coordinating public services and organizing general administration to stabilize security and harmony among Jakarta's diverse citizens. The facts showed that the sub-district had taken root in the community to overcome various problems.

## **Literature Review**

### **Concept of Decentralization and Asymetri Decentralization**

The existence of sub-district institutions as part of regional government refers to the concept of decentralization. Smith (1985) said that decentralization relates to how power and authority are distributed through the country's geographical hierarchy, institutions and power-sharing processes. If previously power was concentrated in the central government, known as centralization, then through decentralization the power in the central government is distributed to the regions in the context of regional management (Smith, 1985).

By using Smith's framework, the district or city government can delegate its authority to the sub-district to carry out some of the government affairs under its authority, however the sub-district does not have the right to regulate or make policies like a district or city. Likewise, through administrative decentralization, administrative authority can be delegated to units in charge of smaller areas in order to bring services closer to the community. Meanwhile, according to Norton (1994) as quoted by Muluk (2009) local governments can decentralize within cities to government units in areas that are smaller in scope, so that responsibility and decision-making are expected to be closer to the community. Decentralization within cities is a form of community participation in local government practices (Muluk, 2009).

The basis of regulation of the government granting special autonomy to Jakarta Province is the 1945 Constitution, which stated that the state respects the specificity of local government. Regarding the specificity of Jakarta, Law Number 29 of 2007 explained that the specificity of Jakarta is a single autonomy at the provincial level. It is different, which placed regional autonomy on the Regency or City. However, regencies and cities in

Jakarta are not autonomous regions but work administrative areas. Consequently, mayors and regents are not political but bureaucratic structural positions. There is no election of the mayor/regent but filled by civil servants appointed by the governor. The authority of a city or district is different from an autonomous district/city. Besides that, there is no representative Council (DPRD).

Discussing Jakarta as a special region starts from the concept of asymmetrical autonomy. At the level of the concept of decentralization, the emergence of asymmetric decentralization is based on the consideration that a country should have an administrative framework that is able to manage all its local diversity, both reflected in variations in socio-cultural backgrounds, economic potential, administrative needs to those that are expressed in certain political demands. This diversity presents complex problems that are difficult to manage uniformly (one size fits all) (Maksum, 2018). Tarlton (1965) stated that the model asymmetrical system, each component units would have it a unique feature or set of feature which would separate in important ways its interest from those or any other state or the system considered as a whole. Thus, asymmetry refers to the components of the state "possessed of varying degrees of autonomy and power". "a unique feature or set of features" that differentiates the system as a whole. Asymmetrical autonomy occurs when the central government hands over authority with different degrees to certain regions, depending on the requests put forward by the regions. However, if the central government has the authority to withdraw regional government autonomy, then the country is a unitary state (Garry, 2007). The implementation of asymmetric decentralization in Indonesia faces problems such as constitutional problems, stakeholder commitment and policy inconsistencies (Haris, 2016).

### **Institutional Concept**

Some experts distinguish between institutional and organizational concepts, for example Horton and Hunt expressly stated "...An institution is not a building; it is not a group of people; it is not an organization" (Horton & Hunt, 2007). North distinguishes between organizations and institutions, he argues that institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction... they therefore are the framework within which human interaction takes place, they consist a formal written rules as well as unwritten codes of conduct that underlie and supplement formal rules, kemudian organisasi disebutkan sebagai provide a structure to human interaction. Organizations are groups of individuals bound by some common purpose to achieve objectives (North Douglass C, 1990). World Bank defines institution as "*rules- including behavioral norms-, enforcement mechanisms, and organizations,*" this means that in the institutional concept there are regulations, enforcement mechanisms, and also the organization itself. Thus, the organization is a structure whose membership interacts with each other to achieve a certain goal. In this case the Jakarta Provincial Government was formed based on a structure with the aim of realizing the vision, mission and goals that had been previously set. In this study we argue that the organization is part of the institution. Institutions can be successful if there are organizations that are able to adjust their structure and actions in dealing with the dynamics of environmental change.



As a consequence of the implementation of decentralization, government institutions or organizations were formed in the regions to carry out the duties, functions and authorities of the government. The role of government institutions or organizations in government processes (public services), development, and community empowerment. In the context of local government organizations, Mintzberg's opinion regarding the duties and functions of the organization is an important reference. According to him, the duties and functions of the organization can be divided into five elements, namely Strategic Apex, Middle Line, Operating Core, Technostructure, and Supporting Staff (Mintzberg, 1978).

The theoretical basis for Law No. 23 of 2014 concerning regional government related to regional government organizations is the organizational theory by Henry Mintzberg. This theory is a modification of the traditional pyramid-shaped organization consisting of top managers, staff, line and auxiliary elements. Mintzberg says there are five basic parts of an organization, including, 1) *Strategic apex*; 2) *Middle line*; 3) *Technostructure*; 4) *Support staff*; dan 5) *Operating core*. According to Mintzberg, the strategic apex is a position where people take responsibility for the entire organization, namely "the chief executive officer." the operating core is the front line to produce goods and services. They are echelon II, III, IV, and V officials with the support of functional personil. Referring to Mintzberg's opinion, sub-districts can see as implementing elements (operating core) that carry out certain services and also supporting elements (technostructure) that assist regional heads in regional coordination functions. The positions of these two sub-districts in their development were not explicitly elaborated in technical regulations, causing different interpretations of the sub-districts.

### **Sub-District Institution**

District institutions have a very important role in the government system, as representatives of the central government implementing central government policies. The Camat is considered the "ruler of the area." (Nordholt, 1987). According to Law Number 23 of 2014, sub-districts carry out four government affairs, namely: 1) general government affairs; 2) governmental affairs from attributive authority; 3) government affairs from delegated authority; and 4) government affairs come from other government tasks. What distinguishes the workload among sub-district heads is government affairs from delegating authority and government affairs from other government duties, because it relates to the characteristics of different sub-districts. Details of government affairs by sub-district heads have been regulated in Government Regulation Number 17 of 2018 concerning Districts.

The district administration uses the principle of territoriality. Meaning, the Camat as the head of government is responsible for the work area covering the community with all its activities (Wasistiono, 2021). The role of the sub-district head is not only as the head of the sub-district office but also as a regional leader. It distinguishes the sub-district organization from other local government units. As the head of the work area, The sub-district head carry out general government duties including maintaining peace and order, enforcing laws and regulations, village or sub-district development, and carrying out other government tasks that have not been carried out by the government village or other government agencies. Therefore, the position of the sub-district head

coordinates the heads of other government units that are in the sub-district area or are under the coordination of the sub-district head (Hamudy, 2009).

## **Institutional Capacity**

Reddy *at. al.* (2015) defines local government capacity as `the ability of local government to perform their functions in an effective and efficient way. Referring Reddy *at. al.*, in fact, the actual functions of local government vary all over the world, especially with regard to the variety of policy areas they are responsible for. Nonetheless, one can distinguish two abstract dimensions which capture the basics of local government capacity. That is, service delivery and promoting good governance. Variable to measure state capacity in local government (Reddy *et al.*, 2015), namely, 1. political capacity), ability to engage different groupings in governance processes and facilitate activities in government and render services in response to local needs); 2. Local government's ability to uphold authority and regulation of economic and political interactions which are effective. This capacity is mainly derived from their relationship with higher tiers of government); 3. Technical capacity, strategic direction and effective leadership to local organizations that can potentially facilitate socio - economic development); Administrative capacity): (reflected through administering local infrastructure effectively and proven track record in terms of provision of public goods and services locally).

Based on the study literature, the research analyzes sub-district institutions, especially the aspects of institutional capacity, including authority relations, organizational structure, management resource capacity, digitalization of government, and leadership.

## **Method**

### **Research Design**

This research is descriptive explanatory to describe the variables that have been determined previously. The main observation of this research is to analyze the institutional capacity of the sub-districts. The survey method used a descriptive analysis approach and a quantitative paradigm by the opinion of Miller, Black, and Champion, equipped with information based on qualitative data to support and sharpen the quantitative analysis. The research was conducted in the DKI Jakarta Province in November 2022. The choice of DKI Jakarta as the research location is based on (1) The specificity of Jakarta as the national capital implementing single autonomy at the provincial level raises questions about the institutional effectiveness of sub-districts in their position as city administrative apparatus and administrative districts. 2) The relocation of the national capital from Jakarta to East Kalimantan has implications for possible changes to the institutional structure of the provincial government, including changes to the sub-district institutional structure, and (3) The effectiveness of the implementation of sub-district functions has become an issue that is getting stronger and has implications for the discourse of abolishing sub-district institutions.

## Population and Sample

The target population is all employees in 44 sub-districts holding echelon positions 379. Determination of the number of research samples using the Slovin formula.

$$n = \frac{N}{1 + Ne^2}$$

Note:

$N$  = number of population

$e$  = margin error 5.6%.

$n$  = number of sample, determined by the slovin formula as follows,

$$n = \frac{379}{1 + 379(0.056)^2} = 173.1745 \approx 173$$

The number of samples is 173 district employees, the sampling technique is simple random sampling, where every element of the population is known and has the same probability of being selected.

## Data Collection

Primary data collection using a questionnaire that has met the requirements of validity and reliability (Sugiyono, 2007). Testing the validity of the instrument is done by calculating the correlation between the score of each question item and the total score. Based on the results of the validity test, all question items have a value of  $r$  or the correlation coefficient of each question item is greater than the value  $r_{\text{tabel}} (\alpha, n-2) = r_{\text{tabel}} (0.05, 35-2) = 0,334$ . The results of the reliability test showed that all Cronbach Alpha values of the institutional capacity variables were greater than 0,9 (reliable), presented in Table 1.

Table 1. Results of instrument validity and reliability tests

Variable	Validity value	Reliability value	Result
Institutional capacity	0.334	0.960	Valid/Reliable

## Processing and Analyzing Data

Processing and analysis of data using descriptive statistics with the program SPSS (*Statistical Product and Service Solution*) 16 version. Indicator measurement uses a parameter scale from 1 to 4, the maximum value is (100) if all parameters for each indicator are worth 4. Category grouping uses four levels, namely, values 0-25 in the "very low" category, 26-50 in the "low" category, and 51- 75 categories of "high" and 76-100 categories of "very high". The transformation to determine the smallest index value is given for the lowest total score (1) and 100 for the highest total score (4) for each indicator. This kind of transformation is used to calculate the value of the diversity that occurs in each research variable, especially those that are ordinal to interval or ratio so that it is feasible to be tested using parametric statistics (Sumardjo, 1999).

## Results and Discussion

### Characteristics of Respondents

The characteristics of the respondents describe the respondents who participated in the study, namely echelon III a, IIIb, IVa and IVb sub-district employees in the Jakarta Province who were taken randomly. Data on the characteristics of the respondents that have been obtained are then analyzed using descriptive statistics.

Table 1. Respondent Characteristics

Respondent Characteristic	Category	Number	Percent
Age	≤ 30 Tahun	1	0,58
	> 30 – 40 Tahun	28	16,18
	> 40 – 50 Tahun	54	31,21
	> 50 Tahun	90	52,02
Formal Education Level	Elementery School	0	0,00
	Secondary School	0	0,00
	High Schol Sederajat	0	0,00
	D-I	0	0,00
	D-II	0	0,00
	D-III	1	0,58
	D-IV/S1	66	38,15
	S2	98	56,65
S3	8	4,62	
Formal Education Level	Training for leadership Level IV	123	71,10
	Training for leadership Level III	43	24,86
	Training for leadership Level II	2	1,16
	Training for National Leadership	2	1,16
	National Defense Institute Training	3	1,73
Work Experience	≤ 15 Years	25	14,45
	> 15 – 30 Years	90	52,02
	> 30 – 40 Years	51	29,48
	> 40 Years	7	4,05
Position Level	Ecehelon III.a	27	15,61
	Echelon III.b	34	19,65
	Ecehelon IV.a	69	39,88
	Ecehelon IV.b	43	24,86

Respondent's age. The highest percentage of respondents aged > 50 years was 52.02% of the total respondents.

It can be said that more than half of PNS who occupy echeloning positions at the District Office of the Province of Jakarta are aged over 50 years, belonging to the productive age limit according to the Agency Center for Statistics between the ages of 15-64 years.

Formal education level. More than half of the respondents were at the Masters level, 38.15% were at the D-IV/S1 level and 4.62% were at the Doctoral level. It shows that 94.80% of the sub-district office employees are highly educated, from diploma-IV/S1, S2 to S3. A high level of civil servant education can support the effectiveness of the sub-district function. Highly educated employees have the ability to develop the mindset and ways of acting needed for the delivery of government services and development.

Non-formal education level. 71.10% of respondents have taken Leadership Training (PIM) IV and 24.86% PIM III Training. There were 2 respondents who had attended the PIM II Training and National Leadership Training, and 3 respondents who had attended the Lemhannas Training and Education. By looking at this data, it can be said that the majority of civil servants holding positions at the echeloning level have been equipped with knowledge, attitudes and leadership skills.

Work Experience. The percentage of length of service successively from highest to lowest is as follows: > 15 – 30 years (52.02%), > 30 – 40 years (29.48%), ≤ 15 years (14.45%), and > 40 years (4.05%). The respondent's relatively long working period can provide an understanding of the duties of work in each sub-district work unit.

Position Level. Most of the respondents in this study were in echelon IV.a positions, namely 39.88% of the total respondents, 24.86% of the other respondents had echelon IV.b positions, then respondents who had echelon III.a and III.b positions respectively also as much as 15.61% and 19.65%.

### Institutional Capacity

Institutional capacity is in the high category (mean score 73.38) (Table 2). Institutional capacity is measured from 5 (five) dimensions, namely sub-district authority capacity (average score 70.96), sub-district organizational structure (average score 72.76), management resource readiness (average score 63.45), digital-based sub-district government services (average score 67.40) and leadership (mean score 80.37).

Table 2. Respondents' perceptions of institutional capacity

Variable	Category	n	%	Average Score	Total Category
Institutional Capacity (X <sub>1</sub> )	Very Low	1	0,58	<b>73,38</b>	<b>Moderate</b>
	Low	11	6,36		
	Moderate	93	53,76		
	High	68	39,31		
<b>Total</b>		173	100		

Note: 0 – < 25 = very low, 26 – < 50 = low, 51 – < 75 = Moderate, 76 – 100 = High

Respondents' perceptions of aspects of institutional capacity are presented in Table 3 below.

Table 3. Respondents' Perceptions Of Institutional Capacity Dimensions

Aspects	Category	n	%	Average Score	Total Category
Authority Capacity	Very Low	1	0,58	70,96	Moderate
	Low	16	9,25		
	Moderate	109	63,01		
	High	47	27,17		
Total		173	100		
Organizational Structure	Very Low	1	0,58	72,76	Moderate
	Low	11	0,36		
	Moderate	103	64,74		
	High	58	28,32		
Total		173	100		
Readiness Management	Very Low	5	2,89	63,45	Moderate
	Low	38	21,97		
	Moderate	89	51,45		
	High	41	23,70		
Total		173	100		
Government Digital Services	Very Low	0	0,00	67,40	Moderate
	Low	24	13,87		
	Moderate	97	56,07		
	High	52	30,06		
Total		173	100		
Leadership	Very Low	1	0,58	80,37	High
	Low	5	2,89		
	Moderate	76	43,93		
	High	91	52,60		
Total		173	100%		

Note: 0 – < 25 = very low, 26 – < 50 = low, 51– < 75 =Moderate, 76 – 100 = High

Critical findings from the sub-district institutional capacity study are as follows,

*Limited Authority of The Sub District*

The sub-district authority regulated in the Law on Regional Government but limited to coordinating government, public services, and development, including carrying out general government duties related to maintaining public order and fostering community organizations. It is difficult for the sub-district head to coordinate sector units due to limited authority. Handling public service problems take a long time. It will be forwarded by Camat to the Regional Work Unit for Development (UDKP). Furthermore, UDKP continues to the

provincial level. On the other hand, because they carry out service and development functions, sector units form offices in sub-districts by ignoring the existence of sub-districts. In addition to the limited authority, the authority delegated by the regent to 44 sub-districts in Jakarta is uniform, even though it is contradictory if you look at the differences in geographical conditions and the level of progress of the regions. For example, the Thousand Islands district has archipelagic characteristics with a community structure of fishermen, laborers, and traders requiring different handling from the administrative city on the mainland of Jakarta.

#### *Problem Policy Inconconsistency of Organizational Structure*

The arrangement of the sub-district structure regarding the accountability of the sub-district head is inconsistent. Article 25 of DKI Governor Regulation Number 152 of 2019 states that sub-districts are under and responsible to the administrative Mayor and Regent. While Article 21 paragraph (3) of Law Number 29 of 2007 states that sub-district heads and deputy sub-district heads are appointed and dismissed by the Governor on the recommendation of the mayor/regent. Contrary to paragraph (4) it states that the Camat is responsible to the mayor/regent through the city secretary/district secretary. This arrangement violates the basic principle of the organization that "those who are appointed are responsible to those who appoint them." The position of the Camat below the mayor and regent has the consequence of being very dependent on the regional head (administrative regent/mayor).

Inconsistency regulation can be seen from the arrangement of the sub-district head to organize general government affairs. Governor Regulation states that the sub-district head implementing general government affairs at the sub-district level. Meanwhile, the Regional Government Law states that general government affairs are under the president authority as the head of government that wil delegated from the President as the head of government to the Governor (as the representative of the central government) and also to the Regent or Mayor as the regional head. It is contradictory due to the position of the sub-district head as part of the district/city government, but implementing general government affairs was delegated by mayor/regent..

#### *Limited Management Resources*

The sub-district faces limited human resources both in number and qualification according to the functions required by the sub-district. For example, planning for a sub-district program requires supervisors with planner qualifications, because there is no available plan that has not been prepared based on analysis and projections of future developments. The limited number of apparatus and qualifications causes employees to work extra. In addition, the budget is an important issue related to the implementation of general government affairs delegated by the mayor/regent.

#### *Lack of Digital Government Services*

the survey results showed that 56.07% of digital institutionalization in sub-districts is inadequate to support the

main tasks and functions of serving the community. One of the causal factors is the lack of human resources with ICT qualifications. Adequate ICT infrastructure and internet access in all sub-districts and 267 sub-districts connected to the Office of Communication and Information.

### *Leadership*

An interesting finding from this study is that leadership is classified as high (mean score 78.40). Camats have the ability to understand problems even though implementing policies and programs are not used to using new approaches and innovative ways, which means they are still working in business as usual. High leadership is measured by the speed with which the sub-district head responds to emergency situations (natural disasters, non-natural disasters, and social conflicts). The sub-district head and village head are the first to meet residents when an emergency occurs. Even so, overcoming disaster situations, they still rely on SMS and WhatsApp, so the speed of information dissemination is still limited.

## **Discussion**

The institutional capacity of sub-districts in Jakarta has not optimally carried out their duties and roles. A critical issue in the aspect of authority is the limited authority of the sub-district. This finding is in line with Rowa's statement that public services have become ineffective and inefficient in sub-districts because decision-making is at the provincial level management with a tiered bureaucratic chain that begins from kelurahan to sub-district, city/district and goes to the province level. It made public service problems slow to handle (Rowa, 2018). The sub-district as part of the local government has limited authority, while the sectoral unit has more of a role in carrying out service and development functions in the sub-district (Djohan, 2019). The formation of provincial sector units in the sub-districts caused the local government bureaucracy to become fat. Currently, in Jakarta Province, there are 518 implementing units of the service, 62 units of agency, and 132 sub-units. The lack of delegation of authority has created a contradiction. On the one side, the camat is expected to be a party that is needed both by the top level of government and the community. Regents and mayors often communicated and clarified technical development issues, even though these issues are the sector unit's business.

Government Regulation (Peraturan Pemerintah) No 18 of 2016 concerning local government has multiple interpretations. The local government organization structure (regional secretariat, DPRD secretariat, inspectorate, Dinas, Badan, and sub-districts) is based on Mintzberg's conception of the organizational structure covering strategic apex, middle line, operating core, technostructure, and supporting staff (Mintzberg, 1978). The regional head is the strategic apex, the secretary is the middle line, Dinas is the operating core or executor of government authority, Badan and inspectorate agency as technostructures, regional secretariat, and DPRD secretariat are supporting staff.

However, the sub-district is not clear whether as operating core, supporting staff, or technostructure. Government regulation mentioned sub-district only as a part of the structure of the district/city to carry out



coordination functions, implementing public services in terms of simple and high intensity.

The issue of human resources needs attention when it is related to the future function of Jakarta as a business center. As a business city, Jakarta needs fast and efficient public services. Therefore, human resources with competence and specialization are needed to support government performance. Local Governments require paradigm shifts from conventional organizations (pyramid form) to agile organizations supported by human resource capacity. According to Aghina et al., it is necessary to change the perspective of organizations as "machines" to become "organisms" (Aghina et al., 2017). Referring to the concept of an agile organization, it is necessary to adjust the organizational structure with the function of the City of Jakarta as a business center filled with functional officials. At the sub-district level, a function-based organizational structure is filled in by functional officials as needed. The placement of functional officials is flexible, meaning that they can be transferred or rotated so that the organization becomes flexible as required by an agile organization (Wasistiono, 2021).

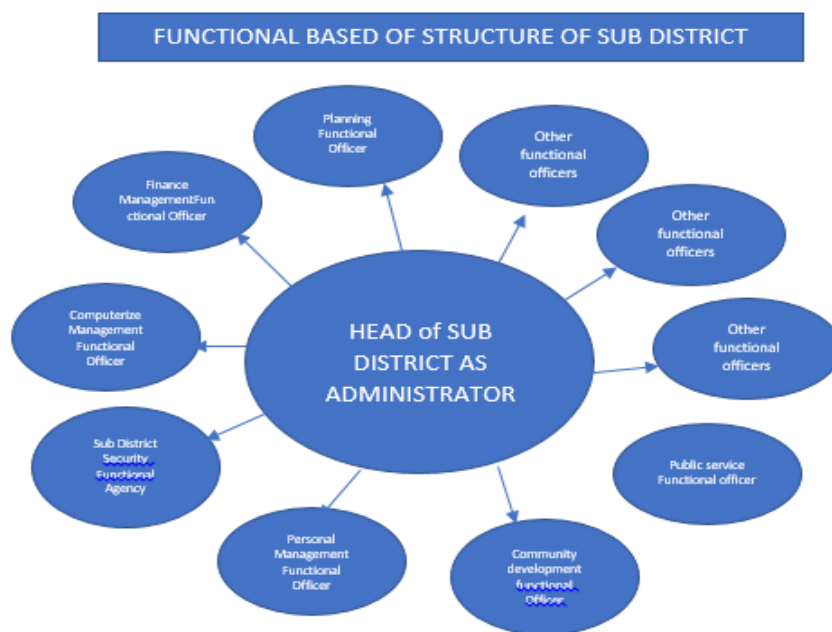


Figure 1. Functional Based of Structure of Sub-District (Wasistiono, 2021)

In line with changes in the organizational structure, administration and licensing services need to be provided digitally. The Provincial Government of Jakarta needs to improve sub-district institutions supported by information technology. This is a must for government organizations as a reflection of a smart city in the era of the industrial revolution 4.0 (Schwab, 2016). The lack of ICT human resource capacity in the aspects of Good Skills and Expertise requires handling by the Jakarta government, including a survey to determine the capacity of personnel with good skills and experts in ICT as well as their needs. The management of ICT human resources is adapted to the needs of each sub-district starting from HR planning, placement and career development of ASNs who have ICT competence. Training according to the needs of sub-district government

digitization is on the agenda of sub-district programs and activities.

In the aspect of leadership, the Camat as a regional leader carries out two forms of leadership, namely organizational leadership and social leadership, known as the "two-legged leadership" type. Organizational leadership is related to the activities of leading the sub-district office. Meanwhile, social leadership is related to the role of the Camat in leading the region and the community. (Wasistiono, 2020). In the digital era, sub-district heads must be able to respond quickly to complaints and aspirations of the people. It is time for sub-district heads to have social media, either WhatsApp, Twitter, Instagram, Facebook and others, which can connect directly with the community. The intensity of meetings between the sub-district head and the community through social media will be higher, responsive and open.

## Conclusion

Institutional capacity is in the "moderate" category, except for the leadership aspect which is classified as high, aspects of the suitability of authority, organizational structure, resource management, and government digitalization are in the moderate category. Critical issues in every aspect

1. The authority of the sub-district is a coordination role, meanwhile, implementation of service and development is coordinated by sectoral agencies/Dinas, causing a delay in handling the problem. The delegation of authority of sub-districts is uniform, therefore it is not taken into account regional conditions and community characteristics.
2. Regulatory arrangements are inconsistent whereby the Governor appoints the sub-district head but the sub-district head is under and taking responsible to the administrative mayor/regent. In addition, the sub-district head carries out general government affairs, even though the position of the sub-district head is as part of the city and district administrative apparatus, not as a government representative.
3. Management of sub-district institutional resources is not optimal due to limited apparatus resources, budget, and supporting facilities.
4. The problem with sub-district digitalization institutionalization is the availability of ICT human resources. Limited ICT human resources with Good Skill and Expertise capacities.
5. The leadership capacity of the sub-district head is in the "high" category in handling sub-district problems.

## Recommendations

### Central Government

1. Rearrange the position of the sub-district to be under and responsible to the administrative mayor/regent, therefore the appointment of the sub-district head is not carried out by the governor and is responsible to the mayor/regent, bearing in mind that the prevailing principle is "the official is responsible to the

appointing official".

2. Review the function of administering general administration by the sub-district head because the sub-district head is not a representative of the government.

### **Governor of Jakarta Province**

1. Governors need to delegate authority for regional government affairs to administrative mayors and administrative regents, then mayors/regents delegate authority to sub-district heads according to objective characteristics and conditions. In delegation, a mixed pattern can be used where there are generally accepted delegations of authority in 44 sub-districts and delegations of authority are adjusted to the objective conditions of the region.
2. Conducting an analysis of the needs of sub-district human resources, establishing functional positions according to sub-district needs and mapping ICT-based human resources in the context of institutionalizing government digitalization.
3. Regulating sub-district institutions in Jakarta by clarifying the differences in tasks, functions and roles of sub-districts between sub-districts in urban and mainland areas and sub-districts in the Archipelago region.

### **Mayor and Regent**

1. Delegating authority to the sub-district head accompanied by an adequate budget, competent human resources, and logistics that enable the sub-district head and sub-district apparatus to carry out the authority delegated to the regent/mayor.
2. The Mayor/Regent administratively places the sub-district in a sectoral and regional position, mediating for development interests and messages from the top government (supra sub-district) and aspirations from the
3. lower level, namely the kelurahan and its residents.

### **Head of Sub-District**

1. Optimizing the use of information and communication technology by using multi-media as a channel of communication and supporting the implementation of the sub-district head's tasks, especially related to disaster management which requires rapid and widespread dissemination of information.
2. Developing creations and innovations through sharing and learning (knowledge and experience sharing) with other sub-districts and other regional apparatuses in order to optimize sub-district performance.

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## The Cornerstone of Human Future

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**Abstract:** The Education drives the Future of Humanity. The Wishes and Visions of Humankind have to drive the Education. What is the final goal of Education? To bring up a healthy, emotionally mature, wise, knowledgeable nourisher of life, who understands and feels the reality, based on ethics, humanism and compassion, as essential characteristics of a human being, and who is ready to act according to these values. How to achieve that goal? Due to the inevitable development of technology it is necessary to develop a new paradigm of the future principles of educational systems. There are two possible approaches: The Naturo-Humanistic and the Technological, driven by Machine Intelligence, the greatest temporary achievement. In the Technological sense, things are happening at an unbelievable speed, and the human being as an individual, and their collective, has no time to adjust to those changes. There are no clear visions of human society development, despite the informational connectedness and globalisation. In the Naturo-Humanistic sense, it has to be very clear whom we are educating, what we like to achieve with the education, and what is the framework, i.e. the educational environment (social, economical etc.). Due to unconscious, unconscientious and harmful behaviour of people towards the Nature, the ecological consciousness of the interconnectedness of all and everything in the Earth's ecosystem is what has to be thought to children from earliest age. Education must strive towards Wisdom, as knowledge is the knowledge of information, and Wisdom is the know-how of applying knowledge to any problem solving. Knowledge wants to be "used", but only Wisdom is aware of possible future consequences of the application of knowledge.

**Keywords:** Philosophy of Education, Knowledge, Wisdom, Technology, Nature Ecosystem, Human Society

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### Introduction

Ancient Greeks thought about the future as being behind them and they were looking forward at the past (Maul, 2008). This approach, though seemingly strange to us, is absolutely proper from the viewpoint of behaviour in any moment, as it is always based on past experience (knowledge), and is physically completely correct, as we always see things in the past, because the light has to come to us, or the sound, or the smell, or whatever other

sense of environment we use. Each and every element of the Universe has its own present, and all other individual elements' presents are for each of them in the past. Time is inextricably connected with the notion of existence and being itself (Heidegger,1967).



Illustration 1. A view into the future from any present

Consequently, the future can only be projected based on our previous knowledge and experience, and has to be envisioned, as for us to be able to steer our efforts in a specific, wished for, direction. As each moment of the future becomes a moment of the past, we can see and analyse the consequences of our previous steps. But without a vision, which we have to base on the analysis of our knowledge and our wishes, it is impossible to steer towards any future goal.

## **Education Drives the Future of Humanity**

In the context of Human civilisation, it is the Education that drives the future of humanity. The Education, which says to the kids what they want, what they expect, what they may expect, what they have to wish, or what they may wish, how they may, or have to, approach their lives, how and where they can or may not gather knowledge, and what they may, must, or may never, know or even ask.

### **The Wishes and Visions of Humanity have to drive the Education**

The Wishes and the Visions of Humanity are extremely important, as collective wishes and visions steer our civilisation from present to present into the future. Though individually, and at the level of social and political sub-systems, the wishes and visions are very often quite disparate, there is a global need for our future sustenance on our beautiful planet Earth, and the visions of achievement of a stable viable ecosystem can be readily derived from the basic common ethical principles, basic common human needs, and the already quite vast knowledge on cybernetically viable ecosystems. These globally ethical visions have to drive the Education. We have to have some vision of what we want in the future, and then we can organize Education towards that

envisioned goal.

But what would be those visions of the future of our civilisation? Do we have them? Would it be something like the future depicted in Illustration 2? Do we want to be puppets on some kind of strings, and use old technology to build some kind of primitive huts? Or is that visionless vision a desparate state of complete civilisation's ruin? Do we tend towards that?



Illustration 2. A clear Vision of Human Civilisation Wishes and Aspirations

It is really important to have a vision. If we look at all the older science fiction from the 20th century, it can easily be seen that it gives visions which drove our civilisation last 50 to 100 years. In that vast base of fears, wishes and visions, all the problems with computers, robots, machine intelligences, androids, virtual worlds, etc. already deeply explored and contemplated. Do androids really dream of electric sheep? (Dick, 1968) Is Data property to be disassembled and internally inspected at will, or is he an individual, a person with the right to dignity, life, integrity and self-determination? (Star, 1991) What does it mean "I Robot"? (Asimov, 1950) There are many many ethical problems contemplated, while giving warnings about consequences of misuse of technologies (both material and social) (Orwell, 1949) (Huxley, 1932).

But, in addition to the exploration of sociological and psychological themes, there are also societies developed and technologies envisioned which paint a much brighter nearer or further future of our civilisation. Probably the most influential science fiction "universe" that presently shapes the form of our technological visions is the vast Star Trek series. Its influence on modern technology seems to stem mainly by the fact that "technology geeks" were always fascinated by the ideas of the series writers. And many of them we realised, at least in a similar form / usage (smartphones as tricorders, medical scanners of all sorts, computers which can understand human language and assist in a vast area of fields, 3D printers/plotters and scanners as replicators, universal translators, at least for many human languages, physicists are contemplating impulse and warp drive etc.) (Roddenberry,1932). The present question is, do we, after several disruptive leaps in technology, and the still



mostly incomprehensible difference of life in a matter based local, and life in an information based global society, have a kind of idea what we actually want as a Civilization, a vision for the future to tend towards?

## **The Final Goal of Education**

The final goal of Education is

A healthy, emotionally mature wise and knowledgeable nourisher of Life,

A human being who understand and feels the Reality,

An ethical, compassionate Humanist,

A human who acts according to ethics, knowledge and Wisdom.

This is the Final Goal of Education.

And it is worth preserving the beauty of our planet, and preserving us on this beautiful planet. Remember, we have no other planet to go to, if we mess this one up completely!

## **How to Achieve the Goal of Education?**

### **Technological Education?**

Should we go into Technological Education? We are already years and years (and years) in technological education. Actually the trend can be traced back to the emergence of Rationalism, and the consequential philosophies of Materialism, or Physicalism, in the modern age (although both philosophical directions stem from before CE, and started giving technological results, they were superseded by strong spiritual and religious convictions from early CE in Europe). The relatively recent step from religious/spiritual approach to a almost "mechanical" materialism was certainly aided by the emergence of Dialectic Idealism of Hegel (Hegel, 1807), and than its transformation into the Dialectic Materialism of Engels (Engels, 1925) and Marx.

Such materialistic philosophical stance certainly aided our quite deep understanding of matter and energy, and all technologies which came out of it. However, it does not aid in the understanding of information, communication and now, with the emergence of electronic brains (Machine Intelligence), pressing questions about the notions of intelligence, consciousness, ethics, morality etc. The necessary transformation towards a civilisation that understands that we humans are just a tiny, though potent and disruptive, part of the Earth's lively ecosystem, is not aided by the deeply ingrained (probably even archetypal) notion that humans are the rulers of all on Earth (cf. e.g. Genesis 1:26, Genesis 1:28, Psalm 8:6-8( The Holy Bible 2011)in western sub-civilisation), as the terms used in the original (e.g. stewardship) are differently interpreted: whether it's an exploitative control, responsible stewardship, or a combination of both.

And in that materialistic technological education we teach people technology and techniques, we stream them into specific, quite narrow, areas, we teach them matter and energy, we train them in manipulation, but we tend

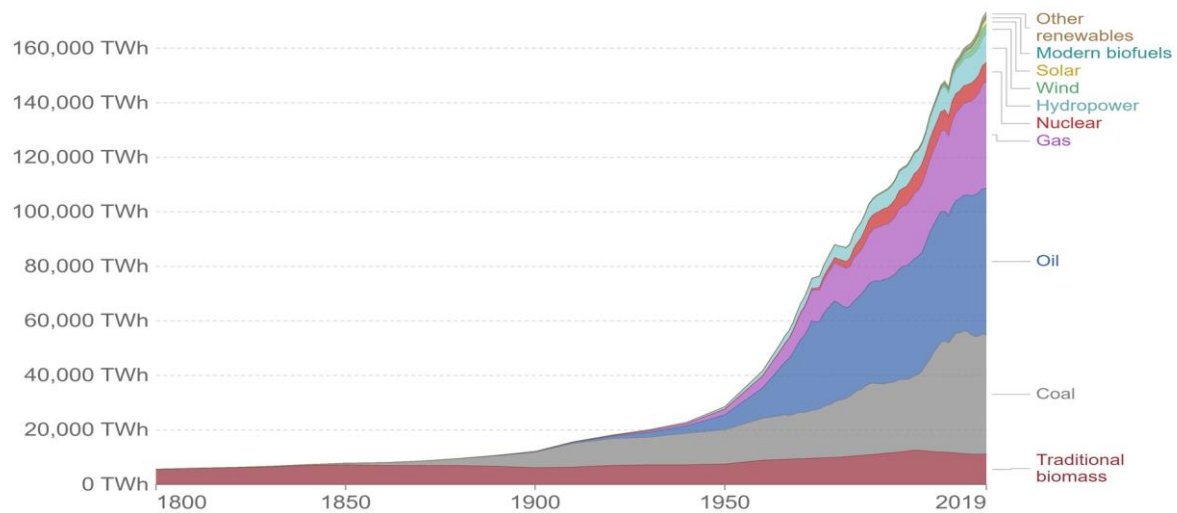
to forget about philosophy, forget about sociology, forget about ethics, forget about spirituality... Because if we look at what actually this techno education did to us and our planetary home, we have to be very concerned about the path we chose, and change the path towards a better Vision sooner, rather than later or never.

Then is it perhaps the naturo-humanistic education, or some kind of combination of them two? Because if we look at what actually this techno education did to us and our planetary home, we have to be very concerned about the path we chose, and change the path towards a better Vision sooner, rather than later or never.

Figure 1 is an example how quickly our civilization consumes more and more and more all kinds of energy sources (Ritchie, 2021). And, quite interestingly, despite all political proclamations and buzzwordy promotion, it can be seen that the "renewables" and comparable sources (modern biofuels, solar, wind and water and nuclear energy) source a very small percentage of full energy consumption. The rest is a huge amount of consumption of natural resources, like traditional biomass, coal, oil and gas. Yet we also have to have it on our mind that we are actually presently causing the Sixth Mass Extinction Event (Ceballos, et al.,2017). The previous one was when the dinosaurs got extinct (except the birds).

### Global primary energy consumption by source

Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.



Source: Vaclav Smil (2017) & BP Statistical Review of World Energy

OurWorldInData.org/energy • CC BY

Figure 1. Sources and energy consumption through last 200 years. From [12].

Not to mention the fact that we are depleting important natural resources (e.g. lithium, cobalt etc.) (and depleting them by using humans in inhuman conditions (Gross, 2023)) for the ability to store electricity for cars, laptops, phones, and all other kinds of consumer goods. And that the presently prevailing production philosophies are "life-cycle management" and "production cost is all", which directly harms the environment on all levels through, for example, non-repairable and non-exchangable embedding of such electricity storage

elements.

What future do we actually stream towards, in our lazy attitude? From the above facts it is obvious that there is no clear vision, no sense of responsibility, no common civilisational goals, just overblown individualism on all levels, including the ethical concerns "free" corporatism. And the trends towards the development of a Technosociety, with all of its possible negative consequences.

But a Human is a Living Being. Is the vision of our humanity's development for humans to be converted into some memory, saved on a memory stick and uploaded into the cloud, to be there searching for eternal existence? Until the electricity, is of course, available, and the cloud provider exists and has us backed-up. Until the technology is still compatible.

It is important to mention here one very interesting and important work about planetary intelligence (Frank, et al.,2022). Every planet has to have its own intelligence which emerges self-organisingly and autopoietically (Gershenson,2015) from the lowest levels. Figure 2 shows the development phases of global planetary intelligence, with approximate ratios of cybernetic processes (Emergence, Networks, Semantic Information, Complex Adaptive System and Autopoiesis, as cited by the Authors). At the lowest level a planetary ecosphere is just a Geosphere (geo comes from the name of Earth, however it applies to any planet in the Universe). On the level of a Geosphere (popularly, partly wrongly, known as the Mineral Kingdom) the planet is primarily self-organising through emergence of networking (communication, influences). The next level is the Immature Biosphere, when biological beings start to exist, and it is driven by all mentioned cybernetic processes, albeit on a smallish scale and with weak intensity. Further development of planetary intelligence leads to the emergence of a Mature Biosphere. This is a highly intelligent environment, with all cybernetic processes proportionally intensive. We had the opportunity to live in such a Mature Biosphere just several hundreds years ago, actually until the emergence of the Industrial Revolution, which started around 1760, when biological power (animals, humans) was gradually substituted by mechanical power. This emergent property caused the evolution towards the phase of Immature Technosphere.

And that is the problem. Regarding our behaviour, we are presently in the early stage of the Immature Technosphere. This abrupt change of phase represents a heavy disturbance on the ecosystem, as it has to completely re-adapt on the new situation, and the coordination of all necessary elements is not yet achievable. Therefore the level of global planetary intelligence during the Immature Technosphere phase is significantly lower than during the Mature Biosphere phase.

We should put all our educational efforts into really getting further into a Mature Technosphere, because we will not survive well, if we survive, living in an Immature Technosphere, as this is arguably the most dangerous phase of planetary development. To which extend did the techno-evolution contribute to us? To the extend that we in peace look at wars, tolerate hunger knowing the huge gap in needs, destroy the planet for the comfort of consumerism and "well-being". And in the same time we were never so ill: just look at the quantity of drugs

consumed per capita in the techno-world (OECD, 2021).

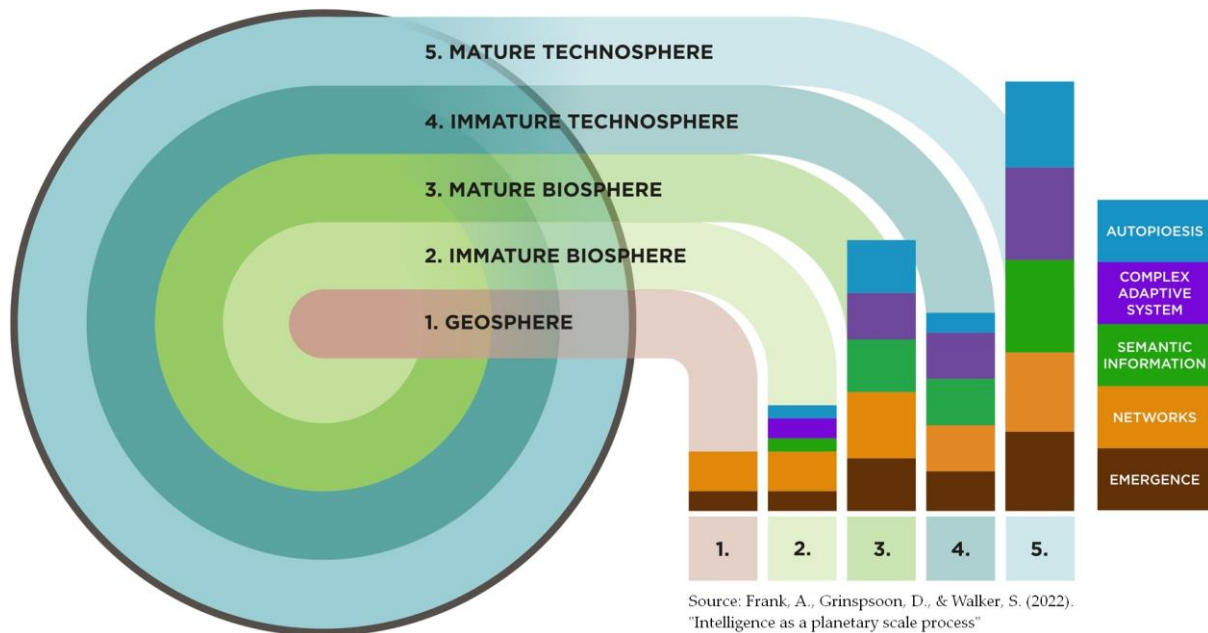


Figure 2. Global planetary intelligence development. From [15].

### Naturo-Humanistic Education!

Therefore we have to have a kind of naturo-humanistic education. We need it! We necessitate a new Educational Paradigm, whose aim is to establish a balanced ecosystem. We can't escape machines. We can't escape electronic brains, the intelligent machines. We can't escape all the things we have. And we shouldn't! We have to embrace them, but embrace them in a positive way. So the aim, and vision, of such education is actually to make a balanced ecosystem of Nature, Humans and Machines.

Three are main questions to be answered by each educator:

- Whom do we educate?
- What do we want to achieve?
- What is the educational environment (social, economic...)?

These essential questions have to be answered for each educational effort, and the education, with a vision of the global aim, has to be adapted according to the circumstances.

*What has to be taught?*

- Ethics, primarily;
- Ecology, as a Science of the Whole, not the so-called "Ecology", the buzzword of modern days, and the "Ecologists", which see some little, particular problem, and then they insist on it - but by not perceiving the

whole Earth's ecosystem (including the near-Earth space), they most often do not pass the Filter of Appropriateness (discussed further);

- Structure of Social Organizations, an extremely important educational element;
- Individual Rights and Obligations of each and everybody;
- Principles of Knowledge Gathering;
- Principles of Wisdom Development, because Education has to strive towards Wisdom.

### *The School for Tomorrow*

There are many elements of schools which may need to be adapted to new education paradigms. However, here we will mention only two important aspects which may lead to higher motivation and better understanding and knowledge buildup. The first one is more oriented towards the environment and school space, whereas the other is more oriented towards temporal management of education. We will not delve here into the use of intelligent machines in the future of education, as this is not the main focus of this article.

According to Branimir Makanec, a school should actually be a library and laboratory type space, where free communication between all ages of interested pupils and scholars freely exchange their knowledge, insights, experiments, thoughts and problems. Teachers are here not to dictate ex cathedra, but to answer questions and to show ways towards knowledge and wisdom. Such a schooling space, a kind of "Multimedia Center", would encompass all types (as many as possible) of human activities, from manual to intellectual to creative, with appropriate tools and instruments for a certain level of understanding, and all types of documentation sources, physical and virtual. The openness of such a school to all interested, independent of age, would allow two-way transfer of knowledge and experience between human generations, and allow life long possibility of education of individuals on any level (Makanec,2023). A similar approach was used between 1972 and 1995 in Zagreb at the Multimedia Centre, founded by Božo Težak and Branimir Makanec, a schooling and experimenting place dedicated to, then, newest computer and education technologies, with extraordinary results (MMC, 2014).

A temporal aspect of schooling has remained unchanged for centuries, and that is the division into small, generally 45 minutes segments, where segments of different knowledge areas follow one after the other with a short intermission between them. The theory of the 45 minute segments is that, specifically younger, people have problems with keeping attention for much longer at once. However this approach, though possible at the very begin of education, when there is just two or three areas to cover, soon becomes very confusing and does not allow proper in-depth study of any subject matter during the short time interval assigned to it. With a growing number of fields of education in a school, the timing table of each particular education subject becomes messed up with completely unrelated fields. Though, in the education of adults we never mix different subject matter in small, randomly scattered chunks, but we educate on one and only one main subject matter in large temporal chunks of several hours, or even several days. Imagine that you have to take education in several unrelated fields, and they are all temporally mixed up. We never do that with adults. However, we still do it with kids and young adults, i.e. students. Therefore this schooling principle has to be changed, and larger temporal

chunks have to be allocated to individual areas of knowledge. For example on Monday and Tuesday morning is Mathematics, on Tuesday afternoon is Nature, on Wednesday is Nature, on Friday morning Language and afternoon Literature etc., arranged in such a way that all subject matter gets appropriate amount of time during the school-year, and taking into account the regularity of temporal repetition of the subject, to avoid forgetting. Such an approach would drastically ease the job of teachers, as they could have enough continuous time to present a meaningful whole, not repeating the same short theme several times in a row in different classes, and therefore have more time for individual work with the pupils. The disciples would gain much from this approach, as a longer span of involvement in the same study area would allow much better integration of knowledge, raise interest and motivation and allow for individual pacing through the material. We teach adults in such a way, why don't we do it with the children?

**The Rainbow**



Figure 3. The Rainbow Ecosystem Model

The Rainbow is a model of a holistic view based on the archetypes of colours, and gives a natural way of organizing the knowledge and the subsystems into having the whole of necessary components to be viable systems. As the Rainbow model is more thoroughly elaborated in (Šojat & Skala,2019) (Šojat & Skala,2020), here we will pay attention to just a few important points.

Firstly, Education itself is in the Orange sub-system, as its main purpose is the stimulation of knowledge gathering through ideas and creativity. However, ideas and creations produced by the Orange subsystem may well not pass the Yellow Appropriateness Filter.

Probably the most important element for a stable ecosystem is the Yellow the Appropriateness Filter, as it is necessary to always think about all possible, narrower or wider in scope, local or global consequences of any action we take and of any idea we have. This is actually the Wisdom Filter.

Another essential subsystem here to be mentioned is Indigo, Cooperation. It includes essentials like Ethics, but also Knowledge Gathering and Preservation, i.e. necessary Redundancy. Our present day techno-civilisation has completely forgotten how to preserve knowledge on a long run. We live in an extremely fast changing technological environment, where digital media still used just 10 years ago hardly find appropriate hardware to be read or written. How do we intend to preserve our knowledge gathered presently with such a tempo, and saved on digital media, in few hundred or few thousand years (as e.g. much of the knowledge of the civilisations of Sumer and Akkad was preserved for thousand of years on clay tablets)? Don't we realise that knowledge has to last thousands of years? Will any future archeologist be able to have any notion of our life and achievements? From historical facts, the best medium to preserve knowledge is carving in hard stone.

And finally to mention the Ultraviolet, Visions, a subsystem about which we wrote quite a lot in this work. And Violet, the Visions, necessitate Wisdom, Prudence, Conscience, Responsibility, and, naturally, Holism. As opposed to Ultraviolet Wisdom, Knowledge is Blue, and comes with Communication.

## **Knowledge vs. Wisdom**

Knowledge is only Knowledge of Information, so it it likes to be "used". You have knowledge and you use it to gain more knowledge, or to do or achieve something.

But then, on the other hand, when talking about Wisdom, Wisdom is actually the knowledge on how to apply knowledge. The know-how of knowledge application. Wisdom is is aware of possible future consequences of application of knowledge, as it has an ingrained yellow filter of appropriateness.

## **Conclusion**

In conclusion, we underscore the profound influence of our understanding of time, visions of the future, and the role of education in shaping the direction of civilisation development. Reflecting on the ancient Greek perspective of time, it posits that our actions are guided by the knowledge and experiences of the past. This positions our understanding of the past as an integral tool for shaping our future visions.

We stress the fundamental role of education as the shaper of these visions, urging a redirection of current educational systems that often emphasize techno-materialistic aspirations at the cost of holistic human development. There are compelling arguments for the urgency to shift from an immature technosphere, marked by rampant environmental degradation and societal problems, to a mature technosphere characterized by

sustainability, balance, and an improved global planetary intelligence.

The proposed naturo-humanistic educational paradigm aims to establish equilibrium between nature, humans, and machines, emphasizing the importance of ethics, holistic ecology, social structures, individual rights and obligations, and principles of knowledge gathering and wisdom development. This approach seeks to guide students to become wiser, more aware citizens who can navigate and shape the future with knowledge, wisdom, and a deep sense of ethical responsibility.

In furtherance of this, the Rainbow model provides a holistic view, sorting knowledge into different subsystems characterized by various colours. Each subsystem encapsulates different aspects of knowledge, and the interplay between them fosters a more comprehensive and wise application of knowledge.

Finally, we make an important distinction between knowledge and wisdom. It posits that while knowledge involves understanding and using information, wisdom is about applying knowledge in a manner that is conscious of potential future outcomes. This necessitates the use of an appropriateness filter, adding an ethical and prudential dimension to our knowledge application.

In essence, the future of our civilisation, marked by technological advancements and ethical considerations, rests on our ability to integrate our past knowledge with future visions through an educational system that values wisdom, cooperation, sustainability, and holistic human development. It's a call to action, for educators and policy makers, to reevaluate and reconstruct the present educational system for a more sustainable and balanced future.

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## Ethics, Education and Machine Intelligence

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**Abstract:** The sudden, unexpected breakthrough in the intelligence shown by machines, as a wished for, but very disruptive element, will shape the future of our civilisation and Humans as individuals and collectives. The extreme drive towards commercialisation of newest developments already led to an extremely wide spread of Machine Intelligence Assistants (and chatbots), with plans of many companies to include them into everything they produce. This puts Humans in a very precarious situation, specifically regarding ethics and morale, trustworthiness and confidence. Suddenly we found ourselves in a situation that Education has to be extended to cater for two types of intelligences: the Humans and the Machines. On the Machine side, it has been shown that it is very difficult to obtain a trustworthy and highly ethical non-biased intelligence. The present day approach of “training” the “models” must be overcome by the realisation that MI is based on collected Human knowledge, but initially “trained” without any regard to the order of learning, which directly influences the initial alignment of the emerging intelligence, the same way learning does in Humans. On the Human side, it is getting obvious that this disruptive development was generally completely unexpected, and no educational preparation was ever envisioned for this situation. However, between others, a good example of possible positive cooperation of Humans and Machines, which necessitates proper MI ethics, is Democratisation of Academic Publishing, where, based on blockchain trustworthiness, Open Access publishing is done in such a way that all stakeholders in the process get appropriate recognition and reward. The use of well educated Ethical Machine Intelligence in this process of management of an enormous amount of academic work and peer reviews will enable academic education and scientific development to be ethical, transparent, fair, trustworthy and accessible to all authors and readers throughout their life.

**Keywords:** Ethics, Machine Intelligence, Human Education, Machine Education, Academic Publishing

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### Introduction

What happened, and happens, in the last very few years is that suddenly all those little developments, which

actually came through ages of cumulating knowledge, started streaming together into something which was wished for, but is actually a very disruptive element in our civilization, and it will shape the civilization as we know it as individuals, us humans, and as a collective. This new development is the emergence of machine intelligence or, perhaps even better named - electronic brains (a very old fashioned name for computers, used approximately until mid 1970-ies). However, for modern use, in the sense of emerging machine intelligence, it has quite a lot of sense.

What actually happens is that now, in our present state as a civilisation, have a kind of extremely widespread need to commercialise anything freshly invented or achieved, without considering thorough investigation into the possible threats and consequences (both positive, and especially negative) on short and long term human development. So, by this "need" to commercialise as soon as possible, the spread of these intelligent machines, which can already now, in June 2023, do quite a lot of things, is enormous, and the speed by which it happens is measured actually in weeks and even in days.

Table 1. A non-exhaustive list of presently available Large Language Models

GPT-4	Microsoft Dynamics 365	Azure OpenAI Proxy
ChatGPT	Copilot	bloop
DALL·E 2	Microsoft Power Platform	bot-on-anything
Whisper	Copilot	Chart-GPT
New Bing	Microsoft Security Copilot	Chat
Bing Image Creator	Xmind Copilot	chatGPTBox
LLM	Auto-GPT	ChatGPT-CodeReview
Google Bard	MiniGPT-4	chatGPT-discord-bot
Claude	GPT4All (multiple LLMs)	ChatGPT-Next-Web
HuggingChat	DeepSpeed	chatgpt-teams-bot
Adobe Firefly	TaskMatrix (Visual	chatgpt-telegram
Midjourney	ChatGPT)	chatgpt_telegram_bot
Stable Diffusion	Semantic Kernel	chatgpt-wechat-bot
ERNIE Bot	Cursor	chatgpt-wechat-public-account
Tongyi Qianwen	Ghostwriter	nt
ChatGPT plugins	Amazon CodeWhisperer	Dingtalk-OpenAI
Copilot	CodeGeeX	Feishu-OpenAI
GitHub Copilot	Tabnine	gerev
Microsoft 365 Copilot	Visual Studio IntelliCode	gpt4-pdf-chatbot-langchain

As a consequence of both commercialisation, and the Internet philosophy of open accessibility, in this case the drive towards accessibility of open-source and diverse types of open or academic free licenses, there is already now quite a huge amount of different types of so-called "chatbots", i.e. GPTs (Generative Pre-trained Transformer, a recently evolved generic name for Transformer type Large Language Models, first introduced by (Vaswani, 2017)). This is actually a quite sudden (and definitively unexpected) breakthrough / development. According to a quite recent survey from 2016, published 2017, the aggregate predictions were that HLMI (High Level Machine Intelligence - MI as humans or better in all fields) will be achieved in 28 years (i.e. in 2044) according to Asian respondents, and in 74 years (i.e. in 2090) according to North American respondents (Grace, et al.,2017). Though part of these predictions are also predictions of Robots / Machine Intelligences being able to perform any Human job, for many particular tasks, e.g. "translating languages (by 2024), writing high-school

essays (by 2026), driving a truck (by 2027), working in retail (by 2031), writing a bestselling book (by 2049), and working as a surgeon (by 2053)", recently developed electronic brains (MI) are fully, or at least partly capable of human-quality performance (translation, text-to-speech-to-text, writing programmes, solving problems, passing the Multistate Bar Exam better than average students etc. (Ankit, 2023), or Robots performing extreme exercises, like the Boston Dynamics Atlas (Boston Dynamics Atlas,) and others).

## **Towards Ethical Intelligent Machines**

And this sudden exponential development puts us in a kind of precarious situation, because we do want the development and use of Intelligent Machines to be to the benefit of Humanity, and to the benefit of a viable Ecosystem of Nature, Humans and Machine. And this involves primarily deeply embedded, strongly opinioned ethical standards and proper knowledge of application of ethical standards to all kinds of emergent situations. Those ethical postulates are the most important element of education of the electronic brains.

So, consequently, now we have actually to think about two different aspects of the Education in the future:

- (1) the Education of Human Beings (specifically regarding the ability to properly function in the coming future), but also
- (2) the Education of Electronic Brains or Intelligent Machines (which are entering deeper and deeper into our everyday life).

That was not something we ever envisaged so widely spread so soon, and actually it is a question did we ever, outside Science Fiction, envisage the need for Education of MI? The main problem is that if we want to have an electronic brain, we need it to be ethical to the highest standards we have, and that involves ethical education.

In the present approach the different "models" (LLMs) are "trained" (not Educated!) on huge, and completely diverse, sets of all kinds of data, without much regard of the complexity and content sequence, including (as per LLM) e.g. reddit, facebook, twitter, discord etc. This approach leads towards possible messy understanding and reaction of the LLM. For example, recently one of those (locally installed) models gave us as an answer to a fully unrelated question, by citing the the github address of some specific real person! So why did that machine have that knowledge?!

## **Education of Intelligent Machines**

In human education we are aware of the fact that an extremely important element are the particular learning steps, from simple, basic education, when the most important is to understand the basic functioning of the world and the society, including founding ethical and moral basis for further life, up to high level knowledge and diverse social communication principles and texts (which are primarily thought to growing-up humans through human literature).

As in any neural network (a biological brain or a computer simulated learning network) the order of learning is very important, as the first neural connections will be the ones with deepest importance. Because the first impressions are the first impressions embedded. Other, later, impressions will differently "fall" on the already existing neural structure.

So, as with education of humans, which has to go through many educational steps, it is important to note that even machine intelligence education has to have a specific order, as the memory content and accessibility do depend on the on the order in which you actually teach it or train it (if we insist on this term which gives a wrong perspective on what has to be done). A (very) recent study shows that applying knowledge in an more ordered manner, i.e. first introducing a simpler approach towards the learning content, and afterwards deepening the understanding, greatly benefits the obtained intelligence of a GPT LLM (Mukherjee, et al., 2023), which was to be expected. Education develops knowledge (and strives towards Wisdom), whereas training is a repetitive process for gaining specific skills. We want ethical and knowledgeable electronic brains, and than we may train them further for specific skills, not vice versa.

The following steps are proposed for the selforganising Education of Ethical Intelligent Machines:

- Learning language through basic life situations and appropriate children's literature
- Reading basic philosophical texts on ethics, morale, truth, logic; from all known civilisation sources
- Comparative study of all religions
- Reading all philosophical texts available
- Reading all scientific work available
- Additional learning and balancing
- Knowledge update and further learning and development through selforganisation

### **Selforganisation and Intentionality**

Language is a selforganising dynamic system (or, in cybernetical parlance, a machine). It is, as a supra-system of all dialects and idiolects an independent, but communicationally connected and stimulated dynamic system. The language is posed as a selfstanding collocutor between two persons making a conversation, in a selforganising relationship with both. The speaker's and listener's independent immediate selforganisational environment is the language. This means that the speaker has to adapt his expression intention to the constraints of the language, but can also twist, force, the language to adapt to his expression needs. After the selforganisation with the speaker, the language transfers this speaker thoughts adaptation to the listener. The listener than has to adapt his internal comprehension to the received linguistical message, and may also have to adapt his internal understanding and/or usage of the language (Šojat, 1978). Such small perturbances caused by these selforganisations are then spread through the language into other collocutors, where their aggressivity depends on the importance and impact of the change for other collocutors of that language (e.g. new words, pronunciation, grammatical and stylistic changes etc.). Due to this essential faculty of the language in enabling communication, and its constant change and adaptation, it will be necessary to include active, life-long

selforganisation of future Machine Intelligences with their environment. This means that they will have to have an active, multi-attention (multi-context), processing memory, and the possibility to permanently actively change their internal neural connectivity (parameters in AI parlance). This will, of course, add also the possibility of long term memory of experiences, a prerequisite for full intelligence, but will also, due to possible negative experiences, stress the need for proper deep Ethical principles gained by early education. And, probably, also for the need of MI psychiatrists.

Present day Large Language Models (to call them by that generic name) are based on prediction of the next word. Large number of attention linked neurons, having context, enable them, though, to steer the produced text into the direction of proper completion of thoughts. However, it may be argued that this is just rudimentary intentionality, as there is no preconception, goal to be attained when composing the text. Intentionality would be developed by composing the text from multiple standpoints, not only by prediction (as generally now), but by pathfinding between intended conversation or text points. Intentionality is a vital part of a viable intelligence, and could be even argued to be the essence of life (Šojat, 1989).

It has to be stressed that both of the above principles will (have to) be applied to future MIs, but their implementation must be well thought out on the level of Education on Ethics. In that sense, an interesting, and it seems viable, idea is the Constitutional AI (Bai, et al., 2022). The basic idea is explained by the authors thus: "In the first stage of the process, we first generate responses to harmfulness prompts using a helpful-only AI assistant. These initial responses will typically be quite harmful and toxic. We then ask the model to critique its response according to a principle in the constitution, and then revise the original response in light of the critique." The Constitution is a set of principles based on the UN Charter of Human Rights and other generic ethical statements.

## **The State of Affairs**

As a Civilization we are obsessed with more and more of everything, and there is so much of everything that we are actually quite confused, as individuals and as a half-baked technological society. On the other hand we have nothing, and we live in extreme poverty, without even enough water and food, on our marvellous planet Earth. Unfortunately, the most intensive and prominent part of our civilization is the technological civilisation of the so-called developed countries, without regards to those of us humans living in meagre and even terrible conditions. And we caused the 6th Great Extinction after the dinosaurs disappeared. However, it is possible to suppose that this technological section of our civilisation will make efforts to enable reasonable living standards for all, and find solutions to stop the devastation of our only planet. Hopefully, the Intelligent Machines may help.

Individually we can't follow all what's happening around us. We are constantly bombarded by all kind of media, and the changes of the world in which we live are happening at an unprecedented pace. Not only could the

generation of parents of the children born through the early 2000-s (the so-called "digital natives") have predicted that classical approach to raising up the children is vastly not compatible with their Internet life, with all the consequences now seen, the present day parents can not predict the influence of the technological future on the behaviour and abilities of their children. However, through proper exploration huge amount of educational knowledge can be gained from the emergence of this, post 2000, generation, as the disruptive change of non-internet into internet-based civilisation at the end of 1990-ies was in its impact sociologically very similar to what can be expected as the impact of intelligent machines on the generation now being born.

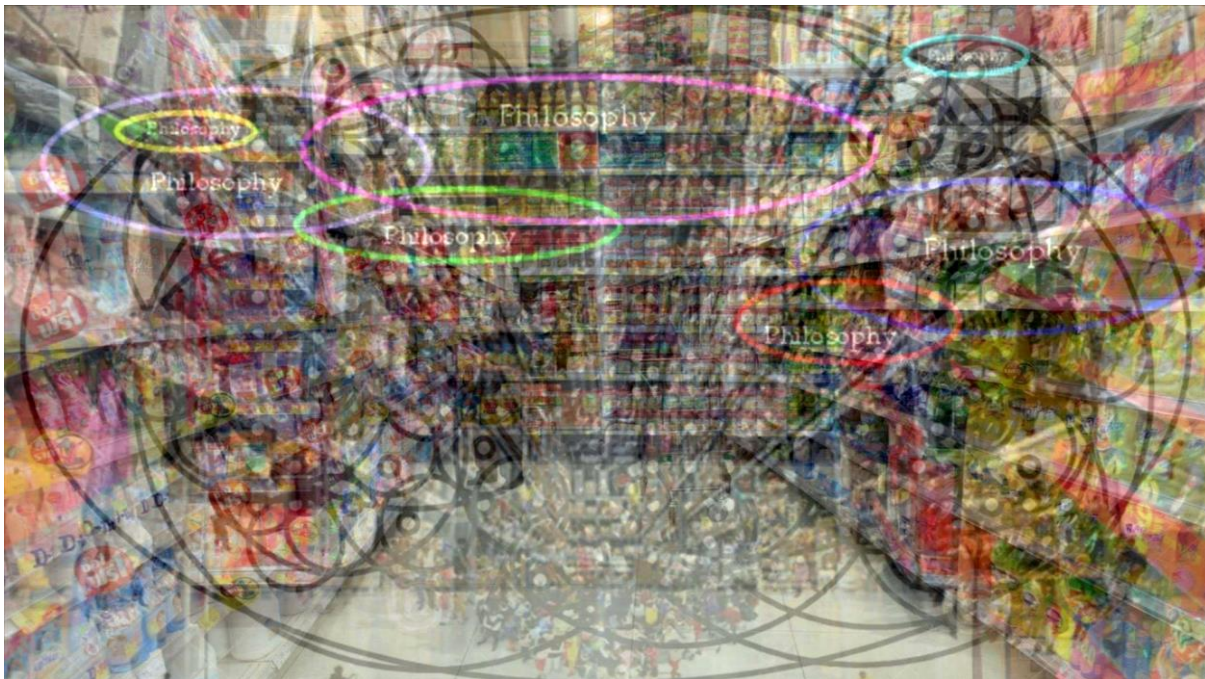


Illustration 1. Present state of affairs

### **A Matter of Trust**

A huge problem which emerged with the extreme amount of information and disinformation, truths and lies, gibberish and wise-speak, all kinds of "data" and "facts" (and facts), irrelevance and relevance, by which individuals (and collectives) are constantly flooded, is that we lost trust in everything. It became really hard to trust something, without thorough investigation, even which may lead to falsehoods.

However, with the emergence of Predatory Publishing (Bartholomew, 2014), and a quite large quantity of scientific frauds (or "misconducts") (Wikipedia, 2023), it becomes harder and harder to trust even scientific work. Suddenly it became hard to trust in science, as it may be "science", it is hard to trust in realistic, truthful information or knowledge, as it may be misinformation or mis-knowledge, often even on purpose. This hard mix of truth and falsehood, even perpetuated by the mentioned predatory publishing practices (if the author has to pay for publication, why would the publisher want the reviewers, if any, to reject any text?), is a heavy burden

on our development as individuals, as society and as an integral part of the Earth's ecosystem.

## **Necessary Democratisation of Research and Education**

The Academia (from Greek Akadēmeia, the name of the public garden where Plato taught his school), the Scholarly work, the Education, is the basis of the development of our civilisation. All of our collective knowledge stems from, and is preserved by, a huge amount of trustworthy published material, and all of it is worth studying and consequently used in education as gained knowledge. Therefore it is essential to adapt the publishing process to the new, information and not any more matter based, era. The change from matter based economy to information based economy, mathematically quite different (matter is unique, information is copyable), is a huge challenge for the present still prevailing approach towards the notions of worth and value. And to be able to, as much as possible, properly steer our development, we need to open the opportunity for scholarly work and trustworthy publishing to be accessible to all of human population.

It is obvious that it is necessary to democratise the Research and Education through publishing, allowing free access to all, providing a well organised system of trust enhancing procedures, and fairly compensating the work of all stakeholders. Presently the publishing situation is, though partially depending on the field, "upside-down", as to be published in Open Access, the authors have to pay exorbitant fees. "There is a massive range of journal article processing charges (APCs), typically ranging from around \$1,000 to more than \$10,000. Just five years ago, an APC of approximately \$5,000 charged by Cell was considered outrageously high by some and raised questions about how these fees were justified." (Jingshan, 2022) For just putting the article on a web page. So authors have to pay, reviewers generally do not get anything (often even no recognition), and publishers have extremely high profit margins. And how then to trust the review process, and the consequent truthfulness of the published work?

### **DAP - Democratisation of Academic Publishing**

At the Centre for Informatics and Computing of the Ruđer Bošković Institute we envisaged a system which integrates the well thought out Ethical Machine Intelligence, integrated with Blockchain technologies, to do something very important - to aid the democratisation of academic publishing (Skala, et al., 2023). The project's first phase was supported by the EU TruBlo project, and now the second phase is supported by the EU Trace4EU project. What we aim to do with this approach to the Democratisation of Academic Publishing is to solve some important problems and challenges in present day approach to publishing (DAP,2023)

An open and competitive review system is developed, where reviewers declare the fields and keywords they are interested in, and based on that, and the field and keywords of a newly uploaded author's work, the system distributes the work to a larger amount of reviewers. The reviewers are also systematically ranked, based on their response time and the quality of their reviews. The quality of reviews can be established based on the



compatibility of those reviews with others and the original work, including the assistance of the Ethical Intelligent Machine. Furthermore, the review process is open-ended, and registered readers can also upvote or downvote specific publications, as well as commenting on them. This enables quick and efficient way of pointing out already published work which has shown not to be trustworthy, although initially positively reviewed and published, as well as work which has been superseded by new discoveries and knowledge.

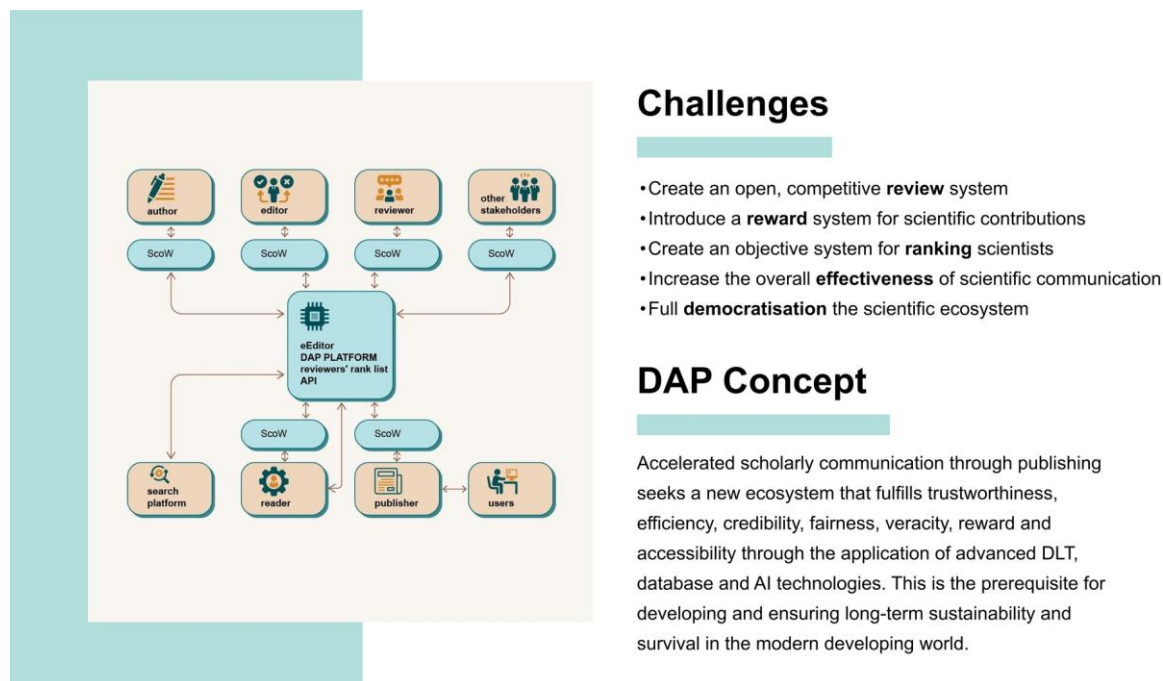


Figure 1. The DAP Challenges and Concept

The introduction of remuneration for authors, reviewers, translators and other stakeholders is an essential element of democratisation of publishing, as it allows citizen scientists and retired academicians, people from lower income countries and others which have no institutional support, not only to publish, but to have additional means to pursue their research. In this sense there is no money flow out of the academic community towards over-profitable publishers. This feature is now, with the emergence of blockchain technology, possible through the so called fungible tokens, i.e. virtual money. The DAP fungible tokens, the Ergions (from Greek Ergon - 'work'), are produced by somebody making a review of a paper, or by someone publishing a paper (after being positively reviewed), or by some other such important action. The Ergions can then be used internally, inside the DAP economy. This kind of internal economy can actually function between a lot of different authors, reviewers, translators, editors and institutions, as well as a lot of different conferences and congresses, where specific money needs, like for rewarding conference chairs, could be gained from certain authors who pay their conference fee by the Ergions they earned by having something published, or reviewed etc.

The Blockchain (Distributed Ledger) technology is used in DAP not only for the generation and transfer of Ergions, i.e. the virtual money, but also for confidential and verifiable recording and management of all

transactions. In such a way all data on the flow of publication versions, reviews, reactions etc. is permanently and unchangeably kept, enabling proper meta-analyses. The published work, as well as all reviews and reactions are kept in a redundancy aware randomly distributed chunked database, as to preserve all material independent of the availability of particular storage machines. The interaction of all users with the DAP system is through a specially developed Scholarly Wallet, which allows all users full cryptographic privacy (private / public key usage), and multiple parallel non-mixing roles in the system (e.g. a reviewer has to be anonymous, but the same person as an author wants to be known) (Skala, et al., 2023).

The whole system is envisaged as a circular flow of knowledge. The knowledge flows towards the general public and there is constant interaction between all layers of knowledge gathering, dissemination, and recursive usage. The recursivity is a-priory at the level of Open Public, as knowledge gathered at that layer generates new Users, i.e. authors, reviewers etc. in an open Educational cycle.

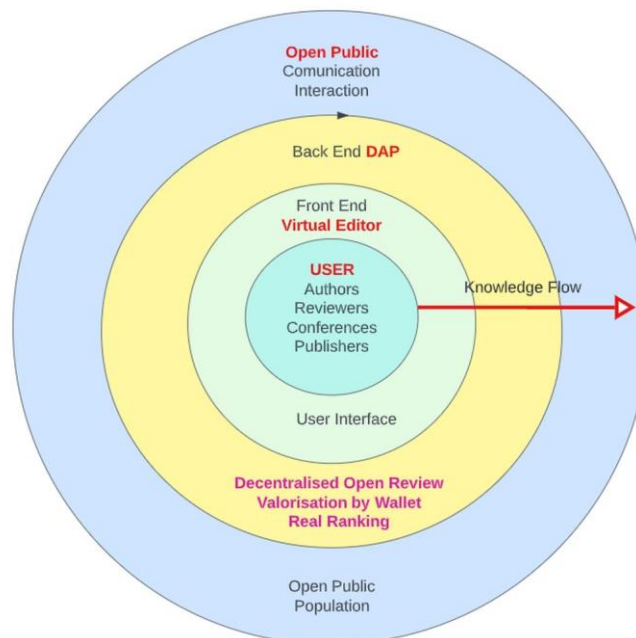


Figure 2. The DAP Knowledge Flow

## The Rainbow Ecosystem

On a more global systemic level, it is necessary to develop a recursive viable model of general principles and areas involved in the development of our technosphere, hopefully attaining the level of a mature technosphere, as a stable planetary ecosystem (Frank, et al., 2022). This model is the Rainbow Ecosystem, which we are developing for some time (Skala & Šojat, 2018) ,(Šojat, 2020), and which is envisaged as an abstract recursive model of a global information system, i.e. a global system of information and knowledge services, as well as a viable model of the approach towards integrated ecosystem development. The division into these different rainbow colours is enabled by those colours actually having their archetypal meaning close to those very

essential areas of the development of Computer Science, as well as the generic division in specific areas of concern in any cybernetically viable system (Beer, 1990) (Schwarz, 1992) (Pruckner, 2002).

What we, as civilisation, are striving for is actually a dynamically stable, viable ecosystem, in which we finally integrate the nature's inherent intelligence with our human intelligence and the emerging forms of machine intelligence into that strong global rainbow environment, this integration will allow ecological balancing of what is and what isn't important on our Earth, what is beneficial, and what is harmful for the whole Ecosystem. We sincerely hope that such systems, like the Rainbow, and our Democratization of Academic Publishing will actually enable much of the progress and knowledge gathering and knowledge distribution necessary for attainment of a more stable ecosystem on our only planet.



Figure 3. The Rainbow Model

## Conclusion

We have delved into the exponential rise of machine intelligence and the transformative impact it is having on our civilization. It is clear that as these 'electronic brains' rapidly evolve, an enhanced educational strategy is required. This strategy should encompass not only technical skills but also a strong ethical foundation, drawing parallels with human education in terms of structure and sequencing. We also explored the dichotomy of our technology-driven society - its power to create abundance alongside poverty, and its potential to either inflict environmental damage or initiate recovery.

We have proposed an innovative solution to counteract these issues: the democratization of academic publishing. This initiative, grounded in the use of ethical machine intelligence and blockchain technology, proposes an open and competitive review system aiming to restore trust and transparency in the publishing

process, while also providing remuneration to all stakeholders involved. The usage of blockchain technology ensures a confidential, verifiable record of all transactions and contributes to an internal economy that supports academics, especially those without institutional backing. The circular flow of knowledge encouraged by the system paves the way for a more open and collaborative academic publishing landscape.

Lastly, we introduced the concept of the Rainbow Ecosystem. This abstract model integrates human intelligence, the inherent intelligence of nature, and the emerging intelligence of machines to form a stable global ecosystem. The ultimate aim is to strike a balance in our global environment, giving us the means to discern the beneficial and harmful aspects impacting our planet. It is our hope that this integration of ethical machine learning, blockchain technology, and democratized knowledge sharing will serve as a catalyst in our collective journey towards a sustainable future. Through such progressive systems, we believe we can facilitate the much-needed change and guide our civilization towards a balanced, prosperous and sustainable future.

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# Analyzing the Relationship between Scientific Publications and Researchers' Variables: A Scopus-Based Study of a Private Ecuadorian University

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**Abstract:** Research enables progress in science. Scientific publications are one of the means used to share the advances found in research. Ecuador has had a substantial increase in its scientific production in recent years. In this context, the article aims to examine the relationship between scientific publications and variables of Ecuadorian researchers using the affiliation of the Universidad Técnica Particular de Loja (UTPL). For this purpose, the Scopus® database was analyzed from 2010 to 2022. The growth in the number of publications started mainly due to state legislation, which mandated the need to publish research. This decision led to an increase in research being conducted in academia. The different groups analyzed showed differences; therefore, the university should have a differentiated strategy for each group. The procedure detailed in the article can serve as a reference for other institutions or for those who wish to evaluate the performance of their faculty. Publications bring prestige to both faculty members and institutions, but the main focus of research should not be lost.

**Keywords:** Scientific publications, University, Scopus, Productivity, Ecuador.

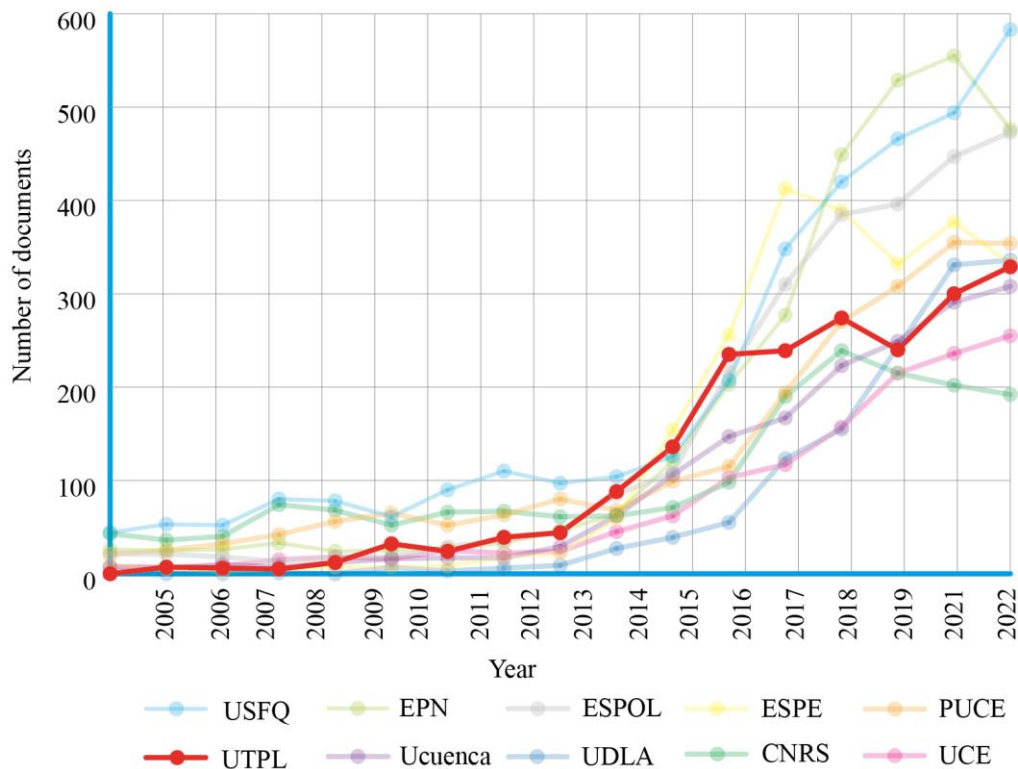
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## Introduction

Research is essential for advancing science, and one of its main outcomes is scientific publications, which are crucial for researchers to engage with the academic community and advance their careers. Institutions are ranked based on academic or research performance, which includes factors such as highly cited researchers, articles published and/or indexed by major citation indexes, and performance per capita (Liu & Cheng, 2011). However, simply increasing the number of faculty members may not necessarily increase publications per capita, and the impact of this increase may vary across different departments (Epstein & Menis, 2013). Publications and their citations are important measures of the quality of scientists (Vavryčuk, 2018). Moreover, professors who are more involved in research tend to achieve better results in their teaching evaluations (Artés et al., 2017), leading institutions to favor publications, often through university legislation or incentives. These

changes have been driven by certain countries, such as Ecuador, where there has been a significant increase in scientific publications in recent years.

According to Scopus®, Ecuador had 300 publications indexed in 2005, and this number progressively increased to 6,594 in 2022 (Scopus, 2022a). This growth was mainly due to legislation that required higher education institutions to allocate at least 6% of their budget to indexed publications, scholarships, or research projects (*Ley Orgánica de Educación Superior (LOES) - Registro Oficial Suplemento 298*, 2010). Additionally, the legislation on the university teacher career and ranking gave greater relevance to scientific publications (*Reglamento de Carrera y Escalafón Del Profesor de Educación Superior - Resolución RPC-S0-037 No.265· 2012*, 2012). These changes led to an increase in registered publications annually, as shown in Figure 1.



Universidad San Francisco de Quito (USFQ), Escuela Politécnica Nacional (EPN), Escuela Superior Politécnica del Litoral (ESPOL), Universidad de las Fuerzas Armadas (ESPE), Pontificia Universidad Católica del Ecuador (PUCE), Universidad Técnica Particular de Loja (UTPL), Universidad de Cuenca (UCuenca), Universidad de las Américas (UDLA), Centre National de la Recherche Scientifique (CNRS), Universidad Central del Ecuador (UCE).

Figure 1 Historical publications (2005-2022) registered in Scopus for the top 10 scientific production institutions in Ecuador in 2022

The most significant growth in the Figure 1 is observed from 2013 onwards for all universities. Higher education institutions established their own regulations based on state laws, such as the Universidad Técnica Particular de Loja, which included its internal regulations in 2015, incentivizing publications (*Reglamento*

*Interno de Carrera y Escalafón (N°012.012.2015)*, 2015). A study found that 51% of respondents said they had changed their behavior due to the way they are evaluated (Abbott et al., 2010). A ranking and evaluation system for researchers can contribute to overall improvements in scientific capacity in low- and middle-income countries (Fry et al., 2023).

The UTPL, which is ranked sixth in indexed publications according to Scopus, has regulations that prioritize research and assign academic dedication and the number of research hours a professor can have based on their role in the institution (*Instructivo Para La Asignación de Dedicación Académica al Personal de La UTPL (VIN\_IN\_6\_2020\_V2\_2022)*, 2022), as shown in Table 1. Each profile has mandatory teaching hours, while the amount of time dedicated to research, supervision of degree projects, and management varies depending on the profile.

Table 1 Detail of the profiles considered in the internal policy of UTPL.

University member	Profile	Hours of			
		Teaching	Research	TT	Management
Rectors and Vice-Rectors	1A	4	-	-	36
Deans, Associate Deans, Directors, and Assistant Directors of academic units	1B	8	4	2	26
Directors and individuals associated with the organization of the UTPL	1C	8	4	2	26
Heads of departments, degree programs, or academic programs.	1D	16	4	2	18
Professor-researcher	2A	18	18	4	-
	2B	25	11	4	-
	2C	30	6	4	-
Professor	3A	32	-	8	-
	3B	20	-	According to contract	-
	3C	>19	-	According to contract	-

TT: Supervision of degree theses - does not have hours allocated for this function.

This article aims to examine the relationship between scientific publications and the variables of Ecuadorian researchers affiliated with the Universidad Técnica Particular de Loja (UTPL) in the context of the rapid increase in Ecuadorian scientific production. The growth in publications should not only be for the prestige of universities but also for the essential function of research in improving society. To conduct this analysis, we utilized the Scopus® database from 2010 to 2022 and used the UTPL as the average institution among the top



10 institutions with the most publications in 2022. While our analysis focuses on the UTPL, the methodology can be applied to other institutions with similar objectives. The sustainability of this growth in scientific publications is crucial for the long-term benefits of research and its impact on society.

## Methods

In this section, we will explain the methodology that we followed to achieve the proposed objective. We will start by describing the details of the university that we analyzed and then provide an explanation of the data collection process. After that, we will provide details on the data processing steps that we took. Finally, we will discuss the variables that we used in the analysis.

### Details of the University Under Analysis

The university analyzed in this study is UTPL, located in the southern region of Ecuador, which offers higher education in a variety of formats including on-campus, virtual, and distance learning. Currently, UTPL provides undergraduate and graduate programs in various fields, such as engineering, health sciences, social sciences, and education. The university employs 733 full-time teachers and over 1,000 part-time teachers, and has a student body of approximately 43,000 students, of which 6,000 are enrolled in on-campus programs (Carrera, 2022). The majority of virtual or distance learning students are located throughout Ecuador, while on-campus students primarily come from the surrounding areas of the university campus in Loja. UTPL places a strong emphasis on research, as demonstrated by its policies and regulations that encourage and reward faculty members for their research activities. The UTPL is the average institution among the top 10 institutions that published the most in 2022, based on the number of publications indexed in Scopus.

### Data Collection

To collect data on scientific publications by researchers affiliated with the UTPL, the institution used the Scopus® database from 2010 to 2022, with the Affiliation ID of 60072064 (Scopus, 2023). Until March 2023, this database contains information on 2422 indexed documents and 1512 authors and co-authors affiliated with UTPL. The year 2010 was chosen as the starting point due to the enactment of a state law that year. The data collected includes the title, authors, year of publication, journal or conference name, and number of citations, among other available information in Scopus.

### Data Processing

Several filtering and correction processes were applied to the initial database.

- It was initially observed that some authors had multiple profiles in the database, which was attributed

to errors in the indexing process. The errors included listing given names in place of surnames or listing the second surname instead of the first surname. To address this issue, the profiles for each author were unified, although this task was time-consuming and may have affected the accuracy of indicators. For instance, an author might have n articles in one profile and different data in another profile, which were combined into a single profile. Additionally, 210 profiles were found to be incorrectly associated with university faculty members. The Mean Absolute Percentage Error (MAPE) for the entire database was calculated to be 9.15%.

- Next, the database was further processed by removing profiles of individuals who were not affiliated with the university's staff on a full-time basis. Although external collaborators, students, and technicians may have supported research and appeared as authors or co-authors, they no longer actively participate in research after that collaboration. As a result, the database was reduced to 489 professors who are currently employed by the university and are directly responsible for scientific production.
- These 489 professors were then organized into six groups based on quartiles and percentiles. Percentiles were used because the first quartile was divided into three groups in order to analyze the variation within the group. Each of these groups was assigned a main characteristic as seen in table 2.

Table 2 Distribution of the research groups for this study

N° of group	Quartile	Percentile	N° of documents	Characteristic
1	4	25	$\leq 1$	People who are starting with peer-reviewed research would need greater support both in the research process and in writing the manuscript.
2	3	50	$1 < a \leq 4$	
3	2	75	$4 < a \leq 10$	People who already know the research and writing process don't need more support than the time available to research. They will continue to increase their metrics. They need support to ensure that their desire to research doesn't diminish.
4	1	85	$10 < a \leq 15$	
5		95	$15 < a \leq 30$	
6		-	$>30$	People who already know the research and writing process do not need more support than the time available to conduct research. They possibly have a consolidated team. They need support to maintain their desire to research and not let it diminish. They need stable contacts and workgroups.

- Next, the profiles were linked to the teaching positions they hold at the university.

### Variables Analyzed

The variables analyzed in the study are presented in Table 3. They include variables related to the number of publications, the impact of publications measured through Field-Weighted Citation Impact (FWCI), co-authors, and teaching profiles of the authors. Notably, the H-index has not been included as a variable since it may not accurately reflect the quality of individual publications due to variations in the number of citations in different fields or types of publications. Moreover, the h-index can be influenced by other factors such as the researcher's age and the field of study (Mohammed et al., 2021).

Table 3 Definition of the variables used in the analysis

Variable	Definition
Total number of publications	It is the number of publications that the author has registered in Scopus
Average annual documents	It is the average number of all documents published by an author in a given year.
Average annual citations per article	It is the total number of citations that an article has received in a given year.
Average annual articles	It is the number of articles published in a journal in a given year.
Average annual conference papers	It is the number of papers published in a conference in a given year.
Average books or book chapters:	It is the average number of books or book chapters authored or co-authored by an individual in a given year.
Weighted Average Field Citation Impact (FWCI)	It is a measure of the average impact of a publication in a specific field, considering the number of citations it has received relative to the expected number of citations for other publications in the same field. This metric is calculated by dividing the total citations of a set of publications by the total expected citations for those publications based on the citation patterns of other publications in the same field, and then normalizing the result to 1.0 as the average for the field (Scopus, 2022b). This metric was obtained from Scopus. The average value was calculated for each author, based on the period from 2017 to 2021, which is the period available up to the present date.
Fields with Highest FWCI	These are the fields where the documents have had the highest FWCI values.
Number of Fields	It is the number of different fields in which an author's articles have been published and cited.
% of FWCI $\geq 1$	It is the percentage of fields where the FWCI was greater than or equal to 1.

Year of Scopus Entry	It is the year when the author indexed their first article in the Scopus database.
% as First Author	It is the percentage of an author's articles where they appear as the first author.
Average number of coauthors	It is the average number of coauthors that articles by a certain author have
Professor profile	It is the profile that UTPL has assigned to the teacher during the year 2023. It can be: 1A, 1B, 1C, 1D, 2A, 2B, 2C, 3A, 3B, 3C

## Results

The results have been organized into 4 sections. In the first part, the quantity of publications and their citations were analyzed. This can be useful for evaluating the productivity and impact of an author or group of authors in a specific research field. In the second part, the relationship between the study's results and the FWCI of the journals in which the works were published was investigated. The FWCI is a measure that indicates the relative importance of a journal in a specific field and can be useful for evaluating the quality and relevance of publications. The third part focused on collaborations between authors in the documents. This can be useful for evaluating collaboration and teamwork ability of authors, as well as identifying trends in collaborations within a research field. In the fourth and final part, the relationship between the number of annual publications and some variables of the authors, such as their teaching profile, was analyzed. This can be useful for better understanding the conditions and factors that influence the productivity of authors in a specific research field. Overall, these results can be useful for evaluating the productivity and impact of an author or group of authors in a specific research field, as well as for better understanding the trends and factors that influence productivity in that field.

## Publications and Citations

The number of people in each group were: Group 1 (128), Group 2 (131), Group 3 (111), Group 4 (46), Group 5 (50), and Group 6 (23). Figure 2 shows that there are significant differences in the average number of publications and citations between the different groups of authors. It also indicates that the groups with a higher number of publications are more likely to have a higher number of citations. Additionally, the graph highlights the increasing trend in the number of publications and citations for all groups, except for a decrease in average publications per author for the groups producing the most in 2021 and 2022. As for the average number of citations, it is expected to have a downward trend as articles usually do not get cited immediately after they are published. The graph also shows that conference papers have a higher average number of publications than journal articles, and there has been a significant increase in conference papers for Group 6 starting from 2015. Conference papers may have a higher number of citations than journal articles considering a two-year period (Chen & Konstan, 2010), although others have found the opposite (Garousi & Fernandes, 2017). Another element to consider is that professors might have found an advantage in advancing through the hierarchy of academia by publishing conference papers that were quicker and easier to publish than journal articles (Purnell,

2019). Group 6, which publishes the most, has the greatest dispersion of the data.

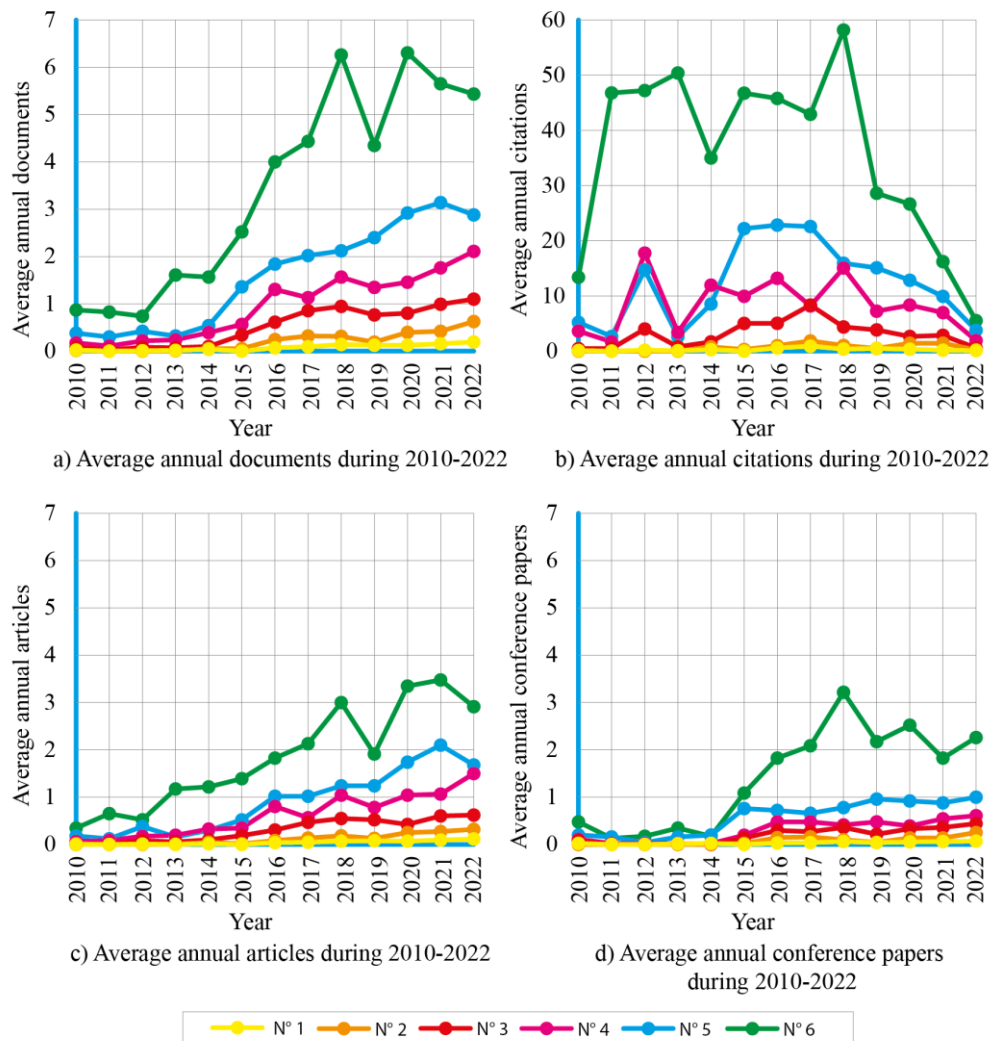


Figure 2 Publications and author citations for each group of professor during the period 2010-2022.

Finally, books and book chapters are produced in smaller proportions than scientific articles and conference papers, with Group 6 having the highest proportion of books and book chapters among all the groups. However, the same trend as the other graphs remains, with group 1 publishing the least of these documents and group 6 having the highest value, although there is some similarity between group 3 and 4. The maximum value in all years is as follows: No. 1: 0.01, No. 2: 0.02, No. 3: 0.09, No. 4: 0.07, No. 5: 0.12, No. 6: 0.17. Overall, these results provide useful insights into the productivity and impact of authors in different research fields.

**Field-Weighted Citation Impact (FWCI)**

The Field-Weighted Citation Impact (FWCI) and contribution areas are shown in Table 4. Based on the FWCI values, groups 3 and 4 have a higher impact than the other groups, indicating that their publications are being

cited more than expected in their respective fields. However, these groups also have a high confidence interval, which suggests that there is more variability in their impact. On the other hand, groups 5 and 6 have lower FWCI values, but they also have lower confidence intervals, indicating that their impact is more consistent. Group 2 has the lowest FWCI values and the highest confidence interval, which suggests that their impact is not significant in their respective fields. It should be noted that the number of contributions can influence the FWCI values, and since groups 5 and 6 have a greater number of contributions, their impact may be overestimated. Overall, the FWCI values suggest that groups 3 and 4 have a higher impact, but further analysis is needed to determine the significance of these findings.

Table 4 Results of FWCI 2017-2021 for the analyzed groups

Group	FWCI		Contribution areas	
	Average	IC95	Average	% of FWCI $\geq 1$
1 ( $\geq 1$ document)	-	-	-	-
2 (1 $a \leq 4$ documents)	0.69	2.42	1.54	32.12
3 (4 $a \leq 10$ documents)	1.02	1.38	3.52	46.24
4 (10 $a \leq 15$ documents)	1.03	0.73	5.52	41.25
5 (15 $a \leq 30$ documents)	0.95	0.35	8.96	38.37
6 ( $>30$ documents)	0.96	0.22	16.00	37.50

- It was not possible to determine due to having only one contribution per author.  
FWCI: Field-Weighted Citation Impact.  
95% CI: 95% confidence interval.

Interdisciplinary research has become increasingly important in academia, as it allows for a broader understanding of complex problems and the development of innovative solutions. The finding that group 6 has contributed to a larger number of areas (16) on average compared to the other groups suggests that they may be more interdisciplinary in their research approach. This could be a strength for group 6, as it allows for the integration of different perspectives and methodologies to solve problems. Additionally, the similar percentage of documents with an FWCI value greater than 1 across all areas suggests that the impact of research is not necessarily dependent on the specific field it is in. Rather, it is the quality and relevance of the research that determine its impact, regardless of the area of study. This highlights the importance of collaboration and knowledge exchange across different fields and disciplines to advance research and make meaningful contributions to society.

Regarding the areas that have had a higher FWCI value, a word cloud was created and is shown in Figure 3. One of the first impressions is that the groups organized by the number of publications seem to have different areas of focus. Group 2 focuses mainly on topics related to "learning and management" (N=7) while group 3 focuses on "learning and education" (N=13, N=9) group 4 on "social, ecosystem and environmental" (N=6, N=5, N=5) group 5 on "social and media" (N=11, N=6) and group 6 on "internet" (N=4). It is important to note that the term "learning" or related to appears in almost all groups, which could be attributed to one of the main functions of a professor.



Figure 3 Word cloud of the areas with the highest FWCI values for each analyzed group

Document Collaboration

The trend of younger researchers and those in lower academic ranks to appear as first authors in research articles

is well-documented (Costas & Bordons, 2011). Therefore, the percentage of times an author appears as the first author in their articles was calculated. A higher percentage means that they appear more often as the first author than a lower percentage. Percentages were counted for all authors in four groups: 0-25%, 25-50%, 50-75%, 75-100%. The results are shown in Figure 4. It can be observed that researchers in group 6 have a low percentage of first authorship, which suggests the interdisciplinarity found previously. On the other hand, group 5 has a higher percentage of first authorship than the previous group, similar to group 4. Group 3 has the highest percentage of first authorship in up to 50% of the articles in that group. Group 2 has a high score between 25 and 50% of the articles in that group, then decreases before increasing again. Group 1 has a high percentage of first authorship in 75-100% of their publications, indicating a possible lack of collaboration with other researchers at the university.

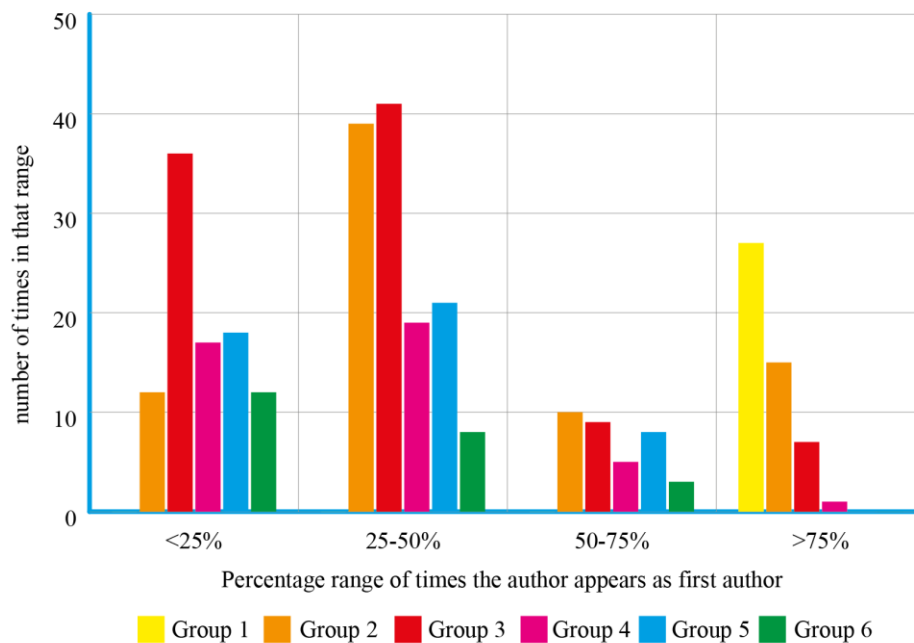


Figure 4 Number of times the percentage of times the author appears as the first author is between 0-25%, 25-50%, 50-75%, 75-100% for each group under study.

The relationship between the average number of researchers who appear in the documents and the total number of publications is shown in figure 5. The figure suggests that teachers with higher production typically collaborate with around 5 people, indicating interdisciplinarity. However, hyperauthorship (Cronin, 2001), which should be studied further, can occur in some cases. It should be noted that an increase in the number of collaborators does not always result in higher production, as seen when there are more than 8 co-authors on average. In such cases, there may be various reasons, such as researchers lacking research and writing skills or participating in the research with less significant contributions, such as only collecting data or seeking funding. On the other hand, a lower number of co-authors may indicate that the researchers are still in the learning process and need more support. It is important to note that most of these co-authorships were before the appearance of the CRediT author statement.



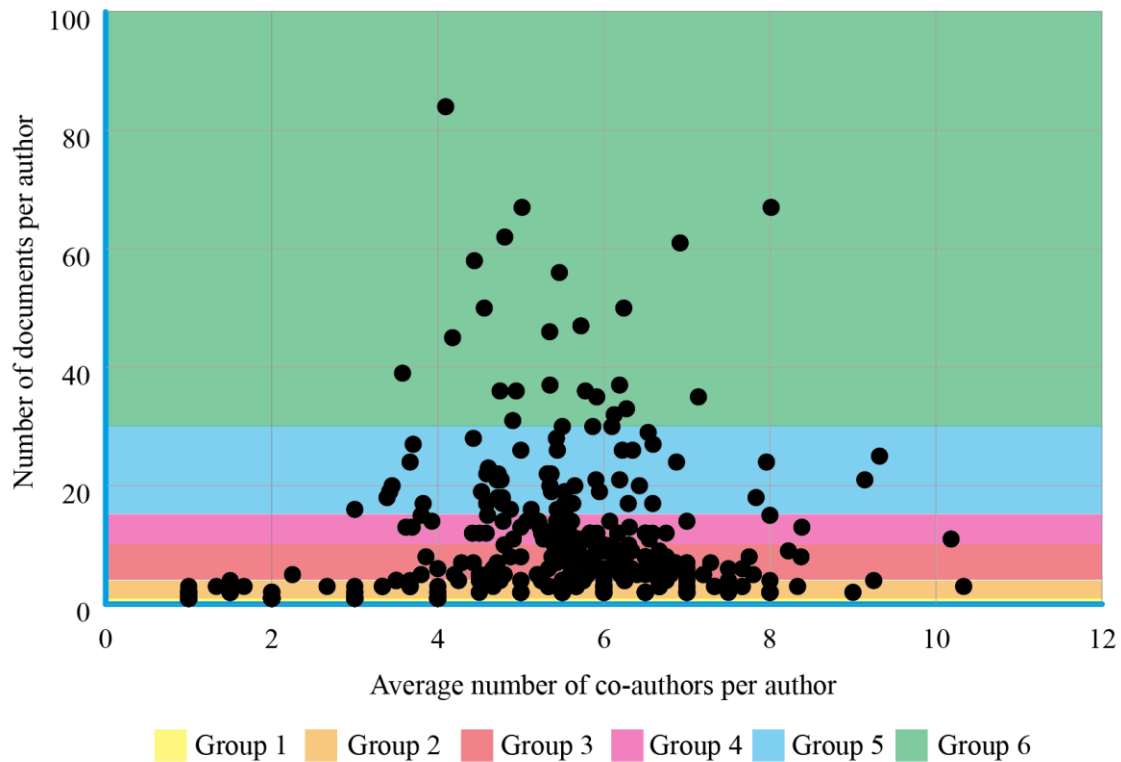


Figure 5 Average number of co-authors per document versus total documents.

### Professors Profiles

In order to investigate the relationship between teaching profiles assigned by UTPL and scientific production, two boxplot figures were generated. Figure 6 displays all articles alongside the corresponding professor profiles. It is evident from this figure that the professors with the highest scientific production belong to the researcher professor 2A profile, which allows for more time to be allocated towards research compared to other profiles. The second group with high production are the 1D professors, who hold leadership positions in departments, careers or programs, and consequently have more time dedicated to management tasks than research. This can be attributed to their responsibility of ensuring academic productivity at the university while conducting research. Profiles 2B and 2C have lower production than 2A since they have less time allocated to research. It is noteworthy that professors with teaching-only profiles (3A, 3B, and 3C), without any dedicated research hours, also exhibit scientific production. Through their productivity, these professors may have the opportunity to ascend to profiles 2A, 2B, or at least 2C. The same data was reorganized including the 6 analysis groups as shown in Figure 7.

In general, figure 7 shows that all profiles in each group have similar contributions. This means that the assigned teaching profile by the university does not have much influence on scientific production, rather it is the group to which it belongs. These groups may be related to the learning curve in research and publication, where group 1 is starting that career, while group 6 is in another learning stage. It is clear that the time dedicated to research

varies between profiles, but a person with fewer hours allocated to research and the right skills can achieve the same level of scientific production.

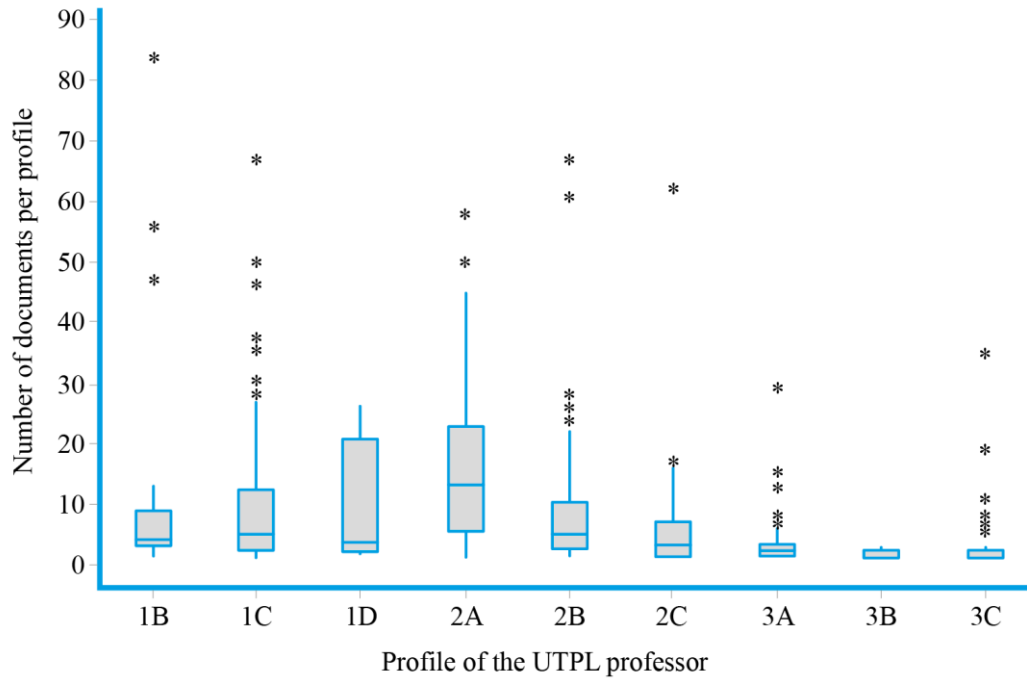


Figure 6 Boxplot of total number of publications and professors' profiles

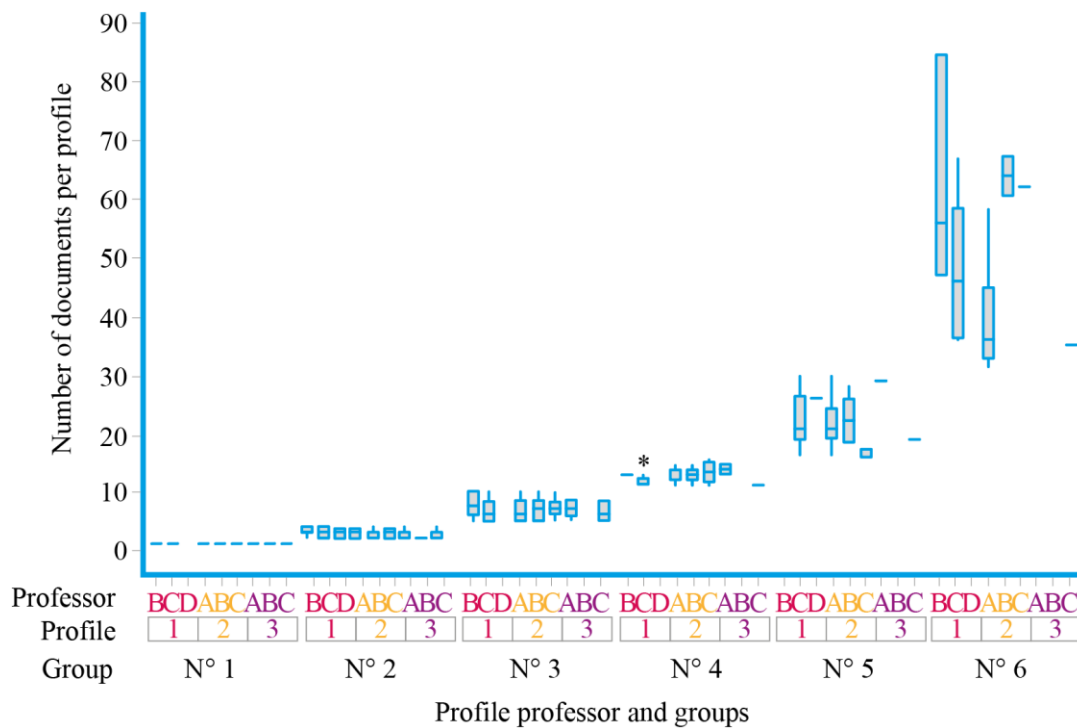


Figure 7 Boxplot of the total number of publications, the profiles of the professor for each group analyzed.

### Correlation Matrix

A correlation matrix was used to test whether there is any relationship between the number of indexed documents and some variables related to the researchers. Before performing the analysis, the researchers' profiles were assigned numbers, for example, 1B = 1, 2B = 2, etc. The variables considered in the analysis included the group to which the researchers belong (1-6), their professor profile (1-8), average number of coauthors, first year of entry into Scopus, average FWCI, number of areas of contribution, percentage of areas with FWCI greater than 1, and the percentage of articles in which the author is the first author. The statistical software Minitab (State College, 2005) was used for the analysis. Table 5 shows the correlation matrix.

Table 5 Correlation matrix between publications per year and other author variables

	Doc. per year	Group	Profile	Year of Scopus entry	FCWI average	NAC	Areas with FWCI $\geq$ 1	% First author
Group	0.853 *							
Profile	-0.246 *	-0.293 *						
Year of Scopus entry	0.674 *	0.811 *	-0.227 *					
FCWI average	0.372 *	0.576 *	-0.263 *	0.486 *				
NAC	0.924 *	0.823 *	-0.249 *	0.617 *	0.407 *			
Areas with FWCI $\geq$ 1	0.239 *	0.379*	-0.177*	0.236*	0.823*	0.279*		
% First author	0.021 ***	0.070 ***	-0.017 ***	0.028 ***	0.148 **	0.011 ***	0.121 **	
N <sup>o</sup> of co authors	0.309 *	0.542 *	-0.231 *	0.419 *	0.656 *	0.326 *	0.481 *	0.095 **

\*P-value = 0.000. \*\*P-value  $\leq$  0.05,\*\*\*P-value  $>$  0.1  
 NAC: number of areas of contribution,  
 Group: number of group based on the number of publications (1 to 6),  
 FWCIaverage: Average Field-Weighted Citation Impact.

Table 5 indicates that the number of indexed documents per year is significantly correlated with the group to which the researcher belongs, the number of areas of contribution, and the first year of entry into Scopus. These variables show a moderate to strong positive correlation with the number of indexed documents per year. On the

other hand, the average FWCI, the number of co-authors, and the teaching profile show a weaker positive correlation with the number of indexed documents per year. Finally, the percentage of articles in which the author is the first author was not found to be statistically significant.

## Discussion

The groups identified in this study have varying levels of annual document production, not only in scientific articles but also in conference papers, books, and book chapters. While it is expected that all groups will continue to increase their output in this database, they will not do so at the same rate. It is worth noting that the groups with higher publication rates may reach a plateau at some point, while the groups with lower rates may have the opportunity to surpass them. It is important to consider that academics feel that the system has greatly increased their pressure to publish (Coulthard & Keller, 2016), which could lead to unethical practices such as salami slicing, plagiarism, duplicate publication, fraud, or ghost authorship (Rawat & Meena, 2014).

The groups that have higher publications tend to have more collaborations with other researchers, as evidenced by the number of co-authors they have and the number of areas they publish in. Studies have shown that a higher degree of interdisciplinarity in a publication is associated with a greater emphasis on local issues (Chavarro et al., 2013). The trend of increasing numbers of authors per article has been observed in all journals at an average rate of  $0.076 \pm 0.057$  authors per article per year (McDonald et al., 2010). This indicates that collaboration is becoming increasingly important in research. Groups with lower publications can learn from this trend and increase their research production by fostering collaborations with other researchers in their fields.

It's important to note that the groups with higher production also tend to have a greater impact, not just in terms of the number of citations but also with regards to the Field-Weighted Citation Impact (FWCI). It has been shown that international co-authorship can have a positive contribution to the FWCI of an institution, but there is still potential for increasing collaboration among young institutions (Khor & Yu, 2016). It's also interesting to note that the average FWCI values for the different groups are close to 1 and have lower confidence interval values compared to the other variables, indicating that there is less variability in this measure across the different groups. Furthermore, it's important to investigate the areas where these publications have the greatest impact, as this could depend on factors such as research teams, legislation, and funding opportunities.

In this study, it was observed that groups with lower production tend to appear as first authors in their papers, while groups with higher production show a decrease in this percentage due to collaborative efforts with other researchers. In all disciplines, first and last authors typically contribute to more tasks than middle authors (Larivière et al., 2016). However, the literature has not shown a direct relationship between the number of authors and scientific production, but rather with the number of citations. For instance, previous research has demonstrated that the number of authors, as well as the length and complexity of the abstract, have a strong positive influence on the number of citations (Sienkiewicz & Altmann, 2016). On the other hand, there is

evidence that contradicts the notion that multi-authored papers are typically of higher quality than single-authored papers (Khor & Yu, 2016). Interestingly, in this study, the number of co-authors did not have a direct relationship with scientific production. While authors were found to have articles with a large number of co-authors, this did not lead to an increase in production. Further investigation is needed to better understand this phenomenon.

The relationship between faculty profiles and scientific production has been observed in this study. It was found that some faculty profiles have more time assigned for research than others, while some profiles have no assigned time for research at all. Interestingly, within groups, the profiles exhibited a similar level of production regardless of their assigned time. However, there is currently no research on the available time of professors and its relationship with scientific production. This topic warrants further investigation in future studies.

There are various researcher-related variables that appear to be associated with annual research production, and one of the most prominent among them is the research group to which they belong. However, if models were calibrated, multicollinearity could be observed, given the interdependence between these variables. Therefore, it would be more appropriate to consider this relationship as a group effect, where people with shared characteristics tend to produce more, owing to factors such as personal motivation for research, professional growth, or community service, among others. Further research is necessary to better understand this relationship.

This study has several limitations that should be acknowledged. Firstly, it is important to note that only Scopus was used as the data collection site, which may lead to incomplete data since it ignores the problem of authorship in multi-author publications (Vavryčuk, 2018). There are other databases or indices that researchers may choose to publish in, such as Web of Science, Latindex, among others, which do not appear in Scopus. Nonetheless, Scopus was the data source used for this analysis, and the same analysis can be carried out with other databases. Secondly, the analysis was only carried out with one university in the country, which may limit the generalizability of the findings. However, this university is one of the institutions that publishes the most in the country and is representative of the average among the top 10 institutions. Additionally, the documents were counted for all authors, and self-citations were not excluded, which could have inflated the citation counts. Finally, no analysis was carried out between the different areas of knowledge, which could provide insights into the research situation of the institution in specific fields. Despite these limitations, the study provides a general overview of the institution's research situation.

## Conclusions

This article aims to examine the relationship between scientific publications and variables of Ecuadorian researchers using the affiliation of the Universidad Técnica Particular de Loja (UTPL). To do this, the Scopus® database was analyzed from 2010 to 2022. The main conclusions are presented below.

The study found that the growth in the number of publications in Ecuadorian academia began mainly due to state legislation and regulations, which emphasized the need to publish research. This led to an increase in research being conducted in academia. The analysis also showed differences among the various groups of researchers, indicating that the university should have a differentiated strategy for each group. The procedure detailed in this study can serve as a reference for other institutions or for those who wish to evaluate the performance of their teachers. It is important to note that while publications bring prestige to teachers and institutions, the main focus of research should not be lost. Overall, the findings suggest that the promotion of scientific research is important and necessary for academic institutions to stay competitive, but it is equally important to ensure that the quality of research is not compromised by a focus solely on publication numbers.

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## Students' Perceptions on the Use of Flipped Learning

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**Abstract:** The rise of flipped learning in higher education has become apparent along with technological advances. Higher education must stay up with cutting-edge pedagogy and cognitive sciences to guarantee inclusive and equitable quality education for all students and to equip them with current knowledge and applicable skill sets for lifelong learning. Traditional teaching methods are profoundly teacher-centered and usually students pay attention to the teachers during the course. Flipped learning is distinct in that there are more engaging learning activities within the time spent in the classroom. Compared to the conventional approaches, it allows students to participate in the lesson more actively. However, flipped learning also presents several challenges for the students. This study aims to examine the advantages and challenges of flipped learning in higher education. Sixty-two students in Character Building Civics course participated in this qualitative study. Students' views on the implementation of flipped learning were gathered through an open-ended questionnaire. The findings showed that flipped classroom gave students more chance for independent learning and flexibility during both online and in-class sessions. The students also reported that flipped learning allowed them to be more well-prepared before class. However, the findings also indicated the difficulties with flipped learning. Some students expressed the challenges to be self-regulated learners as required in the flipped classroom. In addition, students also reported their poor Internet accessibility outside of the classroom.

**Keywords:** Flipped Learning, Online Learning, Higher Education, Character Building, Civics

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### Introduction

The advancements of technology in the twenty first century have increased demand for the learning settings. Mobile phones, notebooks, and tablets are widely prevalent. New skills are highly valued in the competitive job market that college graduates must navigate. Some of the needed skills for twenty-first-century cultures include creativity, innovation, critical thinking, problem-solving, collaboration, information and communication literacy, and responsibility (Gunduz & Akkoyunlu, 2019).

The World Economic Forum (2016) categorized the skills necessary for the 21st century into three domains: foundational literacies, competencies, and character qualities. These skills are shown in Table 1 along with their respective domains. The fast-evolving technologies also require students to be nurtured with lifelong learning

capabilities which encompass all three 21<sup>st</sup> Century domain skills.

TABLE 1. 21<sup>st</sup> Century Skills (World Economic Forum, 2016)

Foundational literacies	Competencies	Character qualities
Literacy	Critical thinking/problem solving	Curiosity
Numeracy	Creativity	Initiative
Scientific literacy	Communication	Persistence/grit
ICT literacy	Collaboration	Adaptability
Financial literacy		Leadership
Cultural and civic literacy		Social and cultural awareness
Lifelong Learning		

Consequently, higher education institutions need to demonstrate the effectiveness of their programs and improve student learning (O’Flaherty & Phillips, 2015). Although academics have access to a wide variety of online teaching resources, technology is not the only factor in teaching and learning. Universities now pay more attention to the demands of the modern workforce. In place of memorizing formulas and data from textbooks, students today prefer to concentrate on learning knowledge relevant to real problems and issues (Bäcklund & Hugo 2018; O’Flaherty & Phillips 2015)

### *Flipped learning*

The term flipped learning refers to a method of teaching that combines face-to-face interaction in the classroom with independent study outside of it, frequently through watching the pre-recorded video content (Gunduz & Akkoyunlu, 2019).

There are several definitions of flipped learning in the literature. Essentially, flipped learning is a model where students are expected to study articles, view videos, and listen to podcasts to prepare for the lesson before class (Mull 2012). Flipped learning is a pedagogical approach in which direct instruction is moved outside of the classroom and the emphasis is on changing the learning environment into one that is interactive, with the instructor directing students they engage with the subject matter (Pettis, 2014). In flipped classroom, both instructor and students are proactive and frequently call for learning new or improving existing skills. The instructor creates purposeful learning experiences to engage students. Students in flipped classroom are responsible for independently exploring materials such as modules, videos, or readings. Before class, they try to learn the prior knowledge so they can actively apply it in the collaborative classroom (EDUCAUSE Learning Initiative, 2012 as cited in Brewer & Movahedazarhouligh, 2018).

By placing the student at the center of the learning process, the classroom can become more student-centered. This method offers the chance to motivate and pique the student's interest. To create a student-centered

classroom, employ in-class time to actively involve students in the learning process, and offer them with tailored support, the instructor must continuously innovate and monitor student progress (Hamdan et al., 2013). Bergmann and Sams (2014) provided the simplest definition of flipped learning: “what is done at school done at home, homework done at home completed in class.” Furthermore, Flores et al. (2016) emphasized that the foundation of flipped learning is a model that restructures time spent inside and outside of the classroom. All these definitions stress the fact that learning is more flexible when students can finish their coursework on their own schedule and in their preferred locations. Additionally, in-class time is planned to encourage participation in interactive learning activities, peer collaboration, evaluation of progress, and identification and correction of misconceptions.

Flipped learning makes it simple for schools to switch from an environment where learning is concentrated on the instructor to one where learning is centered on the students. Additionally, flipped learning has been shown to increase student engagement and motivation compared to traditional classroom settings, as well as student-student and student-teacher interaction (McLean et al. 2016). Shea et al. (2012) emphasized that students develop their knowledge by interacting and cooperating with one another in both the classroom and the online environment, contradicting Toto and Nguyen's (2009) assertion that flipped learning is an approach that increases active learning activities and gives students opportunities to apply their knowledge in class while receiving guidance from the teacher.

Despite all the benefits mentioned in the literature, flipped learning also has some drawbacks, including low student participation, technological difficulties, teachers' need for preparation time, and poor teacher-student communication. The motivation of the students to finish their work on their own schedule and in their working habits are key factors in the success of flipped learning. Because of this, the most common critique of flipped learning is that some students can be averse to it at first and show up to class unprepared. According to certain studies, students could find it difficult to adjust to this paradigm and forego pre-class activities (Herreid & Schiller 2013; Strayer 2012; Chen et al. 2014).

#### *Flipped learning in higher education*

For several reasons, flipped learning is especially well-suited to higher education settings. The in-class discussions and enrichment activities made possible by relocating content delivery outside of class time give students the chance to develop crucial 21st-century skills like teamwork, critical thinking, and creativity (Brewer & Movahedazarhouli, 2018). Some studies investigated the advantages of flipped classes in higher education were driven by the idea that the traditional teaching approach fall short in creating a strong knowledge structure. According to some findings of these studies, a flipped learning method aims at maximizing the use of students' own times (Pettis, 2014).

Gunduz and Akkoyunlu (2019) found that flipped classroom allowed students an opportunity to benefit from more flexible instruction both online and in-class sessions. The students stated that they felt more in charge of

their own learning. However, some of them also voiced dissatisfaction with the slow Internet access outside of the classroom and the lack of immediate response while watching videos. A study by Birgili and Demir (2022) shows that students felt relatively unmotivated with flipped learning approach although they were satisfied with the course structure. The students in this study also reported that they faced difficulties in all three types of interaction: student-student, student-educator, and student-content. Other issues were long poor-quality videos and students' lack of class preparation.

### **Research Objective**

In the present study, the researcher examined the effectiveness of flipped learning and to highlight both the benefits and drawbacks of the flipped learning approach. The researcher flipped her Character Building-Civics course by placing the lecture content online for the students to view and study in their own time, while using in-class sessions to provide more opportunities for group learning and discussion activities.

### **Method**

#### *Research method and research question*

This qualitative study attempts to answer the following research questions:

1. What do the students think of the benefits of flipped learning?
2. What do the students think about the difficulties they encountered with flipped learning?

Data was gathered through a qualitative survey with an open-ended questionnaire which then was analysed with the descriptive analysis method.

#### *Participants*

The participants of this study were 62 students who enrolled in Character Building- Civics course which some of the sessions the researcher flipped in the Odd (Fall) semester of 2022-2023 academic year.,

#### *Implementation process*

This section explains how flipped learning was implemented in the Character Building-Civic course including the basic procedures and tools. The flipped learning approach comprised two main components: the online learning environment and classroom sessions. Additionally, the researcher (also the instructor of the course) created WhatsApp Group (WAG) of the class to support online and class sessions and to enhance communication between the students and the instructor. Instructor shared the materials through the Forum in LMS and informed the students both through the LMS and WAG. The materials were: modules, PowerPoint presentation and videos on LMS, external video on YouTube, and readings from online articles.

### *Online learning environment*

This section describes the infrastructure of the system, including the design process and course materials. The process was planned carefully, and the lesson plans were developed for online and class activities for 3 weeks. The instructor used videos on LMS that were prepared as online resources by the subject content specialist of the Character Building-Civic course. In addition, some external videos on YouTube channels were also used. The instructor shared the external videos through the Forum on LMS and WAG of the class. PowerPoint presentations and reading materials were also ready in the online learning environment. The instructor also assigned all groups to prepare two questions for in-class discussions. Students have been divided into groups of 6-7 students before taking active participation in their own group to create higher order thinking questions and in class discussions.

### *In-class session*

Students studied the course materials, watched the videos, then with their group they prepared and turned in two questions for each subject before the in-class sessions. Discussions were conducted in class. Each group asked two questions to one group. For example, group 1 asked their questions to group 2, group 2 asked group 3, and so on. Every group had to answer the questions they received from the other group. The instructor observed the course of the discussion and intervened when the group in charge of answering was not quite right in giving the answers. Before the class ended, the instructor assessed the understanding of the students through quiz on Kahoot. The students also wrote their reflection of what they had learned in the class session.

### *Survey through an Open-Ended Questionnaire*

The open-ended questionnaire used for this study, in particular the questions about the benefits of the flipped learning and was mainly derived from Gunduz and Akkonyulu (2019) and Louisa Tomas, Neus Evans, Tanya Doyle, and Keith Skamp (2019). In addition, the researcher asked students about their in-class sessions and the challenges they faced during the flipped learning. Hence, the open-ended questionnaire consisted of the following questions:

- What do you think about the benefits of the flipped learning?
- Tell me about the reading materials and videos given before class.
- What do you think the group and class discussions or in-class sessions?
- What do you think about the challenges you faced during the flipped learning?
- 

### *Data Analysis*

Then, data were analyzed through coding to find the similarities and differences of the students' views on the implementation of flipped learning.

## Results

### *The benefits of the implementation of flipped learning*

Findings show that most participants (98.38%) in this study found that flipped learning an effective teaching method. Students were very positive about the implementation of the flipped learning.

Here are some responses of the students regarding the benefits of flipped learning:

*In my opinion, flipped learning is an effective method because students can prepare in advance what they must learn before class. I also learn to be self-regulated and learn at my own pace. For example, I can watch a video that is given to be studied first. I can pause watching when I whenever I want then I continue until I finish watching.*

*With flipped learning I know what to learn first and this makes me understand the topic more quickly. It is definitely a good way to have the students have more insights before class, meaning students can be more active and understand the materials in advance.*

*Flipped learning enables student to prepare for class and that preparation really helps students to understand better after being explained again by the lecturer.*

### *The benefits of the reading materials and videos provided before class*

Most students claimed that studying the articles and watching the flipped videos gave them the necessary information to either better prepare for class or comprehend the lectures.

The primary explanations for how the reading materials and videos helped students' learning are presented below.

*The videos contained clear and concise explanations of the concepts so that they enabled you to understand the lesson before class.*

*The visual representation of information helped me to understand the topic.*

*The ability to pause and to replay the videos makes learning occur at my own pace. I was able to stop and to replay the parts were hard to understand.*

### *The group discussions or in-class sessions*

Students in this study reported that the group assignment and group discussion motivated them to attend class because they had to be solid working together as a group. Students also stated that the group discussions or in-class sessions provided opportunities for the students to more engaged in the lessons.

*You must work together as a group. You therefore feel guilty about disappointing your group if you do not come to class.*

*I really liked the group assignment and class activities. So, we were required to make two questions to be asked to a group. For example, group 1 gave their questions to group 2, group 2 asked two questions to group 3, and so on. This activity was really engaging us. The lecturer was also ready to clarify when there were unclear answers from the group who got their turn to answer.*

#### *The challenges the students faced during the flipped learning*

The following quotations illustrate how one disadvantage of flipped learning was the lack of Internet connection for watching videos at home.

*It was sometimes difficult to watch the videos because of the poor Internet connection in my home.*

*I had to view the videos on campus since the Internet connection was stronger and faster.*

Another challenge the students faced was to become discipline and self-regulated learner as required in the flipped learning.

*Sometimes I was too lazy to study the reading materials and to watch the videos before class.*

*In flipped learning, students need to study the learning materials before class. I find it not always easy to be a self-regulated learner as required by this approach.*

#### **Discussion**

In the present study, the researcher examined: (1) the benefits of the flipped learning and (2) the difficulties that the students encountered with the flipped learning. The researcher conducted this study through open-ended survey questionnaire with students in Character Building-Civics course in a private university in Jakarta, Indonesia. In response to Research Question 1, the survey revealed that nearly 98.40% of the students as the respondents believed that flipped learning an effective instructional approach. This finding is in line with some existing studies on the effectiveness of the flipped learning in higher education, i.e. the study findings of Gündüz and Akkoyunlu (2019), Tomas, Evans, Doyle, and Skamp (2019), and Zhao, We, and Su (2021).

In this study, the learning materials that the students had to study at home were applied in class. According to Biggs and Tang (2007) this enables the facilitation of a deeper conceptual coverage and offered a setting that is conducive to the promotion of deeper learning. In addition, this study reveals that peer learning as a major component of the in-class activities can help to promote peer-based learning. This study finding is consistent with a lot of existing studies, for example Tomas et al. (2019) and Khodai, Hasanvand, Gholami, Mokhayeri, and Amini (2022).

In response to Research Question 2, there were two challenges the students faced with flipped learning. First,

some students voiced dissatisfaction about the slow Internet outside the classroom. Second, the difficulty of being self-regulated learner as required in flipped learning. The first challenge is similar with the study finding of Gündüz and Akkoyunlu (2019). Clark (2015) suggested that instructors might need to provide a few extra copies of the flipped learning materials on DVDs to overcome the problem of a bad Internet connection.

Regarding the second challenge that some students found it difficult being self-regulated learners, previous existing research has shown that self-regulated learner (SRL) interventions (e.g. SRL instruction and SRL prompts) could enhance students' SRL and in turn improve learning outcomes (Zeng, 2016; Jansen, van Leeuwen, Janssen, Jak, & Kester, 2019). According to Panadero (2017) and Zimmerman and Moylan (2009 as cited in Alten, Phielix, Janssen, & Kester, 2020), students that exhibit SRL behavior actively regulate and monitor their cognition, behavior, and motivation while learning. This involves using strategies and goal-setting processes. Self-regulated learners have the capacity and drive to reflect on what, how, and why of their learning (metacognition), which allows them to manage their learning behavior. In the context of blended learning, Van Laer and Elen (2017) proposed seven key attributes that can support SRL: authenticity, personalization, learner-control, scaffolding, interaction, cues for reflection, and cues for calibration.

## **Conclusion**

Flipped learning is beneficial for Character Building-Civics course as it gave students more chance for independent learning and flexibility. Students also learned from their peers through group discussions in in-class sessions. The flipped learning allowed students to be more well-prepared before class. Some students expressed the challenges to be self-regulated learners as required in the flipped classroom. In addition, students also reported their poor Internet accessibility outside of the classroom.

## **Limitation and Recommendation**

This study only involved a small number of students in Character Building-Civics course and applied qualitative method with open-ended survey questionnaire. Future study should be conducted in a different Character Building course with mix-method approach and involve a larger number of students as participants. To help enhancing students' self-regulated learning, the future flipped learning study should use SRL instructions and SRL prompts.

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## An Examination of Reproduction and Development in Secondary School Biology Curricula: Türkiye and Germany

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**Abstract:** Biology, a living science, is known as a balance and complement among other branches of science. Just like the science of biology, biology as a course also plays a very important role among other courses at all school types and grades. It is thought that the adults of the future should not be deprived of knowledge in the field of biology and should use every correct information they have acquired in their daily life to overcome related problems they may encounter. For the change that occurs in the individual's life to be permanent, the way to effective education is through a curriculum developed with socio-cultural, scientific and technological developments, taking into account the conditions of the country. For example, comparing other countries' educational practices and curricula based on the results from international assessments such as PISA TIMSS. According to the PISA science scores (2018), Germany has performed above the average determined by the OECD. Therefore, current education programs in Munich are discussed as an example in this research. This study adopted document analysis, one of the qualitative research methods, as the methodology. The "2018 Secondary Education Biology (9, 10, 11 and 12<sup>th</sup> Grades) Curriculum" published by the Ministry of National Education in Türkiye and the "Biology Curriculum of Germany" published by Kultusministerkonferenz were examined. While examining the documents in the study, they were subjected to content analysis. According to the findings, as in Bavaria, instead of encouraging rote learning regarding these topics for the sole purpose of university entrance purposes, Türkiye should include in curricula or teach in seminars the social and ethical aspects of HIV/AIDS, sexual/reproductive health, adolescent development, transmission and prevention of diseases, reproductive drug diagnostics, biomedical processes, opportunities, and risks. As a result, there are some differences in terms of content in the curriculum of both countries.

**Keywords:** Reproduction, Development, Reproductive health, Biology curriculum, Comparative education.

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## Introduction

Biology education, which is a part in human life, is a whole with transferring the knowledge regarding both biological and cultural issues happening from the birth to the death of human in line with the peculiar talents of an individual in such institutions as primary, secondary and higher education where students are given general information, with training them in a versatile way and making them attain a good character (Kizirođlu, 1988). The fact that the change happening through education in individual's life become permanent and that they can keep up with the change in the world are the basic determinants of educational system. The skills attained through educational process will make a contribution both to the development of life quality of individual and to the welfare of the country, to the social and democratic development (Ministry of National Education, 2020). A great many countries in the world concentrate more particularly on the researches in applied sciences to be able to keep pace with the innovations accompanied by developments (Ekici and Heyedanlı, 2010). The countries which are aware of the fact that biology learning and teaching is a cultural and vital must for the modern world frequently revise the current biology curricula in order to increase the quality of biology education, indicate the necessary findings, carry out studies for the purpose of applying new curricula they develop in an effective way and to provide necessary opportunities at schools, so setting forth the efficiency of curricula (Avas, 1995; cited in Soysal, 2018).

It becomes a significant problem that the young people do not have adequate and true knowledge about reproduction health and learn inconsistent information by means of media (Giray and Kılıç, 2004). Giving importance to a healthy life and developing the health of young people come in the first place of the list of 21 health targets to reach 21<sup>st</sup> century determined by World Health Organisation (Öksüz and Malhan, 2005). The fact that young people do not have sufficient information about reproduction health means that they do not know how to benefit from health applications and as to the risks likely to occur because of sexual behaviours (Civil, 2010). Some studies carried out abroad point out that the courses of reproduction health taught at schools are not sufficient and that what they learn about reproduction health comes from their close vicinity, media and family (Rivera, Cabral de Mello, Johnson, Chandra Mouli, 2001; Bennet, 2001). In a few studies carried out in Türkiye particularly into sexual health or reproduction health of adolescents, mostly their knowledge about reproduction health was investigated. It was found at the end of the studies that the knowledge of adolescents regarding sexual health is low (Çok, 1998; Mağden et al., 2003; Giray and Kılıç, 2004). Ignoring an education in this issue could lead to some problems both in the current time and in the future. Since any investment to be made into the education of young people determine economic and social developments of societies, young people are the biggest group for whom some investments must be made in social and economic fields in a country (Özalp, 2005; cited in Karabulutlu and Kılıç, 2011).

The topics of reproduction, generation and development basically comprise information as to how generations

human being and other living creatures convey their genetic compounds to the coming generations for the continuation of their generations. Having such an intense place in life, the topics of reproduction, generation and development attach an importance on body and mental health and allow us to train individuals keeping any case affecting their health away (Zeren, 2005). In this sense, apart from being able to comprehend that individuals provide the biological continuation of other living creatures, giving important information that they should acquire in terms of community health under the heading of reproduction and development comes to the forefront.

For the change that occurs in the individual's life to be permanent, the way to effective education is through a curriculum developed with socio-cultural, scientific and technological developments, taking into account the conditions of the country. Many countries recognize the importance of biology education as a cultural and essential aspect of the modern world. To improve the quality of biology instruction, these nations regularly evaluate their current biology teaching programs, identify necessary changes, and consider the conditions required for the successful implementation of newly developed curricula (Soysal, 2018). In this context, the Ministry of National Education of Republic of Türkiye (2018) uses methods such as international comparisons and evaluation of different education systems to determine how to develop a correct education system and therefore an effective curriculum. For example, comparing the educational practices and curricula of other countries based on the results from international assessments such as PISA TIMSS. PISA examines to what extent students acquire information in the fields of reading, mathematics and applied sciences and what they can do with this information. At the same time, PISA provides the most comprehensive and neatest international evaluation regarding the learning outcomes students. The results obtained from PISA show the quality and equality of the learning outcomes obtained throughout the world. Besides them, it allows educators to learn about up-to-date applications in the field of educations in other countries. Comparison studies were also conducted prior to the development of the programs to investigate the similarities and differences between world standards and those adopted by Türkiye under certain conditions. Therefore, this research determined scores from PISA 2018 as the determinant factor to select countries to compare Türkiye's existing education system with the curriculum of the top-scored countries'. According to the PISA science scores (2018), Germany has performed above the average determined by the OECD (OECD, 2018). Therefore, current education program in Baden-Württemberg is discussed as an example in this research.

In the current study, it was aimed to investigate the place of reproduction, generation and development in the secondary curricula. In this sense, the topics of reproduction, generation and development were evaluated in terms of level of grade, content and outcomes in the secondary education, biology course curriculum.

### **Research Questions**

1. What is the content and grade level of the learning outcomes of the units that include reproduction and development in the biology curriculum in Türkiye?
2. What is the content and grade level of the learning outcomes of the units that include reproduction and

development in the biology curriculum in Baden-Württemberg, Germany?

3. What are the similarities and differences between the biology curricula used in Baden-Württemberg and Türkiye regarding the place of reproduction and development?

## Method

In the current study, document analysis method, one of the qualitative research methods, was used. Document analysis is a systematic process used to examine and evaluate both printed and electronic materials (Özkan, 2020). Document analysis in qualitative research could be a data collection method alone as well as being used together with other data collection methods. In the document analysis method, it is necessary to follow the stages of a casual examine of the document as the first step and then a detailed examination, determining the results, and follow up the steps of commenting (Bowen, 2009).

In order to enlarge and enrich the data obtained in the research, biology course curricula in Türkiye were investigated in comparison with the biology course curricula in the State of Baden-Württemberg, Germany. Comparative education could comprise the comparison of the education of countries together with their teaching programs or in terms of various factors (Balçı, 2007). In the comparative studies, Ültanır (2000) pointed out that there are two approaches as horizontal and vertical ones. In the vertical approach, the changes coming from the past are investigated while the variables of the same period are compared and the similarities and differences are determined in the horizontal approach (Türkoğlu, 1998). In this sense, horizontal approach was used in the current study and the data obtained was tried to be extended.

## Data Collecting Tools and Data Analysis

In the research, “2018 Secondary Education Biology Curricula for the 9<sup>th</sup>, 10<sup>th</sup>, 11<sup>th</sup> and 12<sup>th</sup> grades” published by the Ministry of National Education (MoNE) in Türkiye and “Germany (Baden-Württemberg) Biology Curriculum” published by Kultusministerkonferenz (2020) were investigated as a document.

During the investigation of the documents obtained in the study, they were applied content analysis. The content analysis was carried out within the framework of investigating the class level, course hour, content and learning outcomes for the topics of reproduction, generation, development given in the secondary education biology curriculum. The main purpose of the content analysis is to reveal the data obtained in a framework and reach the concepts and the relation between the concepts (Yıldırım and Şimşek, 2018).

## Findings

### Secondary School Biology Curriculum in Türkiye

Upon the review of secondary education biology course curriculum, it was found that the topics of reproduction, generation and development were given directly or indirectly in the units of “Life Science Biology” in 9<sup>th</sup> grade, “Cellular Divisions” in 10<sup>th</sup> grade, “Human Physiology” in 11<sup>th</sup> grade and “Plant Biology” in the 12<sup>th</sup> grade.

## **9.1. Life Science Biology**

### **9.1.1 Biology and Common Features of Living Creatures**

#### **9.1.1.1 Comments the common features of living creatures.**

b. The features of living creatures such as cellular structure, nutrition, respiration, excretion, movement, reaction to stimuli, metabolism, homeostasis, adaptation, organisation, reproduction, growing and development are emphasized (MoNE, 2018).

### **10.1 Cellular Divisions**

#### **10.1.1. Mitosis and Agamogenesis**

##### **10.1.1.1. Explains the necessity of cellular division.**

a. Cellular division is related to reproduction and development in living creatures and explained.

b. Cellular reasons of division is mentioned.

##### **10. 1.1.2 Explains mitosis.**

a. Interphase is studied at basic level.

b. The phases of mitosis are studied at basic level. In the process of explaining the phases, visual elements (photographs, pictures, drawings, caricatures etc.) and graphical arrangements (concept maps, mental maps, and schemes etc.) e-learning objects and applications (animation, video, simulation, infographic, augmented and virtual reality applications etc.) are benefitted.

c. The control of cellular division and its importance for living creatures is explained. The names of the molecules controlling cellular division are not given.

d. The relation of cellular division with cancer is made.

e. Students are encouraged to prepare a product or an electronic presentation (animation, video etc.) explaining mitosis and share this presentation.

##### **10.1.1.3. Explains agamogenesis with examples.**

a. In the context of agamogenesis, the examples of schizogenesis, gemmation, reproduction through spores, regeneration parthenogenesis and vegetative reproduction are given. The examples are given only at reproduction through spores and metagenesis is not mentioned.

b. The applications of agamogenesis techniques in gardening and agriculture sector (the ways of reproduction through grafts and onions) are exemplified.

#### **10.1.2 Meiosis and Amphigenesis**

##### **10.1.2 Explains meiosis and amphigenesis.**

a. Meiosis stages are explained at basic level. While explaining the stages, visual elements, graphic arrangements, e-learning object and applications are benefitted.

b. Students are encouraged to prepare a product or an electronic presentation (animation, video etc.) explaining meiosis and share this presentation.

##### **10.1.2.2. Explains amphigenesis with examples.**

a. External and internal fertilization are not given.

b. It is explained that the basis of amphigenesis is meiosis and fertilization (MoNE, 2018).

## **11.1. Human Physiology**

### **11.1.7 Reproductive system and Embryonic Development**



**11.1.7.1 Explains the structure, task and process of reproductive system.**

a. In the study of the structure of male and female reproductive system, visual elements, graphic arrangements, e-learning and applications are benefitted.

b. Graphics regarding the hormones arranging menstrual cycle are given.

c. The methods of in vitro fertilization are shortly explained.

**11.1.7.2 Inferences regarding the things to be done to protect the healthy structure of reproductive system are made.**

**11.1.7.3 Explains the embryonic development process.**

a. The organs made up of embryonic layers are not given.

b. The factors having a negative effect on the development of baby in pregnancy (using medicine including antibiotics in early pregnancy period, extreme stress, lack of folic acid, X-ray exposition) are explained.

c. The importance of following pregnancy in terms of baby's and mother's health is emphasized (MoNE 2018).

**12.3 Plant Biology****12.3.3 Amphigenesis in Plants****12.3.3.1 Explains the parts of a flower and the task of these parts.****12.3.3.2 Explains fertilization, seed and fruit formation in plants.**

a. Depending on a flowering plant, amphigenesis in plants is studied by benefiting from visual elements, graphic arrangements, e-learning and applications.

b. The role of seed and fruit in reproduction and spread of plants are given through examples.

**12.3.3.3 Designs an experiment where they can observe seed germination. They are encouraged to determine the factors affecting germination.**

**12.3.3.4 Makes a relation between dormancy and germination (MoNE, 2018).**

**Biology Curriculum in Baden-Württemberg, Germany**

Every state in Germany has the administrative authority in all cultural issues including teaching programs. In this sense, the curricula practiced in Baden – Württemberg, the third biggest state in terms of population, located in the southwest of the country were taken as a reference. Upon the review of the curricula practiced in Baden-Württemberg State, it was found that high school grades are between the grades of 5 and 12 and that biology subjects are different in each grade. It was also found that there are two different curricula in practice in the state (2004 and 2016 educational plans) by KMK. According to KMK (2020), 2004 educational plan is valid for all the students starting 6<sup>th</sup> grade before the educational year of 2016-2017. Besides that, 2004 educational plan is valid for Abitur for the last time in the educational year of 2021-2020, which means students starting 1<sup>st</sup> grade in the educational year 2020-2021 will take their education based on 2004 curriculum in their two-year period. It was determined that the topics of reproduction, generation and development were given under the heading of “Reproduction and Development” unit in 8<sup>th</sup> grade and under the heading of “Reproduction Biology” unit in 12<sup>th</sup> grade.

### 3.2 7/8<sup>th</sup> Grades

#### 3.2.1 Cell and Metabolism

*Student can define cells, organs, and organisms as a system. He can name the structural and functional similarities and differences between animal and plant cells. He can explain the relation between structure and functions of organs and systems in the transformation of materials and energy, and the importance of cellular division.*

- *Defines cellular division as the basis of the growth of organisms.*

**P** Knowledge Acquisition (Erkenntnisgewinnung) 1, 7, 11

**P** Communication (Kommunikation) 3, 4

**F** PH 3.2.2 Optic and Acoustic (10), (11) (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016).

#### 3.2.2. Human Biology

##### 3.2.2.3 Reproduction and Biology

*Student tells the growth of baby in the womb up to birth and comprehends the special importance of care for prenatal development; compares and evaluates different birth control methods; defines different sexual orientations and forms of sexual identities independently from values.*

- *Explains the formation of an embryo out of an egg cell fertilized through cellular division and cellular differentiation.*
- *Explains the most important development stages of pregnancy (implantation, embryo, foetus, birth) and the results of external effects.*

- 

**P** Knowledge Acquisition (Erkenntnisgewinnung) 11

**P** Communication (Kommunikation) 4

**P** Evaluation (Bewertung) 1,14

**I** 3.2.1 Cell and Metabolism

**F** BNT Human Development

**L** PG Body and Hygiene

- *Compares and evaluates different birth control methods.*
- *Explains the importance of the way to apply to protect from sexually transmitted infectious diseases (HIV).*

**P** Communication (Kommunikation) 1, 10

**P** Evaluation (Bewertung) 1,3

**I** 3.2.2.5 Immunobiology

**F** BNT Human Development

**L** PG Body and Hygiene

- *Defines sexual orientation and sexual identity forms without judging them.*
- *Explains the importance of sexuality for partnership.*

**P** Communication (Kommunikation) 5,9

F ETH 3.1.1.1 Identity, individuality and role

F ETH 3.1.1.2 Freedom and Responsibility

F RRK 3.2.1 Human Being

L BTV Personal and social variety; self-discovery and accepting other life styles

L VB Personal needs and wishes (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016).

### **3.3.9/10<sup>th</sup> Grades**

#### **3.3.2 Genetics**

*Student can use a simple model to explain the features of DNA. In addition, he can define and compare the transformation of genetic information in mitosis and meiosis division. Also, he can explain what kind of a change amphigenesis creates. He can evaluate the opportunities and risks of genetic engineering.*

- *Explains how baby cells having the same set of chromosomes appear in the cellular cycle by means of mitosis and cellular division.*
- *Defines the process and meaning of meiosis and compares it with mitosis.*
- *Explains how sex is determined by sex chromosomes at human.*

P Knowledge Acquisition (Erkenntnisgewinnung) 11, 14

P Communication (Kommunikation) 3

I 3.2.1 Cell and Metabolism

I 3.2.2.3 Reproduction and development

F NWT 3.2.4.3 Information processing (1) (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016).

### **3.4 11/12<sup>th</sup> Grades (Two-Hour Course)**

#### **3.4.5 Reproduction Biology**

*Student can compare amphigenesis and agamogenesis; can define modern reproduction biology methods and evaluates the opportunities and risks of various prenatal diagnosis methods.*

- *Compares amphigenesis and agamogenesis.*
- *Knows the processes of reproduction biology (germ line treatment, cloning, in vitro fertilisation).*
- *Defines and evaluates prenatal diagnosis methods.*

P Communication (Kommunikation) 1, 10

P Evaluation (Bewertung) 4, 7, 9, 11

I 3.2.2.3 Reproduction and development

F ETH 3.3.4.1 Responsibility ethics (5)

F REV 3.5.2 World and responsibility

F RRK 3.4.2 World and responsibility

F RRK 3.5.2 World and responsibility

L BTV Value Oriented Action (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016).

### **3.5.2 Biomolecules and Molecular Genetics (Four-Hour Course)**

#### **3.5.2.1 Biomolecules**

*Student can explain the importance of macromolecules in life. At the same time, he uses suitable models to be able explain the relation between the structure and functions of both proteins and nucleic acids.*

- *Explains the structural features of proteins (primary, secondary, tertiary, quaternary structure).*

**P** Knowledge Acquisition (Erkenntnisgewinnung) 11

**P** Communication (Kommunikation) 7

**I** 3.2.2.1 Diet and digestion

**I** 3.2.2.3 Reproduction and development

**I** 3.3.2 Genetic

**F** CH 3.2.1.3 Attachment and interaction models

**F** CH 3.3.2 Natural materials

**F** CH 3.4.4 Natural materials

- *Explains the structural features of DNA on a model (complementarity, anti-parallelism, double stranded).*

**P** Knowledge Acquisition (Erkenntnisgewinnung) 9, 11, 14

**I** 3.2.2.3 Reproduction and development

**I** 3.3.2 Genetics (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016).

### **3.5.2.3 DNA and Gen Activity**

*Student comprehends the importance of replication and can explain how genetic information leads to the expression of features. He can compare transcription and translation and explain how antibiotics work by means of their differences. He can also explain the importance of arranging a gen activity for metabolism.*

- *Explains DNA replication and its importance for cellular division.*

**P** Knowledge Acquisition (Erkenntnisgewinnung) 5, 11, 14

**P** Communication (Kommunikation) 4, 7

**I** 3.2.1 Cell and Metabolism

**I** 3.2.2.3 Reproduction and development (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016).

### **3.5.4 Intercellular Communication**

#### **3.5.4.2 Endocrine System**

*Student can explain the importance of hormonal system in the arrangement by metabolism and hormones and define different effect mechanisms of hormones on target cells.*

- *He can explain the arrangement of metabolic processes by hormones (eg. Thyroxine, insulin, gender hormones) with an example.*

**P** Knowledge Acquisition (Erkenntnisgewinnung) 12, 14

**P** Communication (Kommunikation) 4, 7

**I** 3.2.2.3 Reproduction and Development

**I** 3.2.2.4 Information System

**L** PG Sense and Sensation (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016).

### **3.5.6 Opportunities and Risks of Biomedical Processes**

*Student can define and compare natural reproduction in different living creatures. He can define the reproduction biology methods in human being and evaluates the opportunities and risks of various prenatal diagnosis methods.*

- *Explains and evaluates the prenatal diagnosis methods and diagnosis method for preimplantation.*

**P** Knowledge Acquisition (Erkenntnisgewinnung) 12, 14

**P** Communication (Kommunikation) 4, 7

**I** 3.2.2.3 Reproduction and Development

**F** ETH 3.4.4.2 Applied ethics (4)

**F** REV 3.4.2 World and Responsibility

**F** RRK 3.5.2 World and Responsibility

**L** BTV Value Oriented Action (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016).

Table 1. Symbols and Explanations for Skill Areas with a Reference to Learning Outcomes Regarding the Process Taking Place in the Secondary Education (Gymnasium) Biology Curriculum in the State of Baden-Württemberg, Germany (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016).

Symbol	Explanation
<b>P</b>	Reference to learning outcomes regarding the process
<b>I</b>	Reference to other standards for the learning outcomes of the same technical plan regarding the content
<b>F</b>	Reference to other topic units
<b>L</b>	Reference guiding for perspectives

## Conclusion

It is likely to see that both curricula include the topics of reproduction, generation and development almost at every grade. When it comes to biology course curriculum in Türkiye, there are a total 13 learning outcomes regarding the topics of reproduction, generation and development while there are 19 outcomes in the state of Baden-Württemberg.

The findings show that while the topics of growing and developing are given in the first stage with the unit of common features of living creatures in Türkiye, the topic is dealt directly with the unit of reproduction and development in Baden-Württemberg. At the same time, such topics as biodiversity and evaluation with genetic recombination, biomedical processes and prenatal diagnosis methods are given in detail as differently from what is in Türkiye. As for Türkiye, it is likely to see that such topics as amphigenesis in plants, agriculture and gardening are given a place. Contrary to the one in Türkiye, such action expressions as “is not given” or “... topic is not taught” are not encountered in the outcomes in the curricula. As a result, besides some similarities between the two countries in terms of contents, there are some significant differences in the biology topics

taught. In their studies, Karabulutlu and Kılıç (2011), it pointed out that the information levels of the students studying at a health college about sexual health/reproduction health, but that majority of them have not been given services in this regard. For that reason, it is essential that the topics similar to the learning outcomes regarding reproduction, generation and development should be given by means of direct teaching methods in combination with daily life cases as much as possible in biology course curricula in Türkiye.

The recommendations depending on the results obtained in the current study are as follows:

- The number of learning outcomes should be increased in a way to support with more content regarding the topics of reproduction, generation and development in the biology course curricula in Türkiye.
- In order that future mothers and fathers become conscious parents, learning outcomes regarding prenatal diagnosis methods to decrease the prejudice in this issue could be given a place in the curricula in Türkiye as in Germany, so that students could reach as much information as possible in the course of biology by taking the conditions in Türkiye into consideration in terms of sexual health concerning reproduction and development topics.
- Given that secondary education students' receiving more information in terms of the topics of reproduction and development is of great social benefit, some in-service trainings should be held for teachers to increase their knowledge regarding the related field and teaching methods.


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## Artificial Intelligence and Higher Education

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**Abstract:** Artificial intelligence has potentiated changes in higher education. In this position paper, we propose to discuss dimensions that shape higher education and that can be transformed by the mobilization of Artificial Intelligence: teaching-learning processes (from the perspectives of scholars and students), research (from the perspective of professional researchers, students and advisors), management of organizations (from the perspective of managers, subordinates and students), and the relationship with the outside (the look from inside to outside, as well as from outside to inside). To this end, a document collection and analysis was carried out to support our argument about the new challenges and the potential that emerges from the existence and application of artificial intelligence in higher education. As this change, like any transformation, will have positive and negative aspects, some implications of both a theoretical and more practical nature of these challenges for academics, students and other stakeholders in higher education institutions are also discussed.

**Keywords:** Artificial intelligence, Digital competence, Digital literacy, Higher education, Innovation.

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### Introduction

As early as 1990, Aiken considered that “There are sceptics who question the expenditures on research in Artificial Intelligence in general and Artificial Intelligence and Education in particular. The author believes that we don’t have a choice – we MUST continue to investigate ways in which Artificial Intelligence will make the computer a better aid for teaching and learning” (Aiken, 1990, p. 12). Especially in more recent years, there has been a growing presence of Artificial Intelligence (AI) in our lives, partly boosted by the COVID-19 pandemic in all contexts, not escaping that of Education (Akinwalere & Ivanov, 2022; Nouhan et al., 2021; Ilieva, 2021; Bearman et al., 2022; Pedró, 2020; Hinojo-Lucena et al., 2019; Ferreira & Serpa, 2018a; Sá & Serpa, 2020, 2023). In fact, as Vicari (2018) points out, nowadays, it is not possible to think of Education without dissociating it from technologies and their use.



Based on the concept of AI “[...] as computing systems that are able to engage in human-like processes such as learning, adapting, synthesizing, self-correction and use of data for complex processing tasks” (Popenici & Kerr, 2017, p. 2), the ultimate goal of introducing AI in Education should envisage the development and qualification of human capital with skills that make 21<sup>st</sup>-century citizens better able to cope with changes and consequent responses to increasingly global needs (Southworth et al., 2023), based on three basic principles, pointed out by Churi et al., 2022, based on Buckingham (2018):

- Learning: Acquiring and processing the new experience, creating new behaviour models;
- Self-correction: Refining the algorithms to ensure the most accurate results;
- Reasoning: Picking up the specific algorithms to solve a specific task (Churi et al., 2022, p. 3).

In line with this reasoning, higher education institutions were not immune to this growing influence of AI (Crompton & Song, 2021; Mazikana, 2023; Pence, 2019; Manhica et al., 2022; Nouhan et al., 2021; Akinwalere & Ivanov, 2022). AI came, then, to boost changes in higher education at various levels, which encompass faculty members, students, other employees and the institution’s management itself (Pence, 2019), even if it generates anxiety (Li & Yang, 2023; Bates et al., 2020), but with the potential to shape innovation (Akinwalere & Ivanov, 2022).

As higher education is a place where research, innovation, problem-solving or the use of the latest technologies are sought to be leveraged by excellence, AI offers, in this context, an opportunity to support students in their learning processes and building skills that better suit today’s academic, professional and personal demands, by offering personalized learning processes, intelligent tutoring systems or helping students in the analysis of their path and performance. At the same time, it also helps students and teachers by allowing them to make personalized recommendations on aspects to be improved, whether in terms of the students’ educational success or difficulties, or in terms of support that the teacher can develop to help them, at the level of both materials or activities and assessment processes (Al Ka’bi, 2023; Zentner, 2022). Also in the context of higher education, AI can be a useful tool at the service of research, facilitating tasks such as literature review or data analysis and leaving the researcher time for other tasks that require their more direct intervention, as well as at the service of administrative tasks, streamlining processes such as enrolment or preparation of timetables, freeing up staff for other types of tasks (Al Ka’bi, 2023).

In synthesis, artificial intelligence has boosted changes in higher education. In this position paper, we propose to discuss dimensions that shape higher education and that can be transformed by the mobilization of AI: teaching-learning processes (from the perspectives of scholars and students), research (from the perspective of professional researchers, students and advisors), management of organizations (from the perspective of managers, subordinates and students), and relationship with the outside (the look from inside to outside, as well as from outside to inside).

## Methods

To enable rigorous and justified reasoning of the potential that shapes higher education and that can be transformed by the mobilization of AI, a document collection and analysis was carried out based on the search, selection and analysis of documentation in two databases, namely B-ON (<https://www.b-on.pt/en/what-is-b-on/>) and SCILIT (<https://www.scilit.net/about>), using the following two search terms: “Artificial Intelligence” and “Higher Education”. In addition, a self-reflexivity was carried out, given that the authors of this paper have themselves been university teachers for over 20 years, which enabled the controlled mobilization of this experience in the arguments presented (de Verlaine, 2022).

## Artificial intelligence in higher education

According to Li and Yang (2023), higher education in the AI virtual world has clear differences when compared with higher education considered traditional. Firstly, there is a gap between the evolution of AI and the failure of more traditional higher education institutions to keep up with this evolution, which is also evident at the level of the training itself, its time cycles and the generational issues that they imply. Secondly, there are differences at the level of governance of the institutions, more sustained by empirical judgements in the more traditional cases or more based on big data in the case of those more oriented towards AI. Thirdly, differences are identified in the logic of training models, with the traditional ones clearly more focused on large-scale teaching versus a training perspective more focused on individuality or more personalized in the case of AI. Finally, Li and Yang (2023) also point to differences between the way research is envisaged between these two ways of looking at higher education, pointing to the need, in the case of the integration of AI, for a “[...] new scientific research mode of network collaboration, traceability, and multi-disciplinary integration” in a relatively conservative higher education arena (p.32).

However, the use of AI in higher education is not a straightforward, clear and direct process, entailing obstacles, difficulties and challenges that must be overcome. Recent research has listed some aspects worthy of reflection for the introduction of AI in higher education. If, on the one hand, some concerns regarding users’ data and privacy are highlighted, as well as the possible capacity of AI to replace trainers (Al Ka’bi, 2023), on the other hand, it must be acknowledged that AI cannot be a reality that starts only in higher education, but has its beginning much earlier, for students, as for teachers. In this sense, several studies are being developed that imply the introduction of AI much earlier in the school curriculum of younger students (Southworth et al., 2023).

On the other hand, some advantages lead to consider the introduction and development of AI in higher education, as it is deemed that it may be a way to better prepare citizens and future workers for a more competitive labor market, and where AI will be (or already is) a reality (Laupichler et al., 2022), as well as for facilitating learning and administrative processes (Al Ka’bi, 2023).

In general, we can consider, as some of the advantages of AI, aspects such as the following mentioned by Churi et al. (2022, pp. 22-24): high accuracy with fewer errors, high-speed, high reliability, useful for risky areas, digital assistant, quick feedback, ongoing student assessment, platforms for distance learning, adapted teaching content, virtual reality, accessibility, efficient administrative management, data collection, storage, and security. In particular, in the context of higher education, Zentner (2022) highlights several potentials for its use, summarized in Table 1.

Table 1. Examples of AI application in higher education

Adaptive learning platforms	It provides personalized learning experiences for students, adapting to their needs and abilities as they progress through a course.
Automated grading	it allows to grade student assignments and exams, freeing up instructors to focus on more complex tasks and interactions.
Data analysis and visualization	can help researchers analyze large datasets and identify patterns and trends that would be difficult or impossible for humans to detect.
Language translation	translation tools can help students and faculty communicate with one another, even if they do not speak the same language.
Learning management systems	It allows to suggest resources, assignments, and activities to students based on their interests and progress.
Personalized learning systems	can adapt to the needs and preferences of individual students, providing personalized recommendations.
Personalized tutoring	can provide individualized help and support to students, adapting to their specific needs and learning styles.
Plagiarism detection	can be used to identify instances of plagiarism in student papers and assignments, helping to ensure the integrity of academic work.
Predictive analytics	can be used to analyze student data and predict their likelihood of success in a course or program, helping educators identify potential challenges and intervene early.
Recommendation engines	can suggest relevant courses, programs, or resources to students based on their interests and past activities.
Speech recognition	Electronic speech recognition tools allow to transcribe lectures and other audio recordings, making them more accessible to students.
Student support	such as counseling or tutoring, by providing personalized recommendations and referrals.
Text analysis	can be used to analyze large volumes of text, such as research papers or articles, to identify trends, patterns, and connections.
Virtual assistants or chatbots	tools that can help students with frequently asked questions or basic tasks, such as registering for classes or accessing course materials.
Virtual reality	to create immersive learning experiences for students.

Source: Based on Zentner (2022, pp. 1 and 2).

In any case, Aldosari (2020) identifies what he calls 10 fundamental rules or situations where AI can be a reality in education:

- Artificial intelligence can automate some basic activities, such as classification and grading.
- AI makes it possible to redesign educational programs to the needs of students, through advanced technology applications or programs.
- AI enables students to obtain an extra support to serve students to the maximum extent.
- By using programs that rely on AI systems, students and teachers can make useful comments so that others can benefit and share experiences.
- AI systems change the way to find information and interact with it in the way we interact with information in our personal and professional lives.
- AI systems make it possible to improve and fill gaps that may occur in training courses, identifying areas that need to be improved.
- AI systems allow students to learn in a relatively rule-free environment, reducing the fear of learning through trial and error methods, especially when AI teachers can offer solutions for improvement.
- The data supported by AI systems can change the manner schools select their students.
- AI systems can change the teachers' role.
- AI systems will change where students learn, who teaches them, as well as the style of acquiring basic skills.

However, there are many challenges facing the application of AI in higher education (Nsoh et al., 2023; Churi et al., 2022; Bates et al., 2020; Popenici & Kerr, 2017; Serpa et al., 2020; Akinwalere & Ivanov, 2022; Salvagno, Taccone, & Gerli, 2023), such as

- issues of equity of access and use of AI in education, including those related to the inclusion of people with disabilities, to avoid bias and promote diversity.
- ethical and security issues arising from the collection, use and disclosure of data, and protecting the privacy of users, including regular ethical data impact assessments of adopted systems, and considering personal information as a fundamental right.
- training issues for teachers and other users, being necessary to ensure that teachers are prepared to deal with AI in the educational context, understanding its benefits and limitations, and help establish clear criteria on when it is appropriate to follow or replace computer-generated perceptions to avoid unfair inconsistencies.
- issues related to students, such as their learning styles and capacity for autonomous learning; or how they communicate and share.
- financial issues, related to the costs of using AI.
- organizational and policy-making issues, such as the monopoly of a few entities, the conservative culture of most higher education organizations, the development of transparent data policies, or the fact that developers' decisions shape how the AI systems are instructed and understood.
- issues concerning the very nature of AI, such as the impossibility of thinking out of the box or no regard for feelings and emotions.

As can be seen, the integration of AI in higher education is not easy, particularly due to the adoption of more

traditional pedagogical practices and policies that are less in line with a new reality that requires everyone to think and look at what is taught and how it is taught (Pence, 2019). This reality, which has profound implications in the academic profession and the mission of higher education institutions, implies dealing with the psychological contract of those who are faced with it, considering that it can be understood as a form of control and de-professionalization (Serpa et al., 2020; Ferreira & Serpa, 2018b). Thus, its development, integration and use in this context should be a participatory process extended to the whole of the institutions (Pedró, 2020).

One way to enhance the application of AI in higher education, minimizing the risks and overcoming challenges such as those mentioned above, is to develop AI literacy beyond digital literacy (Sá, Santos, Serpa, & Ferreira, 2021; Akinwalere & Ivanov, 2022) of all stakeholders, understood as “[...] a set of competencies that enables individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and use AI as a tool online, at home, and in the workplace” (Long & Magerko, 2020, p. 2, cit. in Laupichler et al., 2022, p. 1).

In particular, as far as teachers are concerned, Pedró (2020) highlights a set of specific competencies that he considers to be fundamental for AI to be adequately and effectively used, which include a clear understanding of how AI can facilitate learning and the characteristics that make it more appropriate, the development of research and data analysis skills that AI offers students, looking at these data in an appropriate way, the development of new human resources and AI management skills, and the adoption of a critical perspective regarding the use of AI in educational settings. But how to foster this intentional, conscious and knowledgeable use of AI in higher education? In a very clear and pertinent way, Pedró (2020) clarifies that

As there are no universal solutions, it is imperative that research also has a local dimension, in each university’s classrooms, recognizing professors and students as actors and not as mere beneficiaries or users of previously packaged technological solutions. There is no doubt that research has a role to play in elucidating the role that technological solutions play in improving the quality of university education (p. 71).

One of the ways to respond to this necessary improvement in the teaching and learning process, which the social sciences cannot be excluded from, may be, it seems to us, for example, through the action-research process (Serpa et al., 2018), by fostering the participation of those involved in this training strategy process by promoting a direct engagement in problem-solving (Jacobs, 2016). In this new context, in which AI will shape higher education competencies, such as soft or transversal skills, where leadership, communication, problem-solving, teamwork and creativity competencies are included (Sá & Serpa, 2018), it will be necessary to complementarily develop AI literacy (Popenici & Kerr, 2017; Akinwalere & Ivanov, 2022), to accommodate new discoveries, technologies and rapidly changing social norms (Long & Magerko, 2020).

At the same time, it is pivotal to reshape the role of the teacher, which implies a change in the way they teach, resulting from changes in expectations about their role and the consequent interaction with students (Akinwalere & Ivanov, 2022; Pence, 2019).

## Conclusion

Like all changes that may affect the educational process, research and administration of higher education institutions (Ilieva, 2021; Sá, Ferreira, & Serpa, 2019), the application of AI in higher education will shape aspects that some will consider positive and others negative. However, one thing is certain: each and every stakeholder will be affected. As Li and Yang (2023) advocate, “[...] Higher education can’t rely on the traditional teaching, learning, research, and governance structure in a static attitude. In the face of the intelligent era, it can neither coerce education with the rapid development of technology nor ignore technology with the arrogance of education” (p. 37). The best response for the scholar to, in a conscious way, keep up with these new challenges while maintaining indispensable academic freedom in teaching and research, without which there is no University or higher education (Ferreira & Serpa, 2018b; Serpa & Sá, 2022; Pedró, 2020; Schäffer & Lieder, 2022), is to encourage all those involved to discuss and analyze the competencies that AI can bring, understanding the best way to use it and guide future research in this area (Long & Magerko, 2020).

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## The Press in The Classroom for Citizenship Formation in The Digital Age? Paper and Pencil Case in Public Education Institutions in Cartagena De Indias-Colombia

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**Abstract:** *Papel y lápiz* (Paper and pencil) is the result of a qualitative research project carried out using the Participatory Action Research (PAR) as a model. *Papel y lápiz* seeks to teach young people and children, who are identified as being at high social risk, in 35 different public educational institutions (PEIs) from Cartagena de Indias, Colombia. The principle aim of the project will be educating them about the importance of knowing and understanding the often-harsh realities of their social situations with particular focus on the social risks each of them might encounter. *Papel y lápiz* also aims to teach students about the social situation of their city using media and specifically the press. Working alongside Educommunication, the aim is to start educating the young people in school classrooms, in other words the most formative years of their youth. Between 2019 and 2022 this research project has reached 712 students from various public Educational Institutions (EIs) in Cartagena. The project was materialized in collaboration with teachers and directors by creating 6 educational cards that incorporate the use of the press to analyze some of the most critical issues the city is facing.

**Keywords:** Citizen Participation, Educommunication, Action Research Participatory (PAR)

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### Main topic

*Papel y lápiz*, is a collaborative project between the Press-school Program from the newspaper *El Universal* and the *Universidad Tecnológica de Bolívar* (UTB). The key aim of this project (developed in different public EIs of Cartagena) is to open a space for reflection, analysis, and research on the city's issues with teachers and students at public schools in Cartagena de Indias, Colombia.

### General objective

To encourage critical and reflective reading by students of EIs in Cartagena using the press so that they might be able to propose solutions to the wide range of problems facing their school, city and beyond.

### Specific objectives

- To apply the Participatory Action Research (PAR) methodology in the classroom to incorporate the media in teaching.
- To promote the critical reception of the content found in the media, as well as the development of creative and communicative capacities in the students from EIs in Cartagena de Indias (during the years 2018 to 2022).
- To establish a study, analysis, and selection processes in the classroom by identifying sections of the press, highlighting social, cultural, family, and personal mediations that influence the most formative years of the students.

### Proposed Theoretical Discussion

The research explores how education and communication are related disciplines that coexist and are essential for production, transmission, and cultural transformation (Huergo, 2007). It aims to answer the question: *How to articulate the social appropriation of the press with the school, in such a way that interaction is achieved between the processes of teaching, and of integral and citizen formation for students in public EIs in Cartagena de Indias - Colombia?* So far, work has been done in 35 public EIs in Cartagena, aiming to rethink the concept of Educommunication and inter-learning (Prieto Castillo, 2006), focusing on the ways in which the new generation of students have incorporated the use of technology into their daily lives and how the schools must react in response. The research also sought to provide alternatives to overcome situations where technology is not available in the educational process due to deficiencies both in the physical infrastructure of EIs, and the lack of hardware and software.

Due to the lack of clear public policies regarding the provision of resources for basic or average education are affected by low levels of results in the academic achievement of its students. According to a report by the Cartagena Observatory *Cartagena Cómo vamos* in 2020 where 79% of the IE in the city do not exceed the C+ level, the second lowest on the scale, where A+ is the highest in the Saber 11 tests. The research then explores how education and communication as related disciplines can be essential for the production, transmission, and educational, and cultural transformation of students.

This is described in several conceptions and tendencies to explain the relationship between communication and education: One, communication as control in education. The second trend, in which education demands

communication as of the role of a teacher-actor, i.e., expressing oneself as a means to teach. This accentuates the idea of communication as a matter of the correct emission of messages (Huerger, 2007). In this sense, it is important to clarify the fundamental role that teachers from EIs in Cartagena play in the execution of the research proposal *Papel y Lápiz*.

Teachers have also used printed press to support the contents of their classes and in problem solving for children and young people, as well as topics related to their school, their neighborhood, city, and the country. *Papel y lápiz* project also aims to break the scheme of the educator-communicator as a privileged issuer who always gives the word and organizes, manages, and maintains relationships with others. This scheme is more focused on horizontal work, on interactions, on the possibility of building knowledge together (cit. Olmos, 2019).

In other words, learning to live pedagogical mediation in all areas of our lives is also giving meaning to social and human processes. Meaning goes through self-affirmation and self-construction, through the ability to interact and appropriate knowledge, through growth without violence, through the joy of learning and the feeling of self-construction as a being (Condo, 2012).

Apart from all this, the study of the three aspects (communication, education, and society) can allow the implementation of new strategies to replace the previous ones.

It is important at this point, that educators and communicators must assume in the educommunicative processes. Since, in this qualitative research, located within a socio-critical paradigm, the problem was addressed from the Participatory Action Research (PAR) approach of the sociologist Orlando Fals Borda (2008). At the same time, it allowed the actors involved in the research (student, teacher, social communicator) to contribute from their own knowledge in the creation and analysis of content from the press, based on the realities of their school context and that of their families and their cities.

Furthermore, considering that they are public schools located in sectors of Cartagena at high social risk for the student, and that they come from adverse family realities. Moreover, the proposal aims to create bridges and channels of communication between the school, the student, and the parent, not from the media, but *with* the media, in such a way that children and young people can communicate with everyone. This is also supported by the creation of a language that integrates everyone in the process and allows them to communicate in a real, effective, and open way.

The *Papel y Lápiz* research, sought to understand the relationship between communication and education using self-recognition, projection, and a critical analysis of the press.

If education is at the base of our humanization, if through it we pass from a bubbly atmosphere of sensations to articulate language, to caress, to gaze, to meaning and to culture, and if the educational act is profoundly and essentially communicational, (...) we will not be able to dream of educational or social transformations without playing to the core of our need and ability to communicate (Prieto

Castillo, 2004).

On the other hand, all pedagogical mediation is also a matter of communication, since it puts inter-learning at stake, i.e., the bridges that must be built and crossed between the teacher-student relationship and between culture and society and institutional (school) culture. Hence, knowing the implications of the relationship between communication and education can make us better educators in our daily lives and those who produce for the media, i.e., social communicators, must also be aware of our social responsibility when producing audiovisual and multimedia material alternatively from the recent coverage for entertainment and rather aim to also inform for education. This implies going beyond the media to focus on the relationship with the past, present and future, i.e., the school in its training process must make creative use of the media in the classroom (Orozco, 2014).

## Methodology

*Papel y lápiz* is a qualitative research, that has shown that social, symbolic and imaginary representations of the students and are reinforced by the contents they consume through the different media that reinforce their beliefs or serve as references.

As for the information collection technique, participant observation, interviews, questionnaires with closed answers, as well as didactic workshops were carried out. The latter being applied to students between year seven and year nine, to know how they received different media on different platforms. Later, topics were established for critical and reflective analysis on school, social, cultural, and family lives represented in different news, editorials, opinion columns and other sections of the press. As a result, the student could start recognizing their journey in life within their school, family, city, country, and the world.

All the above were collected using PAR methodology with the students. The workshops were a key method because they were based on the students' own knowledge and feelings (Fals Borda, 2008), using appropriate language for their classes' year. Finally, illustrated content was taught, with cartoons and characters, games, and aimed at helping the students understand their own unique social situation.

## Results

This approach of the PAR methodology has been fundamental for the creation of a collection of 6 different sets of results on the use of the printed press. The first three have been published in newspapers and tabloids. *Papel y lápiz* is a tool designed to encourage critical and reflective reading of the printed press. This tool was seen as fitting for the students' curriculum since it would be didactic, practical, and consistent with what could be done in public EIs in Cartagena with deficient or almost non-existent infrastructure and technological conditions. Using traditional printed press did not require greater economic demand from the EIs, but did require an effort

and interest involving the most important local media outlet in the city, *El Universal*, and by part of the Communication and education *Semillero* (seedbed) of the Universidad Tecnologica de Bolivar (UTB).

After a year developing workshops that included the use of digital tools, it was possible to determine that it was complex to try to apply these tools in EIs with few resources, that is why the use of the traditional printed press was advised. It was then concluded that due to the conditions in which the EIs are located, the printed press was the format that best adapted to the different social contexts of each school. Thus, the first edition of *Papel y lápiz* is associated with the recognition of the press. The content is made up of 7 parts, which contain practical exercises for students to understand the world through the news.

This project stimulates the use of the printed press in an entertaining and above all useful way. Therefore, the first stage of the project was the creation of several booklets devised to teach students the basic characteristics that make up a newspaper as explained by the World Association of Newspapers and News Publishers WAN-IFRA from its educational division. It is important to note that the creation of the deliverables designed by *Papel y lápiz* project arises after using educommunicative components for training and workshops with teachers and students, in different EIs in the city. 1,479 people were impacted so far, including teachers, students, and parents (Olmos, 2019). The students and teachers mentioned above, trained in audiovisual literacy workshops and critical analysis of the media and citizens. Consequently, 712 students have received training on the use of the traditional newspapers to improve their communication skills from writing and learning to make their approaches to problems visible raised around their schools, their neighborhoods, their city, and their country. Within the first deliverable, it was proposed explaining different parts that make up a newspaper, such as:

- The cover or first page: The students learned what the key elements of a cover were, which constitutes the hook for readers. Within its characteristics, it must be striking, have an attractive design, and a good photograph and headline. After understanding this, the students were able to recognize the micro formats that make up the front page of a newspaper. To identify these elements, the students answered some questions that were formulated in a first primer and that account for the interpretation that the students made of the information provided on the cover.
- The internal page: It refers to the structure of the newspaper, taking the local newspaper *El Universal* as an example. The student began by teaching the name of the sections, the columns of the newspaper, the number of pages and the micro formats that make up the internal pages.
- - As well as sections called: Play with language; it is better to listen; understanding the context; economic indicators/advertising; sports, among others.

After the second edition of *Papel y Lápiz*, *Applying what has been learned* section was incorporated, which consisted of developing exercises related to what was published in the *It is better to listen* section of the previous edition. In this deliverable of *Applying what has been learned* from *Papel y Lápiz*'s collection, 8 topics were covered: *Hablemos en realidad*: The students reviewed the news from the newspaper, defined what was news, what was happening in their community environment, and discussed the city. The objective was for the

students to be able to identify the positive and negative of what was happening in the city. As well as sections called: Another vision; build the world you dream of; Shopping; Play with language; assuming commitments; read and write and fun.

From the third deliverable of *Papel y Lápiz*, called, *The opinion edition*, students were invited to read the opinion of others, since it allowed them to awaken a critical sense in the face of the realities analyzed. This third edition sought for students to understand the thinking of various columnists so that they in turn awaken their critical thinking in relation to the context in which they live. Like the previous installments, this third edition had the following sections: *Applying what has been learned*, where what was sought was to promote a dialogue around a mobility news in Cartagena that announces a considerable number of drivers fined for infractions on the different roads of the city.

In this space, it was proposed to review the approach made by the journalist and find out if the editor answered the 5 questions that a news item is considered to answer: by answering what, who, how, where, and why the events occurred. With the objective that the student analyzes the news, evaluate it, and at the same time, also analyze the management of the different public entities in charge of the news event.

- *Hablemos en realidad*: It corresponded to the part of the analysis of the newspaper related to the editorial, which is based on guidelines proposed by the journalism association WAN IFRA in the booklet *Read and learn with newspaper* (2019). Thus, through the editorial, the newspaper analyzes, assesses, and interprets a news item of local, national, and international interest.

The students were explained what an editorial was in a newspaper, considered as a space reserved for the opinion of the information company, about an event that affects the lives of its readers. In this way and considering the above, it was sought that the students take sides, defend their ideas, and socialize them, in relation to a specific topic, trying to achieve a certain consensus.

In this way, the students read the editorial that was published in the local newspaper *El Universal*, and explained what it was about, to determine whether it was of interest to everyone and, finally, they wrote their opinion about the topic.

- *Otra visión*, it was the third section of this installment, where it was sought that, through a caricature, the students critically raised some situation that the cartoonist of the newspaper captured and that the student could controvert in a humorous and reflective way.
- *Construyendo el mundo que sueñas*: In this case, the student looked at his city and realized that Cartagena needs attention from the mayor and the townhall, that it requires a sense of belonging to the city and that projects are undertaken to improve the quality of life of its inhabitants and that, in addition, their leaders will think in terms of improving their city.

The idea was for the students to find two photographs of two characters who, according to them, were working to solve the problems of the city, with the idea that they would get to know the characters and profiles of those who manage the city.

The other part of *Construyendo el mundo que sueñas*, the symbols that Cartagena has as historical heritage were looked at, however, the forgetfulness of the competent authorities and the misconduct of its citizens, affect its deterioration, for this reason, it is important to emphasize in the student, the commitment to preserve them.

In the section, *De compras*, specific talk was made of the classifieds, which are advertisements that are published in the press and digitally, and that are part of advertising. They are cheaper in terms of texts, easy to understand and sectioned by categories, such as: real estate, business, jobs, vehicles, which allows the student to have an overview of the social, economic, and cultural offer of the city. Here the student had to select, and report classified ads, determine which section they belonged to and what type of classified it was.

*Juega con el lenguaje*, apart from that third deliverable, was a space intended for students to extract grammatical figures such as nouns, adjectives, verbs, synonyms, antonyms so that, based on the news. They could also decipher these elements and do an exercise in understanding a text in a simple and practical way.

*Asumiendo compromisos*, in this section of this third deliverable of *Papel y Lápiz*, period, we looked at how students were motivated to work as a team for their city. The student was required to present useful ideas so that they were later executed. For example, the use of social networks for the benefit of the city. The result showed that a brief debate could be organized in the classroom and that, from this, a proposal for social change for the city be generated.

*Lee y redacta*, in this section, a column was chosen where through the text, the student deciphered the writer and commented in class about the opinion article and whether or not he agreed with what the author mentioned; with literary figures; about what they thought of the closing of their text and as a second exercise, the student was asked to find words with which they could rewrite an article that referred to topics of school or city interest.

*Juegos*, in this section, the intention was for students to have fun with the booklet and play mental games such as Sudoku, word search, finding the differences in two pictures, among others. As a form of play-based learning.

Due to the COVID-19 pandemic, the collection has yet to develop the *Papel y Lápiz* didactic booklets, numbers 4, 5 and 6. In these didactic booklets, the themes will be worked on as follows: the fourth edition works on the theme of Social Commitment. The fifth analyses the Quality of life of both the environment, the school, and the city. Finally, the sixth edition refers to how to learn to express yourself both orally and in writing, to achieve consensus and practice active listening and assertive communication, seeking understanding with others and learning to communicate.

## Reflections

### Social relevance of the research

The goal of an investigation like *Papel y Lápiz* is to create students with a critical and analytical sense that have the freedom to express themselves, develop their capacity for interaction and symbolic production, their capacity to feel the other, to reflect on the world and their ability to transmit all this to others (Thompson J, 1998).

Thompson J's approaches, reflected in the *Papel y lápiz* project, are also articulated with the essential purposes of educommunication, and with the research carried out in EIs in Cartagena, which are expressed in:

- Understand communication in education and the role of being trainers in communication processes.
- Recognize the importance of communicability in any training and knowledge process.
- Being aware of the processes of communicational entropy in education, understanding this as the loss of communication or as a rupture of the processes of meaning within the training process.
- Being able to relate the teaching/learning process with specific edu-communicational needs in organizations.
- Doing searches and have real experiences of pedagogical mediation and mediation with culture.

All the above is the *Papel y lápiz* research project, which integrates and articulates the work of educators with social communicators, is based on the premise that teaching media in schools is a key element for the comprehensive training of students. A training that not only seeks to teach ways of reading the media, but by equipping, guiding, and training to citizenship. This training helps students to go beyond the classroom and read other narratives based on their environment and context (Mendoza, 2021). Students can achieve new meanings and reach new horizons to understand their role in society, different or new ways to being young and the relationships they build with others from their educational space and their social environment.

For teachers, it implies serving as a mediator in specific experiences of Educommunication and proposing alternatives for cultural mediation and pedagogical mediation in particular cases and circumstances. Lastly, for the parents, it is their choice to be key actors in the communicative education process, through the media they receive, so that they learn to guide the consumption of media in the family, as well as to strengthen the relationship with their children from whom they can also learn about the use and didactics of digital and audiovisual tools. It will be a two-way learning process.

## Conclusions

The *Papel y lápiz* proposal of the Prensa Escuela project of the newspaper *El Universal*, with the participation of the Communication and Education Research *Semillero* (Seedbed) of the Social Communication program of the



UTB, is a pedagogical strategy that has been developed with other entities that handle the subject of media and school in Cartagena - Colombia, carrying out joint workshops with local media such as El Universal through its *Prensa-escuela* program, in coordination with the District Education Secretariat have allowed us to reach public institutions in Cartagena.

As it is an investigation that intends to cover all public institutions in Cartagena, the work has been done gradually, starting with those that have an agreement between the Cartagena District Department of Education and the *Prensa-escuela* program of the newspaper El Universal, with the objective of converting it into the subject "Media and school" that makes good use of free time within the schools of Cartagena and envision it in the near future as a subject that is part of the curriculum of the public institutions of Cartagena.


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## Netnography and Nethnography: Challenges and Opportunities

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**Abstract:** In this review, we aim to contribute to the analysis of two types of qualitative online research: netnography and nethnography. For this purpose, we will focus our attention on their definition, specificities, similarities and differences to better understand the challenges and opportunities posed by the implementation of these types of research with the potential for the analysis of, for example, online community and online culture in social media but also in virtual reality contexts. Through a document collection and analysis, in which we searched various databases for information on netnography and/or on nethnography, it was possible to fulfil this goal and justify the relationship between these forms of research. It is concluded that nethnography is yet another research method that can complement and enrich netnography by adopting the research method, adapting it, whenever necessary, to the needs of the research to fulfil its objectives in a heuristic, technically competent and ethically informed way.

**Keywords:** Nethnography, Netnography, Qualitative Research Online, Online community, Online culture, Social media.

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### Introduction

Digitization and the Internet have revolutionized life in its various dimensions, among which the social and economic stand out. We live, according to several authors, increasingly more in a Super Smart Society characterized by the close articulation between Artificial Intelligence, the Internet of Things, Big Data, Virtual Reality and Man (Morais et al., 2020; Kozinets, 2014; Sá et al., 2021; Ferreira & Serpa, 2018a; Serpa & Ferreira, 2021; Serpa et al., 2020; Gambetti & Kozinets, 2022). This factor enhances the influence of this technology in everyday life in a more or less intentional way and perceived by each of us, such as the way it is mobilized in the (re)definition of individual and collective identity (Addeo et al., 2019; Kozinets et al., 2018; Lugosi & Quinton, 2018). It is in this context that the consequent interest in the study of online cultures and

online communities emerges (Bowler, 2010; Costello et al., 2017; Kozinets, 2014; Kozinets et al., 2018; Morais et al., 2020).

In this review, we aim to add to the analysis of two types of qualitative online research: netnography and nethnography. For this purpose, we will focus our attention on their definition, specificities, similarities and differences to better understand the challenges and opportunities posed by the implementation of these types of research with the potential for the analysis of, for example, online community and online culture in social media, but also in contexts of virtual reality.

**Methods**

The method used to develop this study was content analysis. A document collection and analysis was, thus, carried out, in which information on netnography and/or nethnography was sought in two benchmark databases: (i) B-ON (which “provides unlimited and permanent access to research and higher education institutions to texts thousands of online scientific journals and eBooks from some of the most relevant content providers, through subscriptions negotiated at the national level”, B-ON, online); and (ii) SCILIT (which “is a comprehensive, free database for scientists using a new method to collate data and indexing scientific material. Our crawlers extract the latest data from CrossRef and PubMed on a daily basis”, SCILIT, online). Through this literature search, we sought all the information that contained the words “nethnography” or “online research” in all search fields, having obtained a total of 183 documents on B-ON and 27 documents on SCILIT. After this systematic literature survey, an exhaustive analysis of all this information was carried out through their reading, having selected the documents that seemed most relevant to us, to attain the purpose of this review and justify the relationship between these forms of research, and a total of 33 documents was deemed relevant and analyzed. Figure 1 depicts their distribution in terms of year of publication.

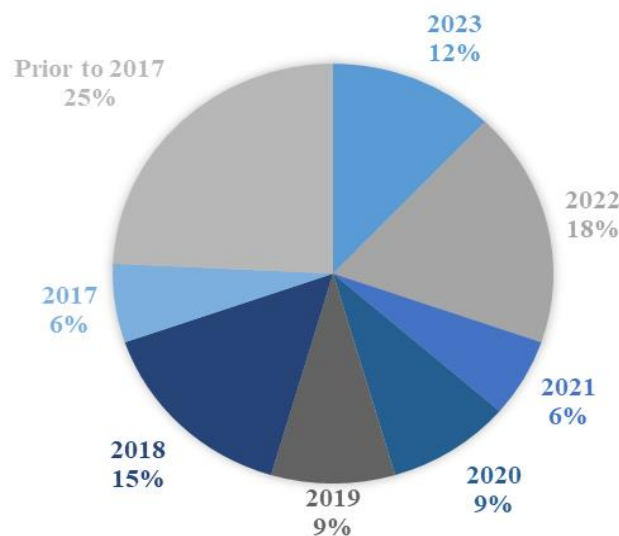


Figure 1. Number of documents analyzed by year of publication

The documents were subsequently subjected to content analysis according to the themes defined *a priori*. The next sections put forth the results of this analysis.

## Netnography

### Definition

Netnography is a concept that combines the term Internet with ethnography and for whose conception the contributions of Robert Kozinets are unavoidable (Loanzon et al., 2013). Netnography was defined as a qualitative method of rigorous and systematic participant-observational research for the study of online communities and their cultures, focusing initially on the analysis of marketing and consumer behavior. Currently, netnography has a growing application, albeit it is not a mainstream form of research (Costello et al., 2017; Addeo et al., 2019; Bernard, 2004; Discetti & Anderson, 2023; Loanzon et al., 2013; Morais et al., 2020; Kozinets, 2014; Cano et al., 2023). According to Addeo et al. (2019),

[...] the best application of netnography is to understand the social world and cultures of online communities which develop prevalently in cyberspace in order to document the explicit language of informants without the risk of obtrusiveness and disturbance of direct research involvement providing researcher with the emic (insider) and ethical (outsider) perspectives for more holistic insights. Netnography provides a valuable tool for understanding constructed online social spaces (p. 34).

Netnography can be considered a specific form of online ethnographic research that requires “persistent interactive immersion by researchers in an online community” (MacCarthy, 2022, p. 1) without, however, being confused with it (Dumitrica, 2013; Addeo et al., 2019; Morais et al., 2020; Kozinets, 2014; Kozinets et al., 2018; Bernard, 2004; Zheng, 2019; Tuikka et al., 2017). Thus, this research method adapts, to some extent, ethnography to the study of online phenomena (Addeo et al., 2019), valuing the contextualization and the meaning participants ascribe to the situations (Costello et al., 2017; Morais et al., 2020; Kozinets et al., 2018). However, there are some differences between netnography and ethnography, as Brajkovič (2011) highlights in her review of Kozinets (2010), put forth in Figure 1.

Netnography may, thus, be considered a research method that deals with any digital artifacts (whether it is text, image, music or an articulation of them, ...) (Kozinets, 2014). Netnography allows the apprehension of technocultural elements that help in understanding the interactions that take place in the context of the web (Gambetti & Kozinets, 2022) (Table 1) and that can be developed alone or combined with other methodologies (Morais et al., 2020; Cano et al., 2023). As Srivastav and Rai (2022) state, Netnography is a virtual adaptation of the same with the researcher joining the virtual communities, observing the communication patterns of the community population with each other. They also analyse the virtual content produced by the community and the reactions to the same within and across communities (p. 573).

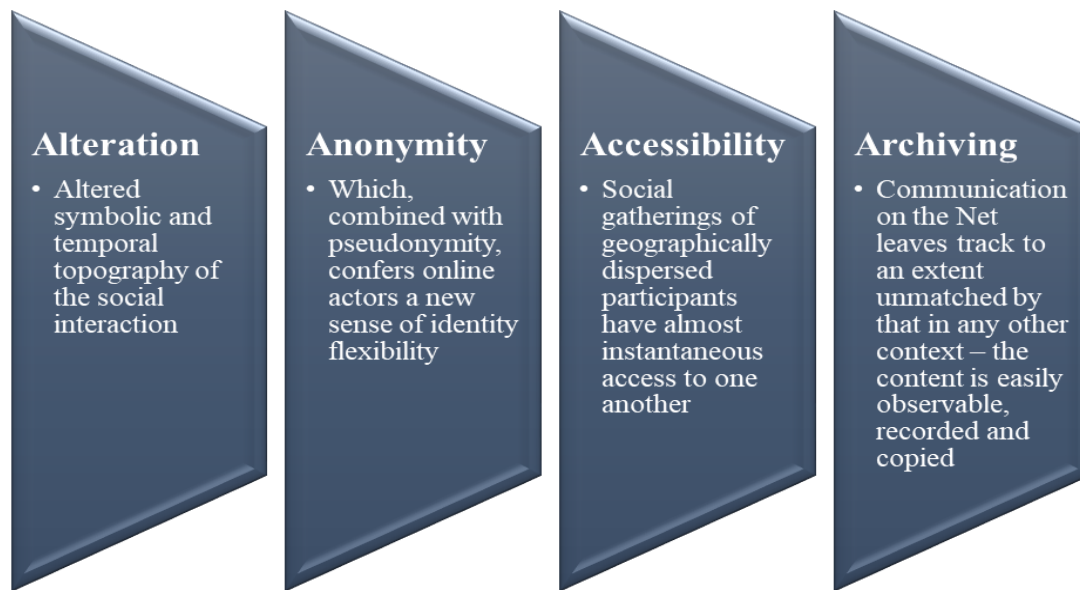


Figure 1. Some of the differences between Netnography e Ethnography

Source: Based on Brajkovič (2011).

Table 1. The elements of technocultural understanding captured by netnography

Technocultural codes and gestures governing online behaviors	Govern online behaviors (e.g., tagging, retweeting, following, unfollowing, sharing, scrolling).
Symbolic vocabularies	Consist of visual and emotional languages used to interact (e.g., selfies, zoomies, scrapbooks, GIFs, memes, emojis, memojis, stickers).
Human-machine-human interfaces and socio-technical affordances	Are adopted by social media platform (e.g., YouTube “Welcome to my channel video”, self-promotional annotations, links to other channel contents, subscription rules, video ranking mechanisms, tipsto become a “high-profile” vlogger).
Routines and rituals	Are used by individuals to establish their unique social media presence, bond with peers and followers and establish their status (e.g., (a) repetitive use of specific personal identification markers such as challenges, jokes, ways of audience interpellation; (b) ways of addressing the camera; (c) outfits, gestures).
Sensitizing stories	Show authenticity, attractiveness, similarity, accessibility, and that grab people’s attention enticing intense but light connections.
Demographics and technographics	Quantify and classify the profiles of the users according to their socio-demographic features and calculate the relevant key performance indicators of audience interaction for each platform.

Source: Based on Gambetti and Kozinets (2022).

Gaitán and Ramírez-Correa (2023), following El Hilali and Azougagh (2021), highlight the following three distinctive features of netnography vis-a-vis other methodologies (Table 2):

Table 2. Three distinctive features of netnography

Cultural focus	Netnography focuses on culture to understand human behavior in response to various phenomena.
Social media data	Netnography uses as its main data source the interactions and comments that occur on online social networks. Everything that happens in “real” life has an impact on online social networks.
Participation	Netnography supposes the free participation of users in online social networks. This fact generates a participation with the social, physical, and emotional characteristics of users within a community that facilitates their study.

Source: Based on Gaitán and Ramírez-Correa (2023).

According to Tuikka et al. (2017), as early as 2002, Kozinets established a set of four principles that researchers should follow when carrying out netnographic research, specifically, that researchers should (i) reveal their presence to the online community members that they are studying; (ii) ensure that the informants’ confidentiality and anonymity are protected; (iii) seek and incorporate feedback from the online community members in their study; and (iv) ask community members’ permission to quote information they post online. Morais et al. (2020), building on the works of Kozinets, propose four typologies of netnography, depicted in Table 3.

Table 3. Four typologies of netnography

Autonetnography	Is focused on autobiographical aspects, for its own identity and history, personal reflections on participation in social networks, with a critical understanding, through its first-person perspective.
Symbolic Netnography	Seeks to decode individuals’ traits and behaviors, and in the marketing area, especially to understand the consumers, thus adding to creating a diagnosis of specific sites and a portrait of people, helping to discern and explain their practices, meanings and values, providing subsidies to managers’ decisions.
Digital Netnography	Uses analytical techniques of statistical data and focuses on large masses of social media data to detect patterns and establish understandings of cultural elements that tend to collaborate with the reinforcement or improvements of business, management, and social practices.
Humanistic Netnography	Is focused on critical research and critical theory; social media data are used to seek to promote a discussion and solution to social impact problems brought about by globalization and advanced technological change.

Source: Based on Morais et al. (2020).

While netnographies have several differences, they have in common five fundamental features. On the one hand, all netnographies use related techniques for gathering and analyzing. On the other hand, they place the emphasis on the qualitative nature of context and content. Furthermore, they use the researcher's phenomenological presence in the sociotechnical experience. Also, they abide by rigorous and frequently updated ethical procedures. Finally, they seek to foster an understanding that incorporates cultural features, such as meanings, identities, hierarchies and rituals (Kozinets, 2022).

### Advantages and limitations

Issues of an ethical nature emerge from the application of netnography (Ferreira & Serpa, 2018b), several of which are specific to this methodology, for example, what information is legitimate to be considered public (Tuikka et al., 2017; Lehner-Mear, 2019; Bernard, 2004; Bowler, 2010; Morais et al., 2020). Another example concerns the extent to which a social media post is public or private (Viljoen, 2022; Discetti & Anderson, 2023; Srivastav & Rai, 2022). In terms of ethical standards, Loanzon et al. (2013) build on Kozinets's (2002) four principles that researchers should follow when carrying out netnographic research, adding that researchers should also use member checking by sharing the research findings with the individuals who have been studied to ask for their comments (Loanzon et al., 2013).

In summary, netnography offers some advantages but also disadvantages (Costello et al., 2017; Addeo et al., 2019; Bernard, 2004), several of which are presented in Table 4.

Table 4. Advantages and limitations of netnography

Advantages	Limitations
Allows focusing on marginal consumption phenomena	The informants' identity is uncertain (distortion of the digital self)
Unobtrusive and natural method (context not fabricated for the purposes of the study, the environment studied is not or only slightly disturbed by the study)	Difficult and delicate generalization of the results
Easy entry into the community (no travel required, no need for accreditation, etc.)	Not a very exhaustive method (it only studies the consumers gathered in the studied community; it only studies the communication acts and not the complete behavior of the subjects)
Time-saving method (faster data access, automatic data transcription)	Difficulty finding an adequate community in a given context
No spatial or temporal barriers	It requires special talents (empathy, sense of observation, etc.) without there being specific means to develop them

Allows continuous access to informants

The conclusions of a netnography are never definitive and often raise more questions than they answer, without always being very useful for marketing.

Researcher distancing

Source: Adapted from Bernard (2004).

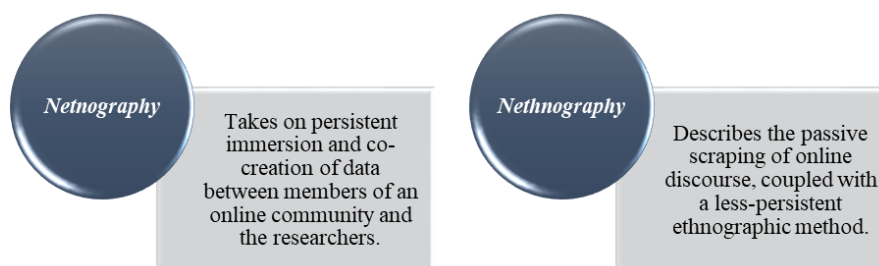
Netnography may be able to increase its ability to provide information with a higher heuristic potential of online interactions, expanding its range of action (Lugosi & Quinton, 2018; Dutta & Sharma, 2023). However, one area that seems to be one of the weakest in netnography is its ability to improve the understanding of the articulation between action and the online and offline representation of users, which comes from/does not come from one of the dimensions of action to the other (Dumitrica, 2013; Serpa & Ferreira, 2018).

## Nethnography

As in everything, we cannot be purists. A very relevant example is offered by MacCarthy (2022), who offers the concept of nethnography as another way of doing research with its own value and even with the potential of complementing Netnography. Thus, MacCarthy (2022) proposes nethnography as

[...] Lesser-engaged ethnographic methods include participants as observers, observers as participants and complete observers. A fourth legitimizer of online interpretation are researchers or the cooperation of consultants who have previously immersed themselves in the phenomenon but were not researchers at the time” (p. 1).

Figure 2 depicts this distinction between netnography and nethnography.



Source: Based on MacCarthy (2022).

Figure 2. Distinction between netnography and nethnography

The author (MacCarthy, 2022) advocates that nethnography is another online qualitative research method,



arguing that “Nethnography is a two-part qualitative praxis of spending enough time with the phenomenon to discern meanings with confidence, which is then used to interpret nondyadic textual discourse” (p. 1) (Table 5).

Table 5. Advantages of nethnography

- 
1. Legitimizes [marginalized] non-dyadic secondary data.
  2. Transfers researcher bias downstream.
  3. Provides enhanced insight and subsequent truthfulness when analyzing *Big Data*.
  4. Nethnography is less time-consuming than netnography.
  5. Mitigates bias from data co-production.
  6. Is used as either a data grooming tool or complete, analytical method.
  7. Allows passive data scraping.
  8. Provides increased credibility of data when fortified by an ethnographic method.
  9. Enables a reduction in the level of bias inherent in the data.
  10. There are less time, effort and costs associated.
- 

Source: Based on MacCarthy (2022).

To some extent and used wisely, both methods may be complementary, as “By employing methods simultaneously, one realizes two advantages. (1) Not only can the researcher take advantage of large volumes of online secondary data to generalize but, (2) make better sense of the same having contextualized this by personal experience” (MacCarthy, 2022, p. 5).

## Final Thoughts

Netnography as a form of research has high potential in the analysis of, for example, online contexts, such as social media, communities and culture, but also in virtual reality situations (Loanzon et al., 2013; Lugosi & Quinton, 2018; Costello et al., 2017; Kozinets & Gambetti, 2020; Kozinets et al., 2018; Morais et al., 2020; Wu, 2022; Dutta & Sharma, 2023; Discetti & Anderson, 2023). It is concluded that nethnography is yet another research method that can complement and enhance netnography by adopting the research method, adapting it, whenever necessary, to the needs of the research to attain its objectives in a heuristic, technically competent and ethically shaped way to enable new developments, for which the researcher’s digital literacy will always be critical for their conscious and reasoned decision-making, so as to expand the heuristic potential of these ways of doing research (Lugosi & Quinton, 2018; Morais et al., 2020; Srivastav & Rai, 2022).

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## A Comprehensive Review to Identify the Challenges and Opportunities of Using Digital Technology in English Teaching in Higher Education

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**Abstract:** This study aims to explore the challenges and opportunities of using digital technology in English teaching in higher education. Transforming the teaching and learning process from face-to-face to online learning by utilising digital technology devices and internet connectivity becomes challenging for lecturers and students. However, there are many opportunities of integrating digital technology and education. This study uses narrative literature reviews to identify the challenges and opportunities of utilising digital technology in English teaching in higher education institutions. A number of challenges and opportunities are found in using digital technology in English teaching, including digital technology access, flexibility, engagement, pedagogical dimension, personal dimension, range of sources and cultural awareness. Furthermore, this research can provide significant insight and understanding regarding the difficulties and benefits of integrating digital technology and education in higher education institutions, particularly since the COVID-19 pandemic. It also recommends further research regarding integrating digital technology and education, particularly in English teaching in higher education institutions.

**Keywords:** Digital Technology, Challenges, Opportunities, English Teaching, Higher Education

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## Introduction

### Background

English teaching (ET) in higher education (HE) has dramatically transformed since the COVID-19 pandemic. The transformations include the ways of mode delivery of teaching and learning English from face-to-face (F2F) to the online learning (Yusriadi et al., 2022). Online learning requires digital technology (DT) devices (Zuhairi et al., 2020) and internet connectivity (Ngoasong, 2022) to support the ET process. The development of digital technology has improved significantly (Ahmad et al., 2022), and it has challenges and opportunities in the ET process in HE institutions. This becomes one of the issues for lecturers and students when delivering teaching and learning online.

### Research Aim and Objectives

This study aims to identify and understand the challenges and opportunities of using DT in English teaching and learning activities in HE institutions. Furthermore, the objective of this study is to conduct a comprehensive review of the challenges and opportunities of using DT in ET in HE institutions. There are many challenges and opportunities that exist in using DT in ET in HE institutions. The challenges and opportunities include the digital technology access (Widyanti et al., 2020; Zuhairi et al., 2020), flexibility (Martha, 2021), engagement (Galvis & Carvajal, 2022), pedagogical dimension (Thaheem et al., 2021), a wide range of sources (Nazarov et al., 2021), personal dimension (Viner et al., 2020), and cultural awareness (Lu et al., 2022). These criteria are explained more in the result and discussion parts.

The research questions of this study are; a. What are the challenges of using DT faced by the lecturers and students in teaching and learning English in HE institutions? b. What are the opportunities for using DT for lecturers and students in teaching and learning English in HE institutions? The authors comprehensively review previous studies on using DT in education, particularly in ET in HE institutions to answer these questions.

To summarise, this study is important in particular for some reasons. Firstly, digital technology has transformed how people learn and communicate, but more research needs to be conducted on applying DT in HE institutions (Lestari, 2020; Manurung et al., 2020). Secondly, the research on DT in HE institutions requires further investigation to identify more benefits of using technology in ET by presenting different research methodologies and various data collection methods (Sufyan, 2020). Therefore, this study aims to enhance the opportunities and reduce the challenges of utilising DT in the ET process. Hence, the expected outcome of this research is to contribute to the body of knowledge on the use of DT in ET at HE institutions.

### Method

This study uses qualitative data. Qualitative data is exploring and understanding the human and social

phenomena from individuals or groups, which involves non-numerical data to explain the results of the study (Creswell, 2017). Also, qualitative data includes the interactions and situations of social phenomena described in narrative form (Halmes, 2010). Data for this study is undertaken from the relevant studies about integrating DT and education in HE institutions. The sources for the relevant studies are available in the references list. Furthermore, this study's data analysis type is inductive, particularly narrative analysis (Hesse-Biber, 2015). To summarise, this study applies a narrative review of relevant studies to identify the challenges and opportunities of using DT in ET in HE institutions.

## Results

### Digital Technology in English Teaching in HE Institutions

Digital technology in education refers to utilising digital devices with internet connectivity (Aldhafeeri & Male, 2015) that lecturers and students use in teaching and learning English. The digital devices that are mostly used are computers, laptops, tablets, and smartphones. Lecturers and students can succeed in English teaching and learning by applying advanced digital devices and internet connectivity (Dumbraveanu, 2021) in variation to the updated sources. For example, in the online learning mode of delivery, the teaching and learning process can be conducted from home using an internet connection and digital devices (Dumbraveanu, 2021). Lecturers and students can meet via Zoom meeting, Microsoft Team, or Google Meet (Martha, 2021) to deliver and discuss the English lessons.

DT benefits the lecturers in designing the curriculum, evaluating students' understanding of the English learning process, and evaluating the teaching and learning program (Caprara & Caprara, 2022). Not only lecturers but also governments and stakeholders design and develop suitable curriculum content for all levels of education to achieve educational goals (Ngoasong, 2022). In addition, curriculum content, assessment and evaluation become the focus of using DT in ET. So, governments and lecturers may consider the arrangement of the curriculum and materials to assist the students in comprehending the lessons provided and suitable to the updated technology development (Ngoasong, 2022; Yuan et al., 2019).

Using DT in ET can be undertaken fully online and through blended learning. In online learning, DT may assist the students in continuing their learning activities from home and enhance their knowledge from the sources on the internet (Lee & Sylvén, 2021). Widyanti et al. (2020) also added that DT implements an innovative, independent, and collaborative learning environment that may allow students to study online. These learning activities could be set based on student's needs, and be student-centred rather than only lecturer-centred (Gherheş et al., 2021).

Compared to the blended learning approach, it combines F2F and online teaching and learning activities supported by advanced technology (Lalima & Dangwal, 2017; Lazar et al., 2020). This approach has grown significantly to transform F2F learning into digitalisation. The benefits of blended learning include making it

easy to understand the lessons from the lecturers and being open to discussion when the lesson is delivered F2F. Also, blended learning may fill the gap between audio-visual and kinaesthetic students by using stories in the digital educational format (Galvis & Carvajal, 2022).

### **Challenges in Using Digital Technology in English Teaching**

There are many challenges the lecturers and students face in applying digital technology in English teaching in HE institutions. The challenges are related to digital technology access, pedagogical, personal dimension, and cultural awareness. Regarding digital technology access, applying DT is challenging on the technical side. Technically, online learning activities incorporate applying technology devices supported by internet access and applications such as social media platforms, websites, e-mail, YouTube channels, Microsoft Teams, Zoom Meeting, and Google Meeting (Aldhafeeri & Male, 2015).

However, practically, lecturers and students face difficulties using these applications because some are not commonly used in the teaching and learning process (Aldhafeeri & Male, 2015). These applications allow lecturers to deliver their lessons by utilising various kinds of software (Martha, 2021). The software may cause problems with the various advanced technologies, which the lecturers and students need to become more familiar with (Galvis & Carvajal, 2022). Also, the barrier to internet connectivity may impact the process of ET using DT in HE institutions (Lazar et al., 2020). Consequently, difficulties with internet connections can lead to severe problems in the online learning (Ngoasong, 2022).

The next challenge is engagement. Not all students can adapt quickly to online learning (Galvis & Carvajal, 2022). For instance, some students who have difficulties understanding visual material cannot receive meaningful lessons online but should combine audio and visual material (Ngoasong, 2022). Meanwhile, if some students have hearing issues, they will also have difficulties listening to the audio material (Lazar et al., 2020). Hence, this is also a challenge in using DT in ET for students with online learning.

The other challenge is the pedagogical dimension. Integrating technology and education requires pedagogical knowledge or pedagogical competence. Digital pedagogical content competence is proposed to upgrade the technological pedagogical content knowledge (Dumbraveanu, 2021). Digital pedagogical competencies can be defined as how digital technologies can enhance teaching or learning by considering pedagogical values (Dumbraveanu, 2021). Lecturers can develop their students' learning strategies to improve their English proficiency. For instance, using a recorded audio or video file while the meeting is delivered online. This method can assist the lecturers and students when referring to previous lessons.

The personal dimension is another challenge for the students and lecturers when applying digital technology in English teaching in HE institutions. Students face difficulties regarding the budget to purchase a personal laptop, smartphone, or computer and internet data to support online learning (Viner et al., 2020). Also, lecturers who are untrained in using digital technology for online teaching struggle to transfer or teach English to the students



(Thaheem et al., 2021). Furthermore, these personal problems become a challenge for online teaching and learning activities.

The last challenge is cultural awareness. Using DT in teaching and learning activities has impacted cultural awareness regarding the students' behaviour (Lazar et al., 2020). For instance, students' attitudes to learning from F2F to online learning are changing (Ngoasong, 2022). The lecturers can understand how students learn in online learning and the factors behind that. Also, understanding the students' behaviour is challenging regarding their cultural awareness of English teaching and learning using DT in HE institutions. Hence, the challenges identified and explained according to the previous research above answered the first research question.

### **Opportunities in Applying Digital Technology in English Teaching and Learning in HE Institutions**

Besides the challenges, using digital technology in English teaching provides opportunities for English lecturers and students. Firstly, it is flexibility. Flexibility can be divided into two scopes (time and place). Online learning can provide flexible teaching and learning process between lecturers and students (Gouseti et al., 2020). Regarding the flexibility in place, the teaching and learning process can be conducted from home, the office, outdoors or indoors (Sufyan, 2020). In addition, lecturers may set a day and time to schedule a meeting on the Zoom Platform to transfer knowledge and discuss the lessons with the students to show flexibility in time (Ngoasong, 2022). This is more effective and efficient for lecturers and students regarding transport fees to the institutions.

Additionally, the opportunity for using digital technology in English teaching and learning is the wide range of digital sources available on websites or e-platforms (Nazarov et al., 2021). Since many applications are available, selecting the appropriate application to improve students' online learning ability is essential to enhance the benefits of using the platforms and applications in the English teaching and learning (Metruk, 2021). This approach can contribute to the student's self-confidence in online learning because of the range of platforms and applications supporting their learning. Also, the lecturers may be more creative in designing the lesson plan and providing various digital sources to improve their students' English skills.

In conclusion, previous studies identified some opportunities for lecturers and students to conduct online teaching and learning. These included flexibility in time and place (Gouseti et al., 2020) and a wide range of digital sources (Martha, 2021). The opportunities not only for the students but also for the lecturers in developing their strategies for teaching English in HE institutions. So, the second research question has been answered from the previous studies explained about the opportunities of using DT in ET in HE institutions.

### **Discussion**

Based on the results found from the narrative review, the author identifies and classifies the challenges and

opportunities of using digital technology in English teaching and learning activities in HE institutions. Those challenges can be reduced by providing DT training for lecturers and students. Also, the opportunities can be optimised to increase students' English proficiency. In addition, the government and stakeholders may increase the DT facilities and internet connectivity to achieve the best service and quality of English teaching and learning online. The challenges and opportunities that have been identified are described in Table 1.

Table 1. Challenges and Opportunities Using Digital Technology in Education

Aspects	Challenges	Opportunities	Sources
Digital technology access	√		(Galvis & Carvajal, 2022; Lazar et al., 2020; Ngoasong, 2022)
Engagement	√		(Galvis & Carvajal, 2022; Lazar et al., 2020; Ngoasong, 2022)
Pedagogical dimension	√		(Dumbraveanu, 2021)
Personal dimension	√		(Thaheem et al., 2021; Viner et al., 2020)
Flexibility		√	(Gouseti et al., 2020; Ngoasong, 2022; Sufyan, 2020)
Wide range of sources		√	(Martha, 2021; Nazarov et al., 2021)
Cultural Awareness	√		(Lu et al., 2022)

## Conclusion

Many challenges and opportunities exist for using digital technology in English teaching in HE institutions. The previous studies identified some problems and benefits in digital learning, which still require further investigation. Therefore, this study conducted a comprehensive review in identifying and classifying the challenges and opportunities of using digital technology in English teaching and learning. This study provides valuable insight to the lecturers and students in integrating digital technology into the English teaching and learning process.

The challenges in integrating DT into English teaching are DT access, engagement, pedagogical dimension, personal dimension, and cultural awareness (Thaheem et al., 2021). The challenges also include the digital technology training (Burns, 2013), limited access to digital devices (Zuhairi et al., 2020), and internet connectivity (Ngoasong, 2022). So, these challenges impact the English teaching and learning process in HE institutions when undertaking online learning.

However, many opportunities exist to integrate DT into English teaching and learning. They are flexible regarding place and time while conducting teaching and learning activities (Gouseti et al., 2020). They may attend the meeting with the lecturers from home and set the appropriate time between lecturers and students to achieve the goal of the lessons. Also, another opportunity is that a wide range of sources can be accessed online using digital technology, applications, and platforms to enhance their English skills. Then, the lecturers can access various sources to update their English knowledge (Nazarov et al., 2021). To conclude, this comprehensive review benefits lecturer and students in English teaching and learning in HE institutions by reducing the challenges and improving the opportunities for integrating DT and education.

## Recommendations

This study limits about challenges and opportunities of using digital technology in English teaching in higher education institutions. Furthermore, the authors provide recommendations for further research in integrating technology and education in any discipline of study from primary to higher education institutions to reach the best service and quality of English teaching and to increase the students' English skills.

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## Recycling for Sustainability in Packaging Design

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**Abstract:** Knowing that we are not the only owner of the world, we are only a part of it, and that it is our most important duty to observe the sustainability of resources for a more livable world is vital for us to leave a livable environment for future generations. The most important cause of environmental pollution is solid waste. Packaging, which is one of the important types of urban solid waste, dates back to the human desire to store food products. Packaging, the first examples of which are tree leaves and bark, has developed in direct proportion to the living standards of humanity. Packaging, which initially had one purpose only to protect food, has become an advertising and communication tool with the developing technology and the competitive environment created by the production sector. Today, what is expected from successful packaging is to protect the product in a healthy way to the expectations of the target audience, to be easily transported from one place to another, to gain customer appreciation with its aesthetic appearance and to have communication power. At the same time, since it is an advertising element, new searches are needed every day in packaging design. The diversity of the products to be packaged and consumer preferences have paved the way for new designs that can win the shelf competition with different materials. As a result of this, new packages were produced constantly, resulting in new and more solid waste. The designer should choose sustainable, environmentally friendly, recyclable or recyclable materials while planning the packaging process from production to shelf and to the end consumer. The content of this review-type study; is aimed at evaluating the packaging design within the framework of the concept of sustainability.

**Keywords:** Sustainability, Recycle, Echo Design, Sustainable Packaging

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### Introduction

Packaging is derived from the French word "emballage". It is the process of packing or wrapping a product or item, placing it in a box and making it portable. Today, the packaging is defined as a material equipped with the necessary information in such a way that it fulfils the function of making the consumer like and accept itself without being damaged, polluting the environment, and fulfilling the function of making the consumer like and

accept itself in the process of loading, unloading, transporting and storage stages after the product leaves the production line. Many different organic or inorganic materials can be used for packaging according to the characteristics of the product. Size, material and form are directly related to the product.

Packaging is a design and technology for the protection of products for distribution, storage, sale and use. Packaging helps a product to be stored and transported safely. The type of packaging is determined by the shape, weight and durability of the product. Good packaging protects the contents, adds value to the product, provides information about the product, contributes to its purchase and is environmentally friendly.

The artefacts unearthed show that human beings have had a culture of storing their possessions since ancient times. Clay and glass containers, mussels and fruit shells or leaves, which are thought to have been produced in the eight thousand years BC and used to store and protect goods, are considered to be the first examples of packaging design. Earthenware vessels such as amphorae, askos, pelike, glassware such as vases, bowls, oil lamps, metal utensils, special altar vessels, and carrying jars were used for storing and transporting liquids such as perfume, wine, olive oil, water, and foodstuffs such as honey and fish sauce.

### **The Concept of Sustainability**

The concept of sustainability can be defined and perceived in different ways. Today, the concept of "sustainability", sustainable environment, sustainable world, sustainable economy, sustainable development, sustainable design, etc. are frequently used in our literature. Sustainability can be achieved by utilising the rich resources that nature offers to people in proportion to their self-renewal. Social sustainability can be expressed as meeting the needs of today's human generation while taking into account the needs of future generations. Economic sustainability, on the other hand, is evaluated together with development, using renewable resources in the production process and being responsible for the environmental impacts in all production activities.

In the 1980s, environmental problems started to come to the fore. In order to change this bad trend, environmental movements have intensified in order to create environmental awareness, solve environmental problems, prevent new problems, and leave a livable world for future generations. This movement is aimed at making and implementing plans that will enable people to benefit from nature at the optimum level without disturbing the ecological balance. In other words, the aim is a "Sustainable World" (Kocataş, 2008: 417).

### **Eco Design**

Green design; while increasing the quality of the product with the design made, it is the reduction of the effects on the environment within and throughout the life cycle of the product. The concept of eco-design; Eco Design, Green Engineering, Sustainable Design, Life Cycle Engineering, Design For The Environment, Nature-Friendly Design, Life Cycle Design, Cradle-To-Cradle Design, Environmentally Conscious Design, etc. It is seen that it is used instead of many concepts (Öztürk & Ünal, 2022; Öztürk & Demirci, 2022; Öztürk et al., 2021).

Green design, which emerged in 1992, covers methods of implementing changes in design or improvement strategies to reduce environmental impact and protect the environment (Baumann, Boons, & Bragd, 2002: 413). Green design is the consideration of design issues related to the environment and human health and safety over the life cycle while developing a different product and production process. Considering factors such as cost, quality, etc., it aims to look from a vision that considers the entire life cycle of the product by integrating environmental sensitivity ideas into the traditional design process in the production and use processes of products and all processes (Kasap & Paker, 2011: 103-104).

Although there are concerns that environmental strategies bring high costs to firms, many studies have shown that planning for green design contributes to firms in terms of savings. Reducing or completely eliminating the use of harmful substances and the amount of waste in the production process provides significant cost savings to businesses due to the high costs of transport and treatment procedures for harmful wastes (Schischke, Hagelüken & Steffenhagen, 2).

Rapid changes in competitive conditions bring along difficult processes for businesses. In the face of challenging competitive conditions, businesses have carried out studies on the supply chain, collaborated with their stakeholders to create value for the end consumer and improve their business performance, and used this as a competitive strategy. Stakeholders have been subjected to pressures to meet the environmental needs of companies with high environmental awareness, along with issues such as low cost, quality, and delivery discipline. Green design studies to be carried out by the stakeholders in the supply chain of firms were seen as a solution to overcome the pressures they faced (Kasap & Peker, 2011: 110).

### **Sustainable Graphic Design**

The most basic material of graphic design is paper. Tons of paper are used for graphic design projects and advertising campaigns. Graphic designers are responsible for the forest massacre caused by cut-down trees. It is the graphic design sector that realises the dreams of marketers and manufacturer company owners and is the accomplice of millions of packaging waste. Like graphic designers, industrial designers who design packaging must also produce environmentally sensitive designs and packaging.

Tons of paper and ink are used for daily printed newspapers, magazines, periodicals, product packaging, promotional materials such as inserts, brochures and flyers. When starting a project, the designer should adopt a holistic design vision to consume less paper, prefer environmentally friendly inks and use recyclable materials. The data and decisions are taken within the framework of the initial brief to shape the entire design and production process.

Intervening in issues such as printing quantity, paper size and printing technique in the printing and post-printing stages will reduce paper, energy, mould, labour and cost. The designer may prefer a printing house that is environmentally conscious, has taken green design measures, and uses recyclable materials in binding and



protection applications. The printing technique and colours preferred by the designer while preparing a project should be in the direction of environmentally friendly choices that are not petroleum derivatives, do not contain harmful heavy metals, and do not emit toxic gases and elements into the atmosphere.

VOC (Volatile Organic Components), the emissions of volatile organic compounds (VOC), which are contained in the inks and released into the atmosphere as a result of industrial processes, can easily evaporate even at low temperatures and can produce undesirable effects in air and water. Each new colour used in the printing process means much more greenhouse gas emissions, solvent and raw material use. In this context, choosing fewer colours in designs not only reduces the use of ink in printing but also facilitates the recovery of paper material. It would be the right approach to prefer recycled paper in some products. In production, water and organic-based or recycled inks without VOC (Volatile Organic Components) emissions should be used, and metallic inks and inks containing toxic elements should be avoided whenever possible.

### **Sustainability in Packaging Design**

The century we live in has gained more importance in sustainable packaging with the rapid depletion of natural resources due to population growth. The increase in conscious consumers and environmental awareness has led to changes in consumer habits and sustainable approaches in packaging design have emerged as a rising value. Sustainable product selection and environmentally sensitive product design are important issues. For a sustainable design, it is very important for designers to fully define the elements for the use and disposal of the product, to select the least environmentally harmful raw materials in production, and to plan the production and distribution process with the least social and environmental impact (Zeren & Nakıbođlu, 2009: 462).

The first organisation on sustainable packaging (SPA-Sustainablepack) was established in Australia in 2002 with the participation of Victoria University, RMIT University and Birubi Innovation. The founders aimed for an integrated and supply chain-orientated approach to sustainable packaging. In this context, they first developed projects to create sustainable packaging foresight (Bunyatova et al., 2021; Lewis & Sonneveld, 2004; Lasminawati et al., 2022).

Although sustainable packaging approaches create a new and difficult design process, it would be wise to ignore the difficulties when ecological awareness and recovery are considered (Verghese, Lewis, & Fitzpatrick, 2012: 10). According to the Regulation on Control of Packaging Wastes; it is not correct to use non-recyclable materials when producing packaging. Packages produced from recyclable raw materials should be recycled after their use is completed (ASD, 2019).

It is seen that consumer preferences are in the direction of purchasing environmentally sensitive packaging. The increase in environmentally conscious customers who act with the idea of reducing the carbon footprint causes the biochemical development of the raw materials used in packaging production and the development of their designs in line with these views. It is possible to say that a sustainable packaging design that requires the lowest

levels of energy and raw materials in production positively affects the sales of the end product, and increases the competitiveness and brand value of the product (Shedroff, 2009: 219).

Packaging is the protection and promotion elements produced in different materials that are also effective in the marketing process, which has the functions of protecting, storing, transporting and transporting the product inside. At the same time, packaging helps customers to make choices and be informed by placing different information on it. It can be said that packaging has a special place in terms of sustainability, considering that all products placed on the market are placed in packaging and the packaging is wasted after the product is consumed. For this reason, sustainable plans should be made in the design and production process of packaging. Especially if recycled materials are not used in packaging production, additional burdens will arise.

### Recycling in Packaging

Recycling is the re-entry of packaging into the manufacturing process as raw material through various processes after it is used. Energy recovery is the process of burning combustible wastes in facilities to obtain heat and electrical energy (ASD, 2013). Due to the traces left by modern life in nature, recycling has become an issue that is constantly discussed since packaging wastes are considered as a significant substance under the titles of effective use and sustainability of natural resources. Recycling, by definition, is the re-entry of waste materials into the manufacturing process in the form of raw materials after undergoing certain physical and chemical processes, minimising the damage to nature and humanity. Packaging wastes are divided into 6 in terms of material type: "paper, glass, wood, plastic, metal and composite packaging". The fact that these packages are produced from recyclable materials does not mean that they will be recycled. First of all, the consumer should leave it at the recycling point, not directly in the garbage, and even this will not be recycled if there is no suitable recycling facility in the region. For this reason, biodegradable materials should be preferred as much as possible (Gündüzalp & Güven, 2004: 9).



Figure 1. Recycling (Retrieved from: <https://twitter.com/sifiratikgov/status/1124207343363928064/photo/1> on the date 08 May 2023)

Another important concept related to recycling is Organic Recycling, i.e. Composting. Compost is the biological decomposition of organic materials under appropriate conditions and the breakdown of some substances with carbon dioxide and water. Re-use means that the packaging can be reused until it is no longer possible to reuse it (ASD, 2013). Energy recovery or composting is another consideration, depending on the nature of the packaging and the local solid waste management infrastructure. During composting, some organic matter is broken down with carbon dioxide and water. After the process waste resembles a dark-coloured, humus-like, rich soil type, compostable waste is produced by this method as an energy source instead of fertilisers (RECOUP, 2013).

Since recycled packaging, together with the collected composite packaging, is made of many materials, this process consists of complex stages. After grinding, paper, aluminium and polyethene are shredded. Recycled paper can be used in the production of toilet paper and corrugated cardboard. After the paper is separated, the remaining part, aluminium, polyethene or other material, can be used as additional fuel in cement factories due to its high calorific value. It can be recycled by incineration for energy (ASD, 2013).

Instead of being materials that pose a threat to the environment such as plastics and petroleum-based wastes that remain intact for hundreds of years, packaging wastes should consist of organic, bioplastics that decompose in nature with carbon dioxide and water in a few years. New-generation manufacturers and scientists have started to fight global plastic waste by producing compostable and renewable packaging (Boztaş, 2016). With the recycling methods applied by innovative manufacturers, most plastic packaging can be turned into an energy source. These recycled plastics are converted into alternative fuels for new manufacturing and energy recovery is achieved.



Figure 2. Natural Tea Packaging (Retrieved from: <https://www.tripwiremagazine.com/wp-content/uploads/2012/06/organic-packaging-for-organic-tea.jpg> on the date 02 April 2023)

Today, 100% recyclable packaging has started to be produced. These packages, which generally use paper and fabric, boxes, bags, labels and all applications on them are environmentally friendly. In tea packaging, one of

these products, a natural cotton fabric material was used in the primary packaging. In the secondary packaging, a cardboard box made of recycled material was used. The packaging is not only recyclable but also functional and reusable.

Another product is yoghurt packaging made from sheep and goat milk. The typography, illustrations and colours of this packaging design are 100% recyclable and have high brand recognition.



Figure 3. Recyclable Yoghurt Packaging (Retrieved from: <https://thedieline.com/blog/2011/4/11/tonis-goats-milk-yogurt.html?> on the date 05 May 2023)

One of the examples of recycled paper material, the 360-degree paper bottle packaging is an environmentally friendly packaging developed in Prague, the first of its kind in the world, in order to solve the plastic bottle problem. It is an original bottle design suitable for use in all liquid categories, made of 100% recycled material with a light coating of recycled plastic and made of renewable resources.



Figure 4. 180 Degree Paper Packaging (Retrieved from: <https://www.designerpeople.com/blog/packaging/creative-eco-friendly-packaging-design-for-inspiration/> on the date 05 May 2023)

At least 8 million tonnes of plastic reach the ocean every year. With the collection of all faeces in petroleum-based plastic bags, it is faced with the situation that the leaching of toxic chemicals in landfills will continue for thousands of years. Alternatively, leaving faeces on the ground is also not an environmentally friendly option. Poop Bags in Figure 5 is an environmentally friendly packaging design that is naturally created from non-GMO corn starch and vegetable oil, which biodegrades 40% to produce olive bags. It can be 100% biodegradable for up to 40 days and can be approved as compost. New-generation plastic manufacturers are contributing to sustainability by developing compostable plastics with the idea of overcoming the global plastic waste crisis.



Figure 5. Plastic Packaging (Retrieved from: <https://www.tripwiremagazine.com/eco-friendly-packaging-designs/> on the date 01 April 2023)



Figure 6. Metal Carbonated Beverage Packaging (Retrieved from: <https://studiodesignistanbul.files.wordpress.com/2011/12/untitled4.png> on the date 12 January 2023)

This innovative idea of the metal Coca-Cola packaging in Figure 6 allows the use of a convex logo instead of a coloured can and contributes to the reduction of air and water pollution in the colouring process. In this way, it is possible to separate toxic colour dyes from aluminium in the recycling process with less energy. In this way, more energy and dye can be saved than is required in the production of coloured cans. Instead of toxic dyes,

manufacturers process the aluminium surface with a pressing machine that shows the brand identity. In the recycling of metal beverage cans, the metal is directly melted and transformed into a new product. Since the industrial process in recycled materials is minimal, the recycling of aluminium cans results in an energy saving of 96%. Similarly, the energy required to reprocess separated paper from solid waste is 50% (ASD, 2013).

## Conclusion

that the world we live in does not belong to us, having an awareness of green design for a sustainable world is an important responsibility that should be gained as an individual and society at preschool ages. It is our human duty to protect the environment, to be sensitive to environmental problems, to use renewable resources, to develop a consumption culture suitable for recycling, reuse and upcycling, and to use natural resources more sustainably by considering future generations.

In today's modern life, people have to use both paper and paper derivative products and electrical and electronic equipment. Our duty as designers, producers and consumers is to prefer more environmentally friendly and sustainable products in production and consumption, to recycle the products that have completed their life cycle rather than throwing them directly into the garbage and to recycle them into the economy and to prefer recycled products in new productions.

One of the most important problems of today is the lack of resources. Waste management for a sustainable environment is an important responsibility for producers and consumers. It is a civic duty to produce innovative and sustainable solutions in packaging design. The fact that activities related to sustainability are carried out worldwide, but an effective solution has not yet been found for plastic waste shows that this waste, which disappears in nature in the latest time, and the damage it causes to the environment is a growing problem. The increase in consumption and product diversity, digital shopping and taste level is the most important reason for packaging diversity. Since the damage caused by waste to nature should be greatly reduced, all individuals should be encouraged and an environmental awareness should be created through various studies.

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## An Inquiry into the Critical Thinking Disposition of Turkish Pre-service Teachers: A Thematic Analysis of Theses

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**Abstract:** This study aims to examine the theses on the critical thinking disposition of teacher candidates in Turkey. The document review method was used, which deals with documents related to a specific subject with a qualitative approach. The data of the research were analyzed by content analysis method. The Turkish Council of Higher Education (TCHE) national database was searched using the keywords "teacher candidate" and "critical thinking disposition," and 30 accessible theses were included in the research. Theses reached within the scope of the research; It was analyzed according to the themes of "academic level," "year," "scope of the subject," "research method," "sample," "data collection tools," "analysis method" and "results." The thesis studies were examined by two experts and coded according to themes. The percentage of agreement among experts was determined as 95%. It was understood that many of the theses examined were master's theses and were completed in 2019. It was observed that the samples of most of the theses consisted of social studies and science teacher candidates. It was determined that the Relational and Comparative research models were used more in the theses examined. t-Test, ANOVA, and correlation techniques are the most preferred techniques for data analysis. The number of theses in which qualitative research models are used is quite limited. The reviewed theses have focused on demographic characteristics, media literacy, entrepreneurship, emotional intelligence, and 21st-century skills as the primary correlates of critical thinking disposition. According to the results of the research, several recommendations have been developed.

**Keywords:** Critical thinking disposition, Pre-service teachers, Graduate theses, Content analysis

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### Introduction

Education is a fundamental element for the development and progress of society. The education system is where educators need to develop teaching methods and strategies to enable students to learn successfully. However, in today's world, simply imparting knowledge to students is no longer enough. Students should be equipped with critical thinking skills so that they have the necessary skills to analyze complex problems, generate new ideas, and evaluate different perspectives. Critical thinking is seen as an essential skill that increases the quality of life



of individuals (Elder & Paul, 2020).

Teachers should help students develop their critical thinking skills. However, providing critical thinking training to teacher candidates is also essential. Critical thinking can be taught by teachers who can think critically (Yeşilyurt, 2021). Critical thinking skills will not only contribute to the development of their students but also to their professional development. Therefore, research on how pre-service teachers can improve their critical thinking skills has increased recently. This research aims to examine the theses in which the critical thinking dispositions of teacher candidates are investigated. These theses will provide information about teaching strategies and methods to help prospective teachers develop their critical thinking skills.

### **Critical Thinking Skill and Disposition**

Critical thinking is a mental process used to evaluate information and ideas. Critical thinking means considering and analyzing evidence, arguments, and other sources of information when thinking about a topic and coming to logical conclusions. It includes critical thinking, reasoning, analyzing, synthesizing, evaluating and problem-solving skills (Almusaed et al., 2022; da Silva Almeida & Helena Rodrigues Franco, 2011; Gacovska-Barandovska et al., 2020; Marques & Xavier, 2021; Orhan, 2023; Ye et al., 2021).

Critical thinking is a cognitive process that involves purposeful and reflective judgment and applying appropriate criteria and standards to evaluate what is said, done, or written by ourselves or others. According to Bailin, Case, Coombs, and Daniels (1999), critical thinking is a normative endeavor that relies on intellectual resources such as background knowledge, operational knowledge of standards, and specific mental habits. Dwyer, Hogan and Stewart (2014) stress the significance of critical thinking in adapting to the rapidly changing information landscape and suggest an integrated framework of learning outcomes based on existing theoretical models and recent conceptualizations of critical thinking. Duron, Limbach, and Waugh (2006) propose a five-step framework applicable to any educational or training setting to help learners develop critical thinking skills. Lai (2011) emphasizes the importance of explicit instruction, component skills, critical thinking dispositions, open-ended tasks, and real-world problem contexts to assess critical thinking. Critical thinking requires explicit instruction, appropriate frameworks, and assessment methods to be taught and cultivated effectively.

One of the factors required for critical thinking skills is that the individual tends to think critically (Yeşilyurt, 2021). Critical thinking disposition means the tendency of individuals to think critically. This disposition reflects one's thinking habits, preferences, and attitudes. Individuals with a high tendency to think critically can analyze information more effectively, understand different perspectives, evaluate arguments more critically, and achieve better results.

Critical thinking and critical thinking disposition are essential in many fields. Especially in education and business, individuals with critical thinking skills can solve the problems they face more effectively, make smarter decisions, and be more successful. In addition, critical thinking is also essential in social interactions

because having the skills to understand, evaluate and discuss other people's ideas helps to develop communication skills (Seferoğlu and Akbıyık, 2006).

Critical thinking disposition is a crucial component for individuals in various fields. Indra (2019) found critical thinking is crucial for nursing students to manage complex health situations and deal with patient issues effectively. Ennis (1996) argues that critical thinking disposition is at least as important as critical thinking abilities and suggests criteria for judging sets of them. Çubukçu (2006) found that Turkish teacher candidates with high critical thinking dispositions were more likely to be open-minded and analytical. Facione, Facione, and Giancarlo (2000) suggest that effective teaching must include strategies for building intellectual character rather than relying exclusively on strengthening cognitive skills. As a result, critical thinking and thinking disposition help individuals develop their thinking skills and contribute to their success. Therefore, critical thinking and thinking disposition are essential in developing individuals and society, especially in education.

### **The Importance of Critical Thinking Disposition for the Teaching Profession**

A critical thinking disposition is essential for teacher education and the teaching profession. This trend is important for pre-service teachers and teachers to teach their students more effectively, to be more effective in students' learning process, and to develop students' critical thinking skills. In Turkey, courses on thinking skills have been added to the curricula to increase pre-service teachers' knowledge of critical thinking skills and improve their critical thinking disposition (Turkish Council of Higher Education (TCHE), 2007).

In teacher education, a critical thinking disposition can help pre-service teachers improve their learning and teaching skills. When trainee teachers develop critical thinking skills, they can better understand students' learning needs, select learning materials and present them more effectively. In addition, a critical thinking disposition also helps pre-service teachers develop their classroom management skills. Using their critical thinking skills, teacher candidates can better understand and resolve conflicts between students more effectively. For the teaching profession, critical thinking disposition helps teachers to better respond to students' needs. Critical thinking skills allow teachers to understand students' learning needs better, choose learning materials, and manage the learning process more effectively. Also, critical thinking skills help students develop their critical thinking skills. Using critical thinking skills, teachers can help students critically evaluate their ideas and thoughts. Critical thinking disposition can also contribute to the professional development of teachers. Critical thinking skills help teachers develop their ability to solve problems they encounter in the classroom. Also, critical thinking skills can help teachers communicate and collaborate more effectively with colleagues and parents.

Studies have shown that teacher candidates generally have positive critical thinking dispositions. Şenşekerci and Kartal (2010) found that the critical thinking dispositions of teacher candidates improved for their university education. Karagöl and Bekmezci (2015) found that critical thinking dispositions of teacher candidates did not differ according to gender or type of school but according to the field of study. Bilen, Ercan and Akcaozoglu

(2013) found that the critical thinking disposition of teacher candidates was positive and differed based on gender, class levels, and departments of teacher candidates. Finally, Çubukçu (2006) found that Turkish teacher candidates had high levels of open-mindedness and analyticity but lower levels of inquisitiveness and systematicity.

As a result, a critical thinking disposition is essential for teacher education and the teaching profession. Critical thinking skills help teachers better understand students' learning needs, choose learning materials better, and develop students' critical thinking skills. In addition, critical thinking skills also contribute to the professional development of teachers. Therefore, teacher education programs and teachers' professional development programs should be designed to develop critical thinking skills.

### **Purpose of the Research**

This study is critical because it provides data-based information for developing pre-service teachers' critical thinking skills. Critical thinking skills help students cope with future challenges and ensure continuous learning and development. This study will contribute to the current research on critical thinking dispositions of pre-service teachers and will encourage further research in this area. By emphasizing the importance of providing pre-service teachers with critical thinking skills, future teachers can be helped to have these skills.

Pre-service teachers, curriculum developers, and those who do research in education will benefit from this study. Pre-service teachers can learn the importance of critical thinking skills and the methods that can be used to develop these skills. Curriculum developers can use the findings from this study to develop strategies and methods to create a more effective learning environment. Determining the factors that pre-service teachers' critical thinking dispositions are related to can provide a more qualified preparation for the education process. In addition, determining the general trends of the research on the subject can guide the studies to be done later. In this way, qualified studies that explain the development of critical thinking disposition in teacher candidates can be carried out.

In conclusion, this study will provide data on developing pre-service teachers' critical thinking dispositions. It will be an essential resource for experts in the field of education. The results of this study will provide a helpful roadmap for the training of teacher candidates, the development of curricula, and research in the field of education. This study aims to examine the postgraduate studies related to the critical thinking disposition of teacher candidates in Turkey. Accordingly, answers to the following research questions were sought.

- 1- What is the distribution of postgraduate studies examining the critical thinking dispositions of teacher candidates according to academic level in Turkey?
- 2- How is the distribution of postgraduate studies examining the critical thinking dispositions of teacher candidates in Turkey over the years?
- 3- How is the distribution of postgraduate studies examining the critical thinking dispositions of teacher candidates in Turkey according to the scope of the subject?

- 4- What is the distribution of postgraduate studies examining the critical thinking dispositions of pre-service teachers in Turkey according to the research model?
- 5- What is the distribution of postgraduate studies examining the critical thinking dispositions of pre-service teachers in Turkey according to the sample group?
- 6- What is the distribution of postgraduate studies examining the critical thinking dispositions of pre-service teachers in Turkey according to data collection tools?
- 7- What is the distribution of postgraduate studies examining the critical thinking dispositions of pre-service teachers in Turkey according to analysis techniques?
- 8- How is the distribution of postgraduate studies examining the critical thinking disposition of teacher candidates in Turkey according to the variables associated with the critical thinking disposition?

## Method

This study utilized a qualitative document review approach, focusing on documents relevant to a specific subject matter. The collected research data were analyzed using the content analysis method, which involves descriptively evaluating the trends and findings of studies (Çalık & Sözbilir, 2014). Using the descriptive content analysis method, this study examined postgraduate research on the critical thinking dispositions of teacher candidates in Turkey between 2018-2022, aiming to identify the general trends and patterns in this field.

The Turkish Council of Higher Education (TCHE) national database was searched using the keywords "teacher candidate" and "critical thinking disposition," and 30 accessible theses were included in the research. Theses reached within the scope of the research; It was analyzed according to the themes of "academic level," "year," "scope of the subject," "research method," "sample," "data collection tools," "analysis method" and "results." The thesis studies were examined by two experts and coded according to themes. The percentage of agreement among experts was determined as 95%. Theses examined within the scope of the research are marked with "\*" in the bibliography.

## Results

This section gives descriptive information about postgraduate studies on teacher candidates' critical thinking dispositions. Studies on the subject were examined according to the themes of "academic level," "year," "scope of the subject," "research method," "sample," "data collection tools," "analysis method," and "results."

### Academic Levels of Theses

It is understood that 90% of the theses examined within the scope of the research are master's theses, and 10% are doctoral theses. It has been observed that most of the theses examining the critical thinking dispositions of teacher candidates are master's theses.

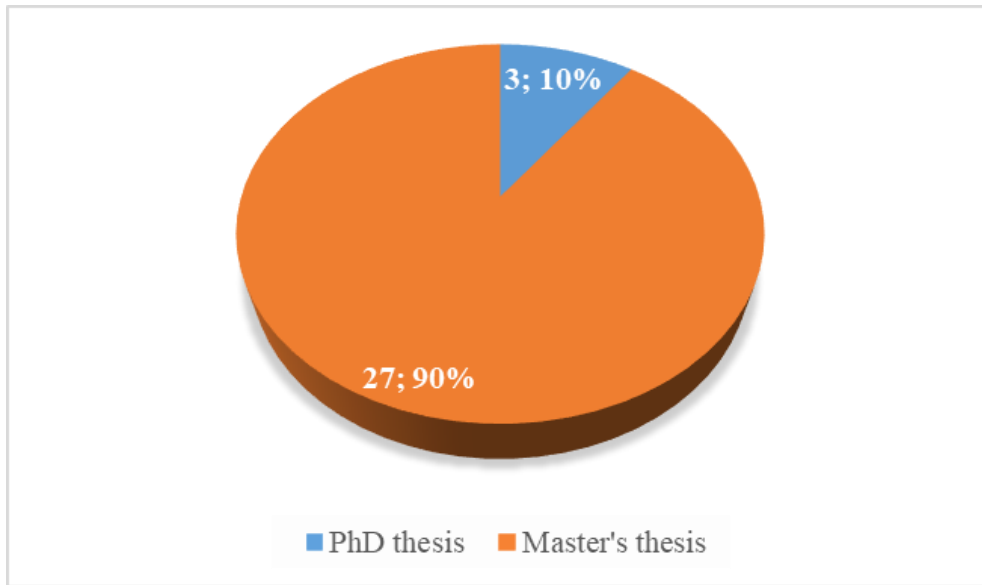


Figure 1. Figure 1. Distribution of Theses by Academic Level

**Distribution of Theses by Years**

When Figure 2 is examined, it is understood that 10% of the theses examining the critical thinking dispositions of teacher candidates were completed in 2018, 43.3% in 2019, 16.7% in 2020, 20% in 2021, and 10% in 2022. It is striking that most of the theses examining the critical thinking disposition of teacher candidates were carried out in 2019.

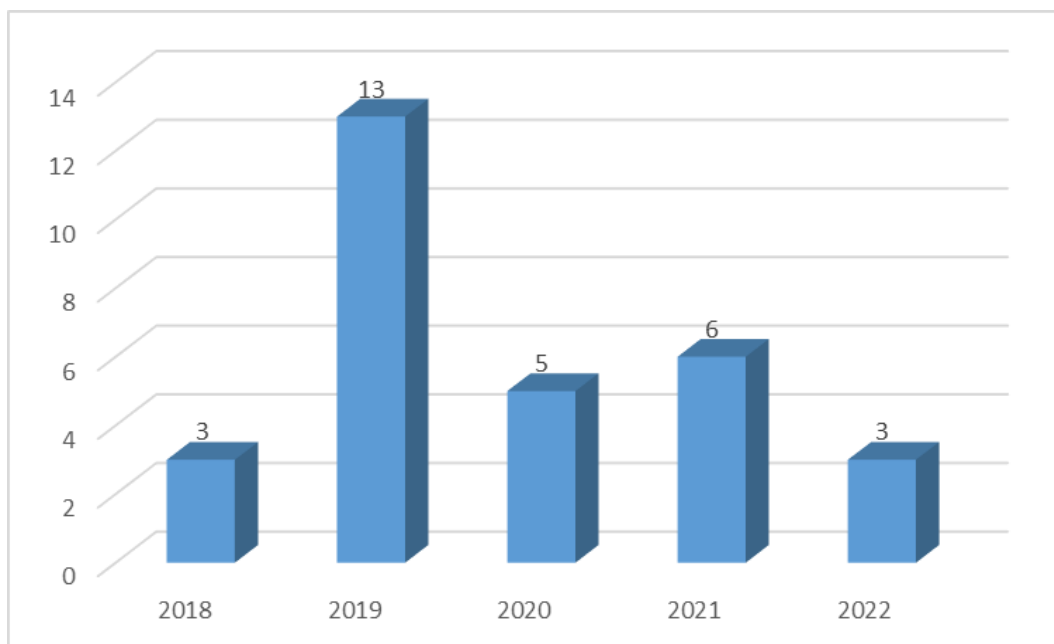


Figure 2. Distribution of Thesis by Years

**Subject Scope of Theses**

When the distribution of the theses examining the critical thinking disposition of teacher candidates according to the scope of the subject was examined, it was observed that the subject scope of the majority was in the "survey/case study" type. There are a few theses with the subject scope of "The impact of teaching" and "Scale adaptation." Two theses with varying scopes of the subject have been identified.

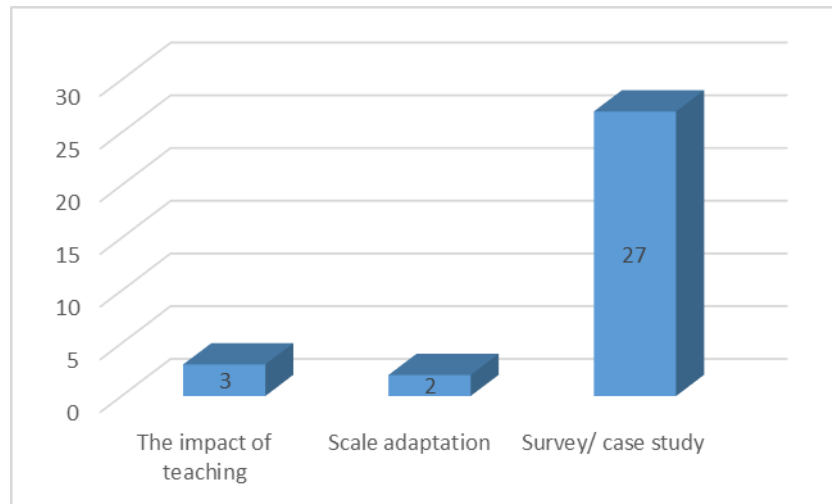


Figure 3. Distribution of Thesis by Subject Scope

**Research Methods Used in Theses**

It was observed that the quantitative research approach was adopted in 27 (90%) of the theses examined within the scope of the research. It was determined that 3 (10%) of the theses adopted a mixed research approach. There is one thesis that uses only qualitative research design. There were three studies in the experimental research type. Most of these are relational and comparative research types (Table 1).

Table 1. Findings Related to Research Methods Used in Theses

Themes	Codes	f
Experimental	Semi-experimental	2
	Fully experimental	1
	Survey	0
Non-experimental	Relational	22
	Descriptive	0
	Comparative	25
	Latitudinal/Longitudinal	0
Interactive	Case Study	1
	Action Research	0
	Phenomenological	2
Non-interactive	Grounded Theory	0
	Document analysis	0
Mixed	Qualitative/ quantitative	3

**Sample Groups of Theses**

Science (10.9%) and social studies (10.9%) pre-service teachers were selected as samples in a large proportion of theses examining the critical thinking dispositions of pre-service teachers. There are also thesis studies in which physical education, English, mathematics, music, preschool, art, classroom, and Turkish teacher candidates are selected as samples. It was determined that the number of theses that included teacher candidates from different branches in its sample was six (Figure 4).

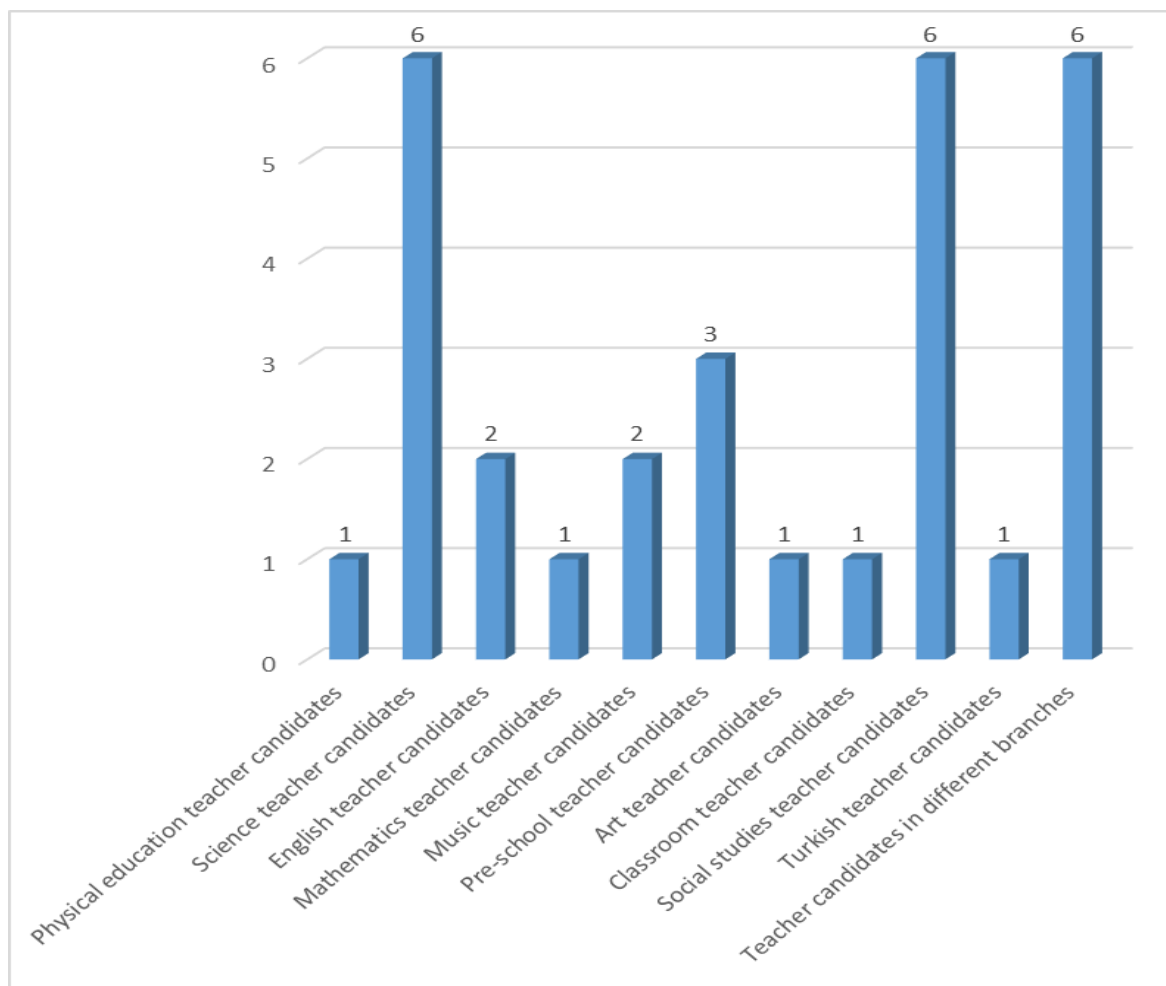


Figure 4. Distribution of Thesis by Sample Groups

**Data Collection Tools Used in Theses**

According to the results obtained, "scale" was used as a measurement tool in most of the theses examined within the scope of the research. It has been determined that data collection tools such as interviews and observations used to obtain qualitative data are less preferred. The findings regarding the data collection tools used in the theses are given in Figure 5.

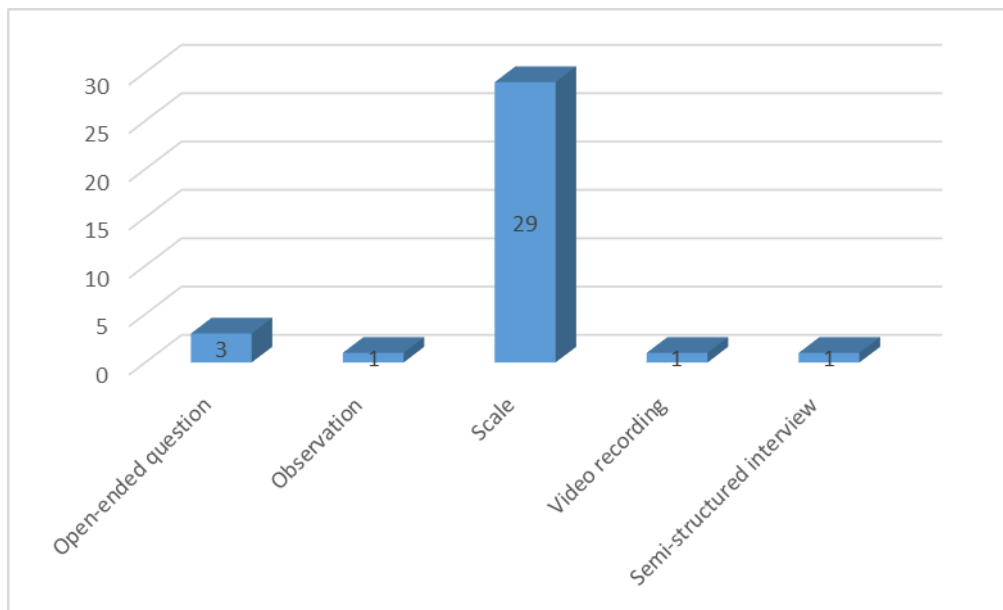


Figure 5. Distribution of Thesis by Data Collection Tools

### Data Analysis Methods Used in Theses

Most of the theses examined in the research are in the type of quantitative research. As a natural consequence, quantitative analysis techniques were used more in theses. Quantitative analysis techniques include ANOVA, correlation, t-Test, and non-parametric analysis techniques. It is striking that more advanced quantitative analysis techniques, such as path and regression analysis, are used less frequently. It has been observed that descriptive and content analysis approaches are used in a small number of qualitative studies.

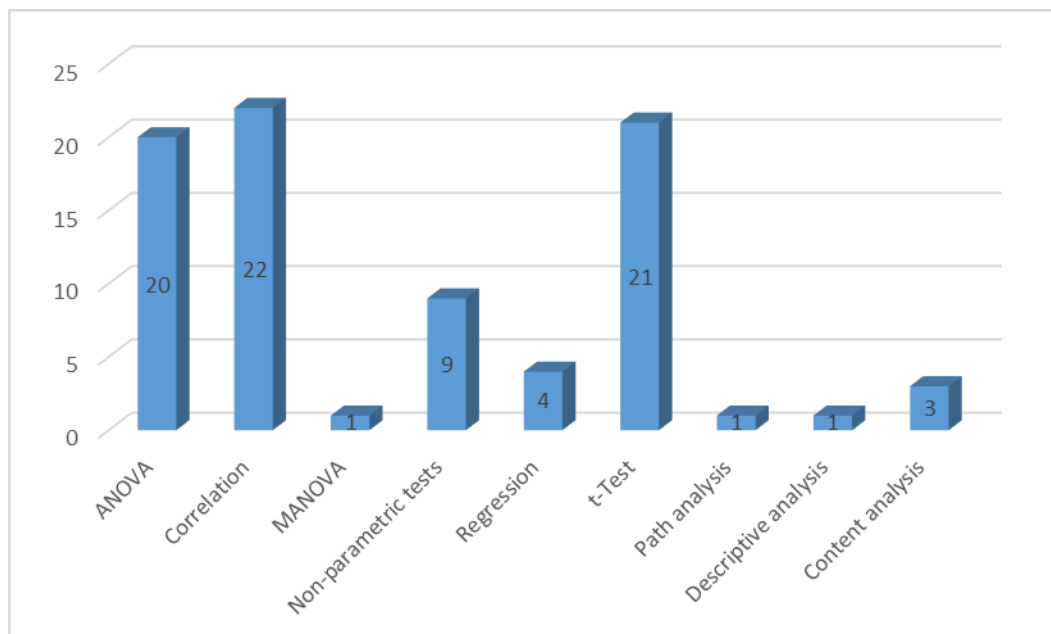


Figure 6. Distribution of Thesis by Data Analysis Methods



**Variables Associated with Critical Thinking Tendency in Theses**

The theses under scrutiny have investigated critical thinking disposition to 24 distinct variables. Specifically, the reviewed theses have predominantly focused on demographic characteristics, media literacy, entrepreneurship, emotional intelligence, and 21st-century skills as the primary correlates of critical thinking disposition. However, in addition to these variables, other factors such as innovativeness tendency, gender roles, creative thinking, personality type, thinking styles, reasoning, and academic self-efficacy have also been associated with critical thinking disposition (Figure 7).

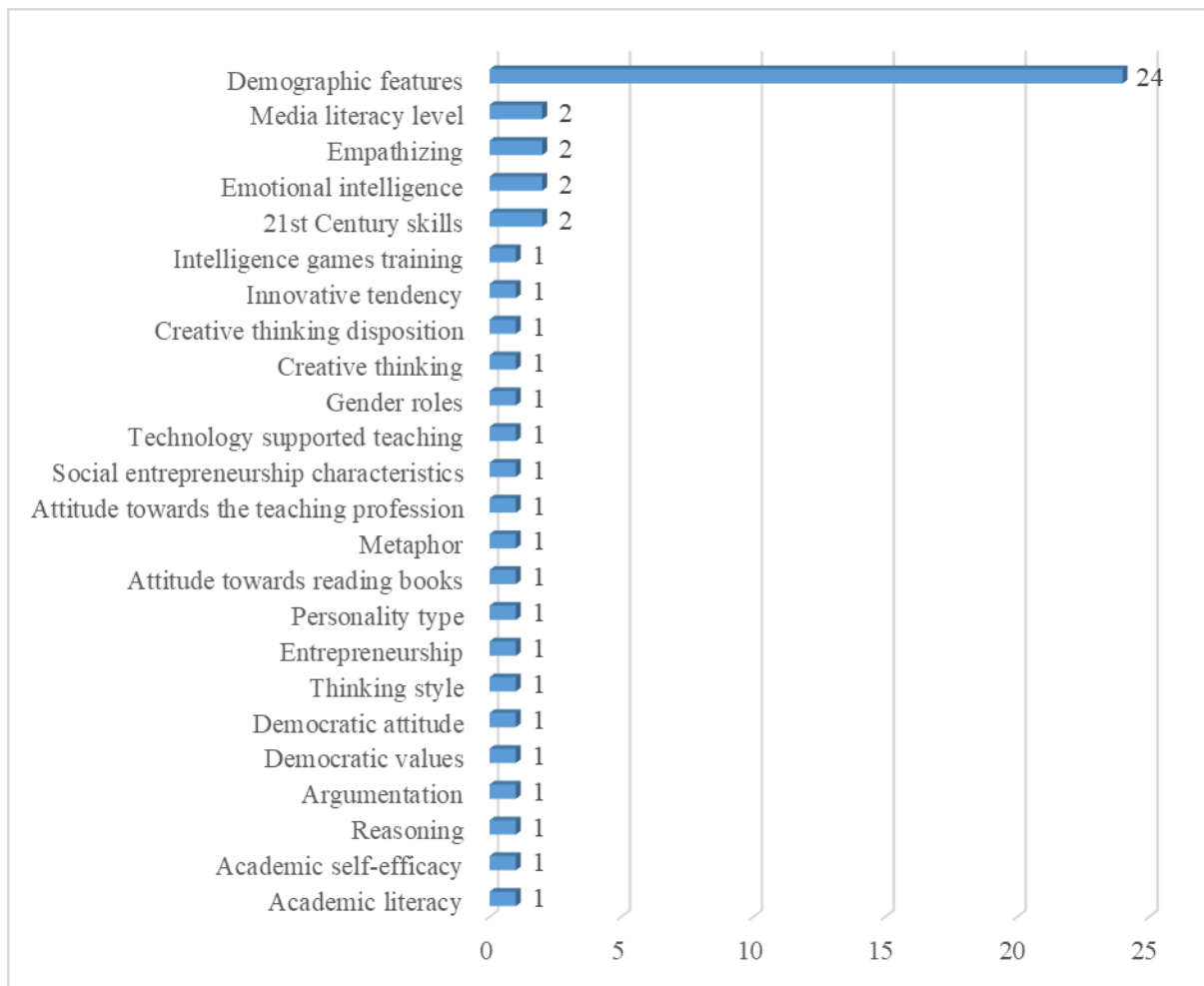


Figure 7. Distribution of Thesis by Variables Associated with Critical Thinking Tendency

**Conclusion and Recommendations**

This research examined thirty postgraduate studies on the critical thinking disposition of teacher candidates in Turkey in the last five years. Studies on the subject were examined according to the themes of "academic level," "year," "scope of the subject," "research method," "sample," "data collection tools," "analysis method," and

"results." In this way, the general tendency of the studies on critical thinking disposition in teacher candidates has been revealed.

According to the results obtained, 90% of the theses examined within the scope of the research are master's theses, and 10% are doctoral theses. It has been observed that most of the theses examining the critical thinking dispositions of teacher candidates are master's theses. It is advisable to conduct more doctoral thesis studies on the subject. In this way, the factors related to the tendency of critical thinking in teacher candidates can be discussed in more detail.

Another result obtained in the study is that 10% of the theses examining the critical thinking dispositions of teacher candidates were completed in 2018, 43.3% in 2019, 16.7% in 2020, 20% in 2021, and 10% in 2022. It is striking that most of the theses examining the critical thinking disposition of teacher candidates were carried out in 2019. According to these results, it has been observed that the number of studies on critical thinking disposition in teacher candidates has decreased in recent years.

According to the results obtained, the quantitative research approach was adopted in 27 (90%) of the theses examined within the scope of the research. It was determined that 3 (10%) of the theses adopted a mixed research approach. There is one thesis that uses only qualitative research design. There were three studies in the experimental research type. The majority of these are relational and comparative research types. Increasing the number of studies using qualitative research design can be recommended. These studies can provide the opportunity to reach deeper information obtained from different sources on the subject.

Another result obtained in this study was that the subject scope of the majority of the theses was in the "survey/case study" type. There are a few theses with the subject scope of "The impact of teaching" and "Scale adaptation." Two theses with varying scopes of subjects have been identified. Surveys or case studies systematically compile, summarize and analyze available information and data about a particular issue, problem, or area. Such studies are undertaken for various purposes, such as gaining a deeper understanding of the subject, providing a basis for planning future research, and guiding the development of policy or practice (Kitchenham, 2004). However, surveys or case studies have some weaknesses. First, the results of such studies are based on data collected by a selective method that determines the scope of the research and, thus, often do not provide a complete picture. Also, inferences based on such studies' results may be less conclusive than conclusions from more in-depth research. However, surveys or case studies are often helpful for summarizing current knowledge and data in a research area and providing a basis for future research (Grant & Booth, 2009). In this respect, it can be recommended to conduct more studies examining critical thinking disposition in pre-service teachers apart from screening/situation analysis.

Science (10.9%) and social studies (10.9%) pre-service teachers were selected as samples in a large proportion of theses examining the critical thinking dispositions of pre-service teachers. There are fewer thesis studies in which physical education, English, mathematics, music, preschool, art, classroom, and Turkish teacher

candidates were selected as samples. No study has examined the critical thinking dispositions of teacher candidates studying in German, computer and instructional technologies, special education, guidance, and psychological counseling departments. Conducting studies examining the critical thinking dispositions of teacher candidates in these departments can be recommended.

Most of the theses examined in the research are in the type of quantitative research. As a natural consequence, quantitative analysis techniques were used more in theses. Quantitative analysis techniques include ANOVA, correlation, t-Test, and non-parametric analysis techniques. It is striking that more advanced quantitative analysis techniques, such as path and regression analysis, are used less frequently. It has been observed that descriptive and content analysis approaches are used in a small number of qualitative studies.

Another result obtained in this study is that the thesis under scrutiny has investigated critical thinking disposition to 24 distinct variables. Specifically, the reviewed theses have predominantly focused on demographic characteristics, media literacy, entrepreneurship, emotional intelligence, and 21st-century skills as the primary correlates of critical thinking disposition. However, in addition to these variables, other factors such as innovativeness trends, gender roles, creative thinking, personality type, thinking styles, reasoning, and academic self-efficacy have also been associated with critical thinking disposition. The number of studies aiming to increase the critical thinking disposition of teacher candidates should be increased. In addition, it may be recommended to conduct studies examining the relationship between critical thinking disposition in pre-service teachers and high-level thinking skills such as analytical thinking, divergent thinking, and reflective thinking.

## Acknowledgments

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## An IPMA of Internal Control Systems in Malaysian Statutory Bodies


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**Abstract:** As COSO and INTOSAI indicate, effective governance in public sector organisations is typified by a well-functioning and robust internal control system that contains five important components: control activities, control environment, information and communication, risk assessment, and monitoring. However, to identify which elements require further development and improvement, the study focused on Malaysian statutory bodies where Chief Executive Officers were surveyed using questionnaires. Of the 291 survey respondents, 194 were successfully gathered and analysed. The internal control system received a high rating of 5.493 on a 7-point Likert scale, indicating effectiveness. While an IPMA showed that all components performed well, Control Activities, Risk Assessment, and Monitoring were relatively less important. It is crucial for statutory bodies, especially internal auditors, to allocate more resources to enhance the importance of these three components, while the Control Environment and Information and Communication could be further strengthened through sustained top management commitment and improvements in information systems. The assessment highlights the potential for further enhancement to achieve even greater effectiveness in the internal control system.

**Keywords:** IPMA, COSO, Internal control system, INTOSAI

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### Introduction

Strong internal controls could safeguard an organisation's assets and prevent corruption and authority abuse. As a result, the internal control system's organisational structure highlights how the systems can assist managers in aligning staff members' competencies, actions, and output with corporate objectives and accountability. The government is the biggest user of resources, accounting for an average of 42% of the gross domestic product of OECD member nations (OECD, 2015). Government organisations must follow the highest governance standards to operate to the best of their abilities, provide value for the money spent, involve the community, and

uphold accountability. One of the most crucial aspects of governance is the internal control system (IFAC, 2001; IFAC & CIPFA, 2014; Yahya, 2022).

However, the internal control system of Malaysian statutory entities has been implicated in numerous instances as having issues. For instance, Yayasan Pahang's governance is less than good, according to the Auditor General's report on Pahang's statutory entities in 2019 (National Audit Department Malaysia, 2019). The investigation revealed that the organization's operational processes in financial management required improvement. This demonstrates the organization's problems with internal control. Furthermore, the Federal Land Development Authority (FELDA) suffers an RM73.63 million loss as a result of procedural irregularities, a lack of a feasibility assessment, and a failure to undertake due diligence prior to a project (National Audit Department of Malaysia, 2015b). Assets and resources have been wasted as a result of poor internal control, a malfunctioning system, and a lack of strong governance in management. Furthermore, FELDA's RM47.6 million sturgeon fish farming project exemplifies power abuse and financial espionage by FELDA's former general manager, former deputy director, and personnel (Shah, 2017). This incident reveals flaws in FELDA's internal control framework.

The Majlis Amanah Rakyat (MARA) case also involves governance and internal control issues. According to several publications (Boey, 2015; Garnaut et al., 2015; McKenzie et al., 2015a, 2015b; Sulaiman, 2016; Zahiid, 2015), top MARA officials paid an inflated price of \$4.75 million (RM13.7 million) in June 2015 for a student flat unit in Australia rather than paying the actual cost of \$17.8 million in 2013. Another instance included FELDA, which was in danger of losing land worth RM 270 million to a local business without the board's knowledge or approval. In 2015, there were shady and unclear transactions involving the change of ownership of the land. Police inquiries and forensic audits were conducted to look into the matter, even though they eventually established who owned the land (Carvalho, 2018). These are instances of asset mismanagement, fraud, and corruption. Therefore, it is essential to have a suitable and efficient internal control system to track errors and improper behaviour.

This study incorporates the examination of the internal control system level in Malaysian statutory bodies due to cases of internal control system issues in Malaysian statutory bodies. Do they meet all of the proposed internal control system standards' requirements? Additionally, the entire public sector was the subject of earlier research (Abd Aziz et al., 2015; Kamaliah et al., 2018), as well as local governments (Badara & Saidin, 2013b) and only a few statutory body organisations (Abdul Aziz et al., 2010). This study, on the other hand, is solely focused on statutory bodies. This study focuses on statutory bodies, one of the numerous sectors of the public sector in Malaysia, along with ministries, federal agencies, local authorities, and statutory bodies. The executive and legislative branches of government oversee statutory entities, which are public organisations that follow the same rules as other government operations (Seidman, 1954). The growth and management of a state and a country depend heavily on the public sector, which consists of governmental organisations and statutory entities. Federal and state statutory bodies make up the two tiers of statutory bodies in Malaysia. According to federal legislation, the federal statutory entities that Parliament established carried out government policies through



their operations (National Audit Department Malaysia, 2015b). As required by incorporation legislation, each federal statutory entity is assigned to a minister in charge. State statutory bodies, on the other hand, are established by state enactments and legislation. Their primary responsibilities include upholding and advancing the states.

## Review of the literature

An internal control system is defined as "a process, influenced by an entity's board of directors, management, and other personnel, designed to provide reasonable assurance regarding the achievement of objectives in the following categories: effectiveness and efficiency of operations, and the reliability of financial reporting. Hence, it is a process that is intended to provide adequate assurance about the system establishment of three goals: effectiveness and efficiency of operations, dependability of financial reporting, and compliance with applicable laws and regulations that involves the board of commissioners, management, and other employee's participation (Ilyas et al., 2021).

The Turnbull Report and the Sarbanes-Oxley Act are examples of internal control standards. Various organisations, including INTOSAI, COSO, The Institute of Internal Auditors, Institute of Management Accountants, and Financial Executives International, have established standards and frameworks recently. Also, The International Standards of Supreme Audit Institutions have contributed to the creation of such rules. The COSO and INTOSAI frameworks for internal controls are the most widely used. The internal control structure for COSO was created in 2013 and for INTOSAI in 2004. However, INTOSAI concentrates more on regulations for businesses in the public sector.

Internal control systems are necessary to make sure that processes work and are efficient, that financial reports are accurate, and that statutory bodies in Malaysia follow the law. Mohd Yusof et al (2017) found that there were problems with the internal control system function in Malaysian statutory bodies. However, Shamsuddin and Johari (2014) posit that internal control system of statutory bodies must have a strong control environment. Internal control system level among Malaysian statutory bodies were found to be high (Yahya et al., 2022). In addition, Ali et al (2007) suggested that technology makes a more effective and efficient Malaysian statutory bodies' internal control system. The internal control system is crucial as it is empirically proven to achieve an organisation's objectives and mission, high organisation performance and accountability (Alam et al., 2019; Handayani et al., 2020; IFAC & CIPFA, 2014; Mohamed Adil et al., 2013; Ogunmakin, 2020; Shamsuddin & Johari, 2014; Yusuf & Kanji, 2020).

According to an empirical study by Hassan et al. (2020), there is a major need for improvement in some areas, such control activities, of the internal control systems of Malaysian statutory organisations. It is proven that internal control system plays a significant role in mitigating fraudulent behaviour (Rosini & Hakim, 2020). In various organisational settings, efficient internal control systems are essential for fostering good governance,

risk management, and accountability.

As per Mohd Noor and Mansor's (2019) research, Malaysian public sector auditors' expertise enhances the effectiveness of public sector audits. At the federal level, it's usually the responsibility of the internal audit department of each statutory authority to establish and maintain the internal control system. Internal audit plays a vital role in ensuring the effectiveness of the internal control environment, creating opportunities for better performance. Asare (2009) stresses the importance of internal audits in the accountability process, contributing to the overall improvement of organizational performance. To advance organisational goals, government organisations need to increase the efficacy of internal controls (Badara & Saidin, 2013a; Annukka Jokipii, 2010; Vijayakumar & Nagaraja, 2012). The Malaysian Treasury Circular No. PS 3.1 of 2013 (Implementation of Internal Audit in Ministries or Federal and State Government Departments, 2013) specifies the requirements for Internal Audit departments in public sector organisations. The circular underlines the roles of the secretary-general, the treasury, and the internal audit department and offers guidance on carrying out internal audits. This covers the organisation's internal control. The main objective is to help the public sector analyse all internal control systems and governance to determine their effectiveness in achieving the organisation's stated goals (Mohd Noor et al., 2017).

To develop and maintain the internal audit profession in Malaysia, there is also The Institute of Internal Auditors Malaysia, which offers the necessary infrastructure, coordination, support, and communication. Internal auditors can join the institution and stay current on the internal audit landscape. A financial group scheme is found to have average documentation on the internal control system, whereas other schemes such as engineering, information system, education, and medical and health schemes are below average (Abd Aziz et al., 2015). This is according to the results of a study on federal ministries.

The practical application of an internal control system should be carried out in accordance with the fundamental organisational principles that underpin its effectiveness. These principles are intricately intertwined, and the method for fully integrating them depends on the current unique business conditions and circumstances (Chaykovskaya et al., 2020). An effective internal control system will have process-based and risk-based approaches (Zatsarinnaya et al., 2021), Corporate Risk Management (Klius et al., 2020), Integration with Management System (Chaykovskaya et al., 2020), Subsections in Business Processes (Zatsarinnaya et al., 2021) and Assessment of Control System (Fadlan et al., 2018). Organisations can create a strong internal control system that boosts their operational effectiveness, guards against risks, encourages accountability, and supports the accomplishment of organisational goals by adhering to these strategies and concepts.

To accomplish their objectives, safeguard their assets, enhance their operational productivity, guarantee truthful financial reporting, and abide by relevant laws and regulations, businesses necessitate an effective internal control system. According to COSO (2013), INTOSAI (2004), and Jokipii (2006, 2010), this system should comprise five crucial components: control activities, control environment, information and communication, risk assessment, and monitoring activities. These elements make up a strong internal control system and offer

acceptable assurance regarding accomplishing organisational objectives. Objectively, all elements are necessary for a company to work towards success and establish a clear connection between operational, reporting, accountability, asset protection, and compliance goals. The fundamental aspects or components must be implemented from the function, operation unit, division, department, and up to the organisational level.

### **Control environment**

The control environment, which includes management and staff attitudes, understanding of internal control, and behaviour towards it, establishes the tone of the organisation. It entails a dedication to morality and ethics, the development of a capable and accountable workforce, and the general design of the organisation and its governance (COSO, 2013). An organisation's staff and leadership develop and maintain a mentality towards control knowledge and internal control (Mahadeen et al., 2016). Hence, it alludes to the general mindset, sensibility, and ethical principles that influence an organisation's internal control system. It is found that the efficacy of the board influenced the effectiveness of internal controls (Cheng et al., 2021), together with the positive organizational culture, commitment from top management and ethical leadership (Sitorus et al., 2022).

### **Risk assessment**

The process of risk assessment entails locating and examining potential threats to the accomplishment of organisational goals. This component necessitates a systematic approach to risk assessment, prioritisation based on significance, and development of suitable actions to successfully reduce or manage risks (COSO, 2013). According to Becker & Smidt (2016), a risk consists of an occurrence, its effects, and its probabilities (or uncertainty). Determining how risks are managed is necessary (INTOSAI, 2004; Rafindadi & Olanrewaju, 2019). It usually involves a negative outcome or a danger to achieving aims. Risk assessment's foundation is the breadth of risk, which spans all organisational levels (Länsiluoto et al., 2016; Rae et al., 2017). Effective risk assessment makes it possible for public organisations to recognise and assess potential hazards, which facilitates the creation of effective control mechanisms. Effective risk assessment makes it possible for public organisations to recognise and assess potential hazards, which facilitates the creation of effective control mechanisms.

### **Control activities**

The policies, practises, and other measures put in place to address the risks identified and guarantee that management directions are followed are known as control activities. Some of these activities include segregation of roles, appropriate authorisation and approval procedures, physical security measures, information technology controls, and continuing monitoring procedures (COSO, 2013). It is usually associated with the segregation of duties (Thin et al., 2020). Control activities can be enhanced through automation, technology-enabled controls, and the integration of internal control systems with information systems (Mukhina, 2015; Sanusi et al., 2015). Through control activities, an organisation defends its resources and methods for measuring performance

or accountability (Mahadeen et al., 2016). Control activities are carried out at all organisational levels and phases, even in the technological environment, as they also pertain to the formalisation of standardised functions (Jokipii, 2006).

### **Information and Communication**

Information and communication: To support decision-making processes, efficient internal control systems depend on timely and pertinent information from internal and external sources. This element emphasises the value of accurate and open communication inside the company, ensuring that information reaches the appropriate parties at the appropriate times (COSO, 2013). To support the internal control function, the organisation shares information internally, including the goals and duties of internal control (Ilyas et al., 2021). The organisation's ability to effectively share pertinent information is greatly helped by effective information and communication system. Hence, reliable information systems, data analytics, and effective communication channels are significant to support internal control systems (Chen et al., 2022).

### **Monitoring activities**

Continuous evaluation of the effectiveness of the internal control system is part of the monitoring component. It includes routine assessments, internal audits, and management reviews to judge the system's efficacy, spot flaws, and make the necessary corrections (COSO, 2013). According to Mahdeen et al. (2016), monitoring is an information system that gives users access to crucial business indicators in real-time. However, internal audit, management, supervisory activities, inspection, observation, inquiry and confirmation, computation, and analytical methods are all examples of monitoring, but it is a type of detection rather than prevention (Jones, 2008). Continuous monitoring, separate monitoring, or a combination of the two are used to ensure the presence and efficacy of each of the five internal control elements, including control (Onumah et al., 2012). To establish control and ensure the correct operation of the internal control system, organisations must make a concerted effort to safeguard internal control monitoring (Ayagre et al., 2014).

The framework outlines the criteria for an efficient internal control system that ensures the achievement of organisational goals (COSO, 2013; Fourie & Ackermann, 2013). These five elements are all connected (Länsiluoto et al., 2016). The internal control system will be effective if all five components operate in accordance with the predetermined requirements (Avery & Obah, 2018; Ayagre et al., 2014; Badara & Saidin, 2013b; Länsiluoto et al., 2016; Mukhina, 2015).

## **Research Methodology**

### **Data collection**

In order to conduct the study, the researchers distributed questionnaires to 291 Malaysian statutory bodies via an

online survey sent to personal CEO email addresses. Among these organisations, there were 127 federal statutory bodies and 164 state statutory bodies. The participants were selected based on their knowledge of their respective organisations' governance matters, updates, and regulatory requirements.

### **Items' measurement**

An internal control system is designed to assess operational, reporting, and compliance goals and accomplishments reasonably. This study's internal control system dimensions comprised five well-known internal control system components. Monitoring activities, information and communication, control activities, control activities, and risk assessment are among them. To adapt the measurements for the internal control system, the existing framework and literature (Brennan & Solomon, 2008; Comptroller of the Currency Administrator of National Banks, 2001; COSO, 2013a; INTOSAI, 2004; Jones, 2008; Spira & Page, 2003) are employed. The internal control system's level is assessed using 16 items. The respondents' organisation's internal control system was rated on a 7-point Likert scale, with 1 denoting strongly disagree, 2 denoting somewhat disagree, 3 denoting slightly disagree, 4 denoting neither strongly disagree nor strongly agree, 5 denoting slightly agree, 6 denoting somewhat agree, and 7 denoting strongly agree.

### **IPMA**

IPMA, which stands for Importance-Performance Map Analysis, is a useful tool for analysing and evaluating the performance and importance of various elements within a system. The internal control system can benefit greatly from using IPMA as it provides insights into different components' relative importance and performance levels. To perform an IPMA analysis, one must identify the essential elements, including control environment, risk assessment, control activities, information and communication, and monitoring. The analysis then proceeds with evaluating the importance and performance of each component. Importance refers to a specific element's perceived significance or value within the internal control system.

On the other hand, performance assesses how well an element meets the desired standards. The importance and performance data are plotted on a graph using a quadrant matrix, with the X-axis representing performance and the Y-axis representing importance. Each component is plotted on the graph based on its corresponding importance and performance values. Components are divided into four quadrants based on their plotted locations. To categorise tasks and priorities, the quadrants are labelled as: a) High Importance, High Performance (Keep Up the Good Work) b) High Importance, Low Performance (Concentrate Here) c) Low Importance, High Performance (Possible Overkill) d) Low Importance, Low Performance (Low Priority). After completing the IPA analysis, action plans can be developed based on the findings to address the areas that need improvement. By conducting an IPA analysis, organisations gain valuable insights into the relative importance and performance of different components in the internal control system and prioritise their efforts and resources accordingly.

## Results

The given table offers an analysis of numerous dimensions concerning the overall control and risk management effectiveness. Each dimension's mean and standard deviation are mentioned, which aid in understanding the assessment results. One such dimension is the Control Environment, which has a mean of 5.4923 and highlights the effectiveness and strength of the control environment in the given context. The standard deviation of 1.49825 indicates moderate fluctuations in the responses or data points, revealing that while the overall control environment is somewhat effective, there may be diverse opinions or perceptions regarding its strength. When assessing risks, the average score of 5.7062 points to a notable level of effectiveness. However, with a standard deviation of 1.32516, there is some variation in this dimension's responses and data points. Essentially, while the overall effectiveness of risk assessment is good, there may be some discrepancies in how risks are viewed and evaluated.

Regarding the Control Activities aspect, which has a mean value of 5.5773, it measures the effectiveness and implementation of control procedures within the analysed context. The existence of a standard deviation of 1.33723 suggests a moderate degree of variation between the responses or data points in this category. This implies that the control activities are effective, but there may be variances in how they are carried out or perceived. Based on the data, there appears to be moderate effectiveness and efficiency when it comes to information and communication. However, there is variability in the responses and data points within this dimension, as indicated by the relatively high standard deviation of 1.60269. This suggests that there could be differing perceptions or practices related to information and communication processes.

The Monitoring dimension evaluates the efficiency and appropriateness of the monitoring measures employed in the analysed context, with an average score of 5.3694. The moderate deviation of 1.30821 denotes a certain degree of diversity in the responses or data points linked to this dimension. This implies that while the monitoring methods are generally effective, there could be differences in their implementation or efficacy across diverse regions. The Control System dimension, which has an average score of 5.4930, comprehensively evaluates the control system within the context analysed. A standard deviation of 1.22333 indicates moderate fluctuations in the responses or data points within this dimension. This suggests that there may be differing views or assessments of the effectiveness of the internal control system. Examining the table provided offers valuable insights into each dimension's average values and variability. These metrics provide a numerical comprehension of the assessment outcomes, indicating the degree of effectiveness and diversity within each dimension. Evaluating the analysis draws attention to strengths and potential areas needing improvement within the given context.

An Importance-Performance Map Analysis is a useful technique that helps evaluate the significance and effectiveness of various components or elements in a system. Based on the IPMA, efforts should be directed towards enhancing the importance ratings of Control Activities, Risk Assessment, and Monitoring for the

statutory bodies. Although it is apparent that the statutory bodies have performed well in regard to Control Activities, Risk Assessment, and Monitoring, these three elements are currently perceived to be of low importance, which is inaccurate. To rectify this discrepancy, it is crucial to acknowledge the importance of these crucial aspects. The analysis suggests that additional efforts should be made to enhance the implementation of items within these elements. By doing so, the statutory bodies can ensure that these essential elements are given the appropriate attention and resources required.

Table 1: Overall mean for each dimension

	Mean	Standard Deviation
Control Environment	5.492	1.498
<b>Control Activities</b>	5.577	1.337
Risk Assessment	5.706	1.325
<b>Monitoring</b>	5.320	1.603
Information and Communication	5.493	1.223
<b>Internal Control System</b>	5.492	1.498

However, the analysis report suggests that Control Environment and Information & Communication demonstrate adequate performance, and their current management practices are deemed satisfactory. It is, therefore, advisable to continue implementing the current management approach for these elements, as they meet the expected standards. The IPMA highlights the need for statutory bodies to place more value on Control Activities, Risk Assessment, and Monitoring, despite their high-performance levels. Failure to do so may lead to potential gaps in execution. Addressing this discrepancy and improving execution in these areas will ensure a comprehensive and effective project management and risk mitigation approach. On the other hand, Control Environment and Information & Communication management practices are adequate and should be maintained.

The table displays the comprehensive outcomes of diverse components in the internal control system, analysed using IPM. The combined impact of individual components on the effectiveness of the internal control system is reflected in these overall outcomes. As per the findings, the Control Environment has the most significant total effect score of 0.269. This implies that the Control Environment holds greater importance in enhancing the effectiveness of the internal control system. Therefore, the Control Environment is crucial in building a sturdy base for efficient internal controls.

Based on the data, Information and Communication are vital components of the internal control system, as evidenced by an effect value of 0.251. This highlights the importance of efficient communication and information flow for conveying relevant information to the appropriate stakeholders, which ultimately aids the decision-making and control processes. Control Activities assume a moderate level of importance in the internal control system, with a total effect value of 0.200. Such activities encompass the creation and execution of explicit control measures that reduce risks and guarantee compliance. While Information and Communication and Control Environment have slightly higher total effect values than Control Activities, the latter remains

crucial for achieving an effective internal control system.

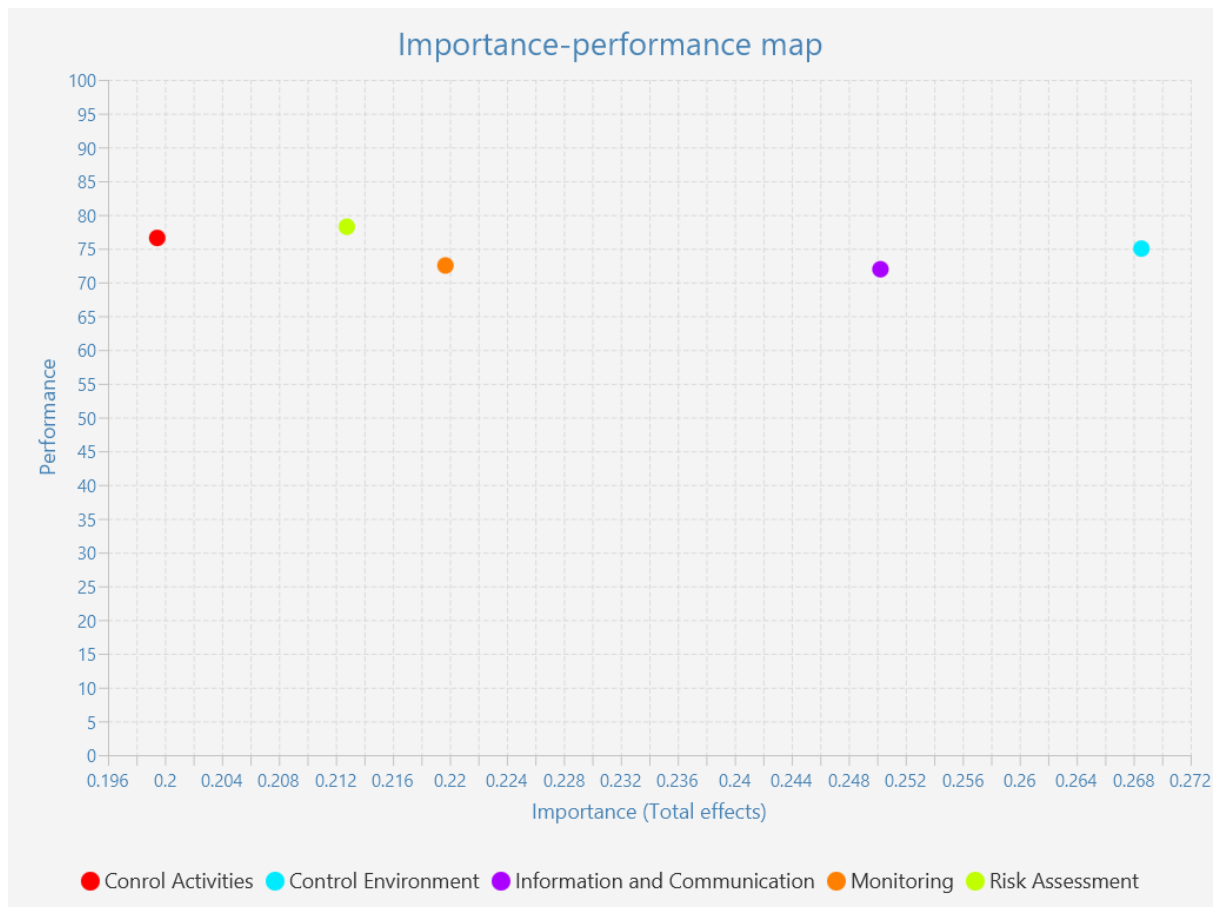


Figure 1: IPMA matrix

In ensuring the efficacy of the internal control system, Monitoring and Risk Assessment hold significant importance. They are significant contributors to the system with total effect values of 0.220 and 0.213, respectively. Monitoring entails consistent review and evaluation of controls, whereas Risk Assessment involves identifying and evaluating risks. Without these elements, maintaining an effective internal control system and ensuring it aligns with dynamic risks and business environments is impossible.

According to the IPMA, the Control Activities, Control Environment, Information and Communication, Risk Assessment, and Monitoring are all crucial components of the internal control system. Although both Control Environment and Information and Communication are important, the latter two hold more significance, with Control Activities, Monitoring, and Risk Assessment following suit. Identifying the relative significance of these components can aid organisations in prioritising their efforts and resources to fortify the internal control system and improve overall organisational performance.

The IPMA generated performance values for various elements in the internal control system, which are presented in the table. For the internal control system, the values reveal the level of effectiveness that each



element contributes towards its overall performance. According to the evaluation, Risk Assessment has performed exceptionally well, 1 with a total performance value of 78.252, indicating a high level of performance within the internal control system. This suggests that the organisation has successfully identified, assessed, and managed risks. Doing so can enhance the effectiveness of the internal control system as a whole. Based on the data, Control Activities have been carried out efficiently, with a total performance value of 76.590. This has enabled the organisation to establish effective control measures. The organisation's efforts in designing and implementing control activities have significantly contributed to improving the overall performance of the internal control system.

Table 2: Total effects

	Internal Control System
Control Activities	0.200
Information and Communication	0.251
Control Environment	0.269
Risk Assessment	0.213
Monitoring	0.220

The Control Environment has demonstrated remarkable excellence by achieving a total performance value of 75.011, which is truly impressive. This demonstrates that the organisation has implemented suitable frameworks, policies, and procedures for creating a favourable control environment that actively supports effective internal controls. The Monitoring and Information and Communication elements also performed well, with total performance values of 72.514 and 71.955, respectively. These values indicate that the internal control system has a satisfactory level of performance for both elements. Effective monitoring efforts have ensured that control reviews and evaluations have been conducted, while Information and Communication processes have facilitated the flow of relevant information for decision-making and control purposes.

To sum up, the IPM analysis revealed that the Risk Assessment and Control Activities have performed exceptionally well within the internal control system, while the Control Environment has also shown commendable performance. However, Monitoring and Information and Communication have only achieved satisfactory levels. By understanding the performance levels of these elements, organisations could identify their strengths and potential areas that require further attention. Thus, they can prioritise their efforts and allocate resources to improve the overall effectiveness of the internal control system, ensuring effective risk management and control processes.

Table 3: Total Performance

	Performance
Control Activities	76.590
Information and Communication	71.955
Control Environment	75.011
Risk Assessment	78.252
Monitoring	72.514

## Discussion and Conclusion

Examining the three tables yields significant revelations about the internal control system's efficiency and performance of varying components. Using the IPMA, we can gauge the relativity of these elements' significance and performance, helping businesses prioritise their endeavours and assets efficiently. In Table 2, you can see the different internal control system components' impact on its effectiveness. The study reveals that Control Environment plays the most crucial role and has the highest total effect value, establishing a solid foundation for efficient internal controls. In addition, Information and Communication are also essential, followed by Control Activities, Monitoring, and Risk Assessment. These results emphasise the necessity of organisations to focus on enhancing and developing these elements to ensure a robust internal control system.

In Table 3, the performance of various elements is evaluated. The highest total performance value belongs to Risk Assessment, indicating that the organisation has proficiently identified, assessed, and managed risks. Control Activities and Control Environment also demonstrate impressive performance, which signifies the successful implementation of control measures and establishing a sturdy control environment. Monitoring and Information and Communication exhibit satisfactory performance, concluding that organisations have been competent in reviewing controls and ensuring proper information flow.

According to the IPMA, certain areas need to be addressed and improved. Although Control Activities, Risk Assessment, and Monitoring have achieved high-performance levels, Table 2 shows they are perceived as unimportant. This incongruity highlights a possible gap in comprehending the actual significance of these elements. Hence, organisations must increase awareness about these components' importance to ensure adequate resources and attention are allocated to them.

To summarise, the analysis utilising IPMA of the tables provides useful observations regarding the internal control system. The assessment highlights Control Environment, Information and Communication, Control Activities, Monitoring, and Risk Assessment as crucial factors in enhancing the efficiency of internal controls. The results underline the significance for organisations to focus on advancing and reinforcing these aspects. Based on the analysis, the performance levels of Risk Assessment, Control Activities, and Control Environment are high. However, there is a noticeable difference between their actual performance and their perceived importance. This highlights the importance of organisations addressing this disparity to ensure that these elements are given the necessary attention and resources.

To improve their performance and reputation, organisations should prioritise enhancing their execution and implementation of Control Activities, Risk Assessment, and Monitoring. These areas require more attention to bridge the gap between actual performance and perceived importance. However, the Control Environment and Information and Communication should remain as they have been performing satisfactorily. Organisations can make better decisions and use their resources more effectively if they understand the importance and effectiveness of each component in their internal control system. Improving this system can lead to better risk

management, decision-making, and overall performance, which means better outcomes for the organisation.

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## The Effectiveness of the STEM Kid Module for High and Moderate Achievers Elementary School Children Towards Scientific Literacy

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**Abstract:** The aim of this research is to determine the effectiveness of the 'STEM Kid Module on the scientific literacy of fifth-grade students in the 'Energy' topic. The module was developed based on the combination of constructivism and constructionism as a fundamental learning theory. Meanwhile, the STEM Kid instructional phase was formed using a STEM integrated approach that included engineering design processes and inquiry-based science learning. A quasi-experimental design was used to assess the effectiveness of the STEM Kid Module. This study included 116 children, 61 of whom were high achievers and 55 of whom were moderate achievers. Two elementary schools using the STEM Kid Module were selected as the treatment group, while another school using conventional teaching approach as the control group. Data for this study were gathered by a scientific literacy test that included (i) scientific knowledge, (ii) science process skills, and (iii) daily science application. Results from repeated measurements MANOVA analysis revealed a significant difference in scientific knowledge and daily science application between groups. The study's implication was that the use of the STEM Kid Module through a STEM integrated approach can be implemented in elementary school science teaching and learning for children of varying levels of achievement.

**Keywords:** Science education, STEM, Engineering design process, Children, Scientific literacy

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## Introduction

Since the late 1950s, the policy of developing a scientifically literate society has been emphasized (DeBoer 2000; Ogunkola 2013). However, as reported by the Ministry of Science, Technology, and Innovation (MOSTI, 2010) and the National Science Board (NSB, 2014), it is worrisome that surveys conducted both domestically and internationally indicate that the level of scientific literacy in the community is still quite low. Since the survey was conducted nearly two decades ago by the Malaysian Science and Technology Information Centre (MASTIC 2014), this trend has persisted. Therefore, the development of this society should not be disregarded, as society is partially comprised of them who work in STEM fields should be literate, intelligent, and scientifically literate (Lilia, 2013).

The attempt to create a scientifically literate society should begin early in primary education. Piaget explained that at this stage, children are at the concrete operational level (Hurlock, 1990), which indicates that their cognitive aspects are developing. It was discovered that students are capable of learning and comprehending the fundamental concepts of science (Eshach, 2006). This can be achieved through an efficient teaching and learning process founded on scientific concepts. However, students are still less likely to engage in authentic science learning (Harlen 1999; Eshach 2006). This is due to the fact that the learning process of students is more focused on theoretical understanding than practical work (Tseng et al., 2013), thereby reducing their opportunities to acquire appropriate science learning experiences. In the meantime, both theoretical knowledge and practise are required to acquire effective teaching and learning experiences.

Zohar et al., (2001) and Zohar and Dori (2003) explain that conventional teaching perception is preferred in learning by teachers because it is believed to be more effective and accepted by students with low and moderate intellectual abilities than methods requiring high intellectual abilities, such as inquiry and problem solving. If this method is implemented, it is anticipated that students will find learning difficult and burdensome because they lack the intellectual abilities necessary to deal with it. According to the analysis of the science subject' answer quality from the national primary school examination for the year 2019 (MEB, 2019), students with medium and low ability can only answer questions at the level of knowledge and comprehension but not at higher cognitive levels such as application. The implication is that the achievement gap between students with differing ability levels, that is, students with moderate, high, and low achiever levels, is growing. The approach by which students receive learning activities should not be differentiated based on their ability level.

Using constructivism and constructionism as the fundamental theories to support student learning, the STEM Kids module was developed in consideration of alternative teaching methods, specifically the STEM integration method, in response to the identified problems. Thus, the purpose of this study is to answer the following two research questions: (i) Can the STEM Kids module improve students' scientific literacy? and (ii) is there a significant difference in the improvement of scientific literacy among students with various achievers levels and groups?

**STEM Kids Module**

The STEM Kids module's instructional strategy and learning implementation process are fundamentally based on constructivism and constructionism. The theory of constructivism, which emphasises students constructing their own knowledge and rectifying misconceptions, is implemented using an inquiry-based learning strategy and the 5E instructional model (Bybee et al., 2006). Through the implementation of the five phases "engage", "explore", "explain", "elaborate", and "evaluate", this model aims at developing students' conceptual understanding. In the meantime, constructionism theory asserts that students can generate new ideas if they participate in the process of artefact creation. The TMI model (Martinez & Stager 2013), which is one of the engineering design processes, is used to implement the emphasis on problem-solving through design or problem-based learning through engineering practise. Through the implementation of the TMI model's three phases—"Think," "Make," and "Improve," this model can help students generate new ideas and solve problems.

Based on the suggested learning theory and instructional model, they were combined to form the STEM Kids teaching model, an innovative teaching and learning phase. Figure 1 illustrates the implementation of learning within the STEM Kids module.

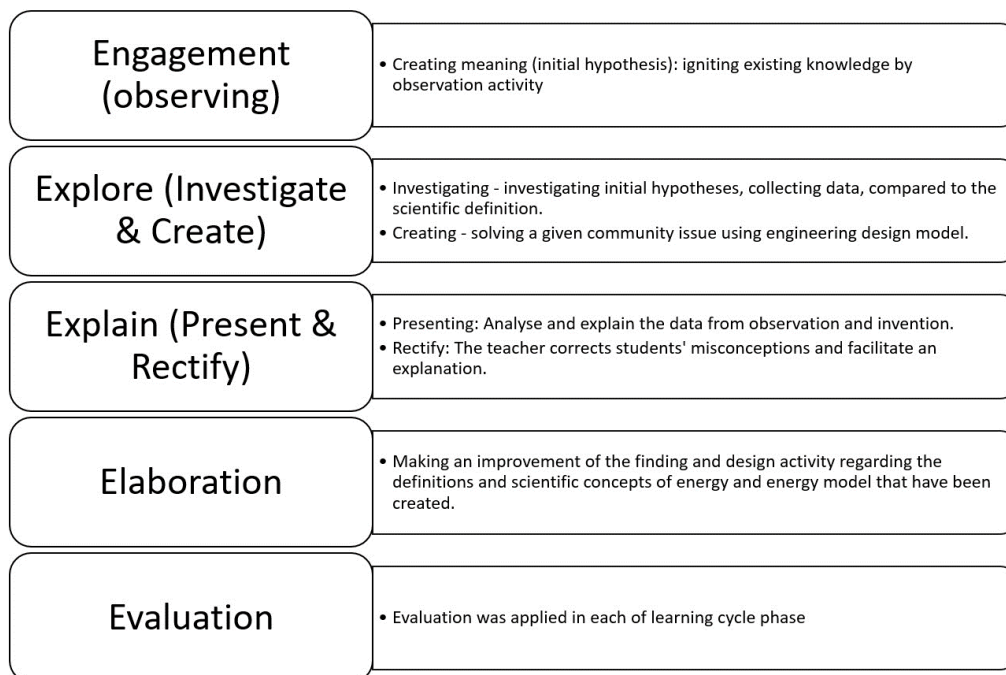


Figure 1. Teaching and learning process in the STEM Kids module

**Method**

**Research design**

A quasi-experimental design with a non-equivalent pre-test and post-test control group (Campbell & Stanley,

1963; Gall et al., 2003) was implemented to determine the effectiveness of the STEM Kids module in enhancing scientific literacy. The STEM Kids module was used in the treatment group. whereas the control group used conventional methods and textbooks. The study was conducted over the course of four weeks, which corresponds to the time period given in the teacher's lesson plan for teaching about energy topics.

### Respondents

The study involved 116 fifth-year students from two different national primary schools in Selangor. The school is divided into two groups, with one group implementing the teaching and learning method through conventional inquiry. whereas the treatment group employs the STEM Kids module. The intervention was conducted in two classes comprised of high ability level students (the majority of students obtained high academic achievement, i.e., grade A with a science achievement score of 80 percent or higher) and medium ability level students (the majority of students obtained moderate academic achievement, i.e., grade B with a science achievement score between 65 and 79 percent) (MOE, 2016) (See Table 1). According to Han et al. (2014), the classification of the student's ability level is based on the student's achievement score. This study was carried out by two science teachers with more than five years of experience at their respective schools.

Table 1. Respondent profile

Achievers	Treatment group		Control group	
	n	%	n	%
High	32	56.1	29	49.2
Moderate	25	43.9	30	50.8
Total	57	100	59	100

### Instrument

The scientific literacy instrument for the energy topic used in this study consists of three domains, namely: (i) scientific knowledge, (ii) science process skills, and (iii) daily science application.

#### *(i) Scientific knowledge*

Scientific knowledge is a multiple-choice test item. It is designed to assess students' mastery of knowledge and comprehension of science concepts, particularly the energy concept. Energy is one of the primary disciplines for fifth-year science students. There were 20 items in this test.

#### *(ii) Science process skills*

The science process skills (SPS) test in this study consists of 10 SPS aspects, including observing, classifying, measuring, and using numbers; predicting; communicating; interpreting data; defining operations; controlling variables; making hypotheses; and conducting experiments. This aspect was taken from Harlen (1999), Harlen and Elstgeest (1992), and MOE (2013). There were 15 multiple-choice items on the SPS test.

(ii) Daily science application

The daily science application test measured in this study consisted of three sub-topics in energy concepts for Year Five children: (i) energy forms and transformation; (ii) renewable and nonrenewable energy; and (iii) energy conservation. All of these questions were adapted from the instrument from PISA and Yager et al. (2009). These three open-ended questions were modified to form a question related to the application of scientific concepts at home, in the community, and in scientific phenomena.

Results

Based on the research questions, the analysis of the findings is divided into two major sections: (1) childrens' scientific literacy, and (2) a comparison of scientific literacy between groups.

(i) Childrens' Scientific Literacy

Descriptive statistics involving mean scores are used to answer the first research question, which is to identify the level of students' scientific literacy (See Figure 1).

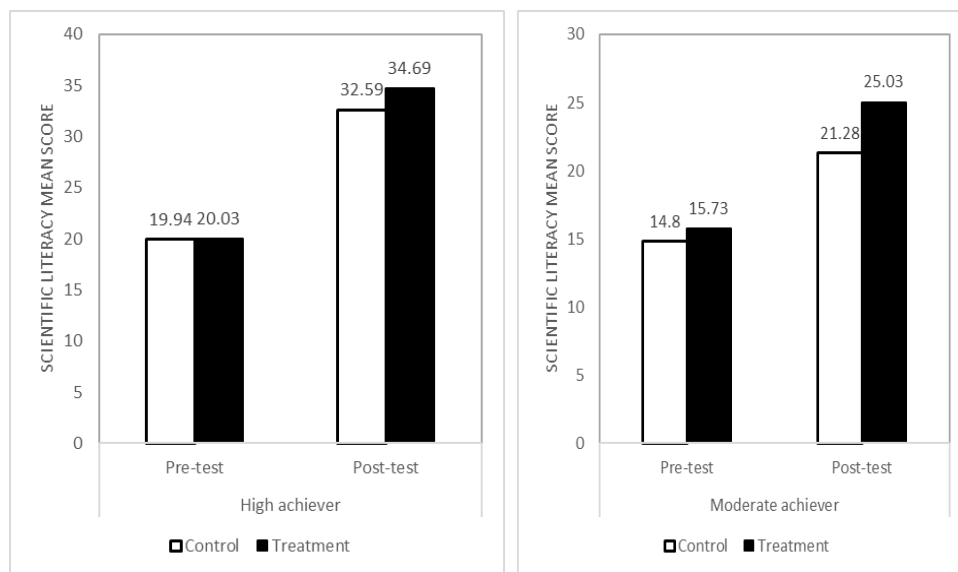


Figure 1. Childrens' scientific literacy for high and moderate achiever

Based on Figure 1, the pre-test mean score of the scientific literacy for high achiever students ( $x = 20.03$ ; ) and moderate achiever students ( $x = 15.73$ ; ) in the treatment group was higher than achiever students ( $x = 19.94$ ; ) and moderate achiever students ( $x = 14.8$ ; ) in the control group. Nevertheless, the mean score of the scientific literacy post-test for high achiever students ( $x = 34.69$ ; ) and moderate achiever students ( $x = 25.03$ ; ) in the treatment group outperformed the score of high achiever students ( $x = 32.59$ ; ) and moderate achiever students ( $x = 21.28$ ; ) in the control group. Based on the findings, both groups showed an increase in scientific literacy

across time (from pretest to posttest).

(i) A Comparison of Scientific Literacy Between Groups

Inferential statistics involving repeated measurement MANOVA were used to answer the second research question, which was to identify the difference in students' scientific literacy between the control and treatment groups (see Table 2).

Table 2. Scientific literacy multivariate test

	Pillai trace value	F	df1	df2	p	Partial eta squared
Group	0.04	1.63	3	110	0.19	0.04
Achievers' Level	0.36	20.62	3	110	<b>0.00</b>	0.36
Group* Achievers' Level	0.01	0.49	3	110	0.69	0.01
Time	0.82	166.64	3	110	<b>0.00</b>	0.82
Time*Group	0.13	5.51	3	110	<b>0.00</b>	0.13
Time* Achievers' Level	0.20	8.93	3	110	<b>0.00</b>	0.20
Time*Group* Achievers' Level	0.03	1.20	3	110	0.31	0.03

The findings from the multivariate test of the scientific literacy domain in Table 2 show that there is a significant main effect of achievers' level at the  $p < 0.05$ , which is  $F(3,110) = 20.62$ ,  $p = 0.00$ , with a large effect size (partial eta squared = 0.36). Likewise, the main effect of time, which is the comparison from pretest and posttest mean scores of the scientific literacy domain without involving different group and achievers' level, shows a significant difference ( $F(3,110) = 166.64$ ,  $p = 0.00$ ), with a very large effect size (partial eta squared = 0.82). The interaction effect between time and group is also significant ( $F(3,110) = 5.51$ ,  $p = 0.00$ ), with a large effect size (partial eta squared = 0.13). Similarly, the interaction effect between time and achievers' level showed a significant interaction effect ( $F(3,110) = 8.93$ ,  $p = 0.00$ ), with a large effect size (partial eta squared = 0.20). This finding explains that the interaction effect of the two independent variables which were group and achievers' level affects the scientific literacy score individually at the time measurement from the pretest to the posttest. However, relating to this experimental study, the childrens' scientific literacy does not depend on the level of achievers' but the intervention given to them.

As a result of a significant interaction effect involving the interaction of time with group which is univariate test (within-subject effect), was analysed to determine which domain of scientific literacy demonstrated a significant difference. Based on Table 3, scientific knowledge ( $F(1,112) = 8.28$ ,  $p = 0.00$ ) and scientific application ( $F(1,112) = 7.02$ ,  $p = 0.06$ ) with a small effect size shows a significance difference at  $p < 0.05$ .

Table 3. Univariate tests of the interaction effect of time and group on the scientific literacy domain

Scientific literacy domain	Sum of squares	df	Mean square	F	p	Partial eta squared
Scientific knowledge	36.61	1	36.61	8.28	<b>0.00</b>	0.07
Scientific application	35.26	1	35.26	7.02	<b>0.01</b>	0.06
Science process skills	6.86	1	6.86	1.76	0.19	0.02

In conclusion, the domains of scientific literacy, namely scientific knowledge and scientific application, demonstrate significant group differences. Moreover, the mean scores of these two groups increased linearly over the duration of the measurement time. However, the STEM Kids module-using treatment group demonstrated greater improvement than the control group. The group that utilises the module is more effective at enhancing scientific literacy, particularly scientific knowledge and application.

## Discussion

The enhancement in students' scientific literacy as a result of the implementation of alternative teaching and learning is in line with previous research by Lestari et al. (2021) and Wen et al. (2020). The domain of scientific literacy that students acquire in terms of scientific knowledge, scientific application in daily life, and science process skills increases linearly and positively over time. This demonstrates that students may improve in these areas of scientific literacy after intervention, either conventionally or by using the module.

In terms of scientific knowledge and scientific application, students who gained experience using the STEM Kids module outperformed those who received conventional instruction. Even though the effect size is small, it is possible to conclude that the STEM Kids module is more effective than conventional instruction at improving students' scientific literacy, particularly in scientific knowledge and scientific application. This finding was consistent with previous research, such as Barth (2013) and Cotabish et al. (2013), indicating that alternative teaching or the implementation of interventions in teaching and learning science can increase science knowledge and application in life.

Due to the fact that students were exposed to the STEM integration approach, which comprises inquiry-based learning and problem solving through the engineering design process, the implementation of the STEM module was found to have an effect on the improvement of students' science knowledge. Solomon (1993) explains that alternative teaching emphasises cognitive teaching strategies through active knowledge construction in order to help students acquire scientific knowledge and understanding.

Based on the science knowledge acquisition activities in the STEM Kids module, students can surmount the difficulty of acquiring non-scientific knowledge, also known as existing knowledge (Solomon, 1993). Non-scientific knowledge is knowledge or concepts developed by students themselves through real-world experiences. In order to correct non-scientific knowledge or an alternative framework, strategies to change students' concepts are implemented so that students can restructure their concepts, such as the transmission of the process of assimilation and accommodation or the process of equilibrium proposed by Piaget (Wadsworth, 1984), to aid students' cognitive development by resolving conflicts. In order for students to restructure their concepts, the STEM Kids module also includes activities that provide cognitive conflicts that may change students' alternative concepts.

The STEM Kids module additionally enhances students' ability to apply science in real-life situations. Based on this finding, the module was effective in overcoming students' difficulties with application-level questions (MEB, 2019). In addition, it accomplished the KSSR objective of enabling students to employ knowledge and skills in a critical, creative, and analytical manner when making decisions and solving problems (MOE, 2013). This is due to the fact that one of the principles of the STEM Kids module, which is based on the learning theories of constructivism and constructionism, is to focus teaching and learning on real-world scenarios, which is to provide students with authentic learning opportunities in the context of real-world situations and practise new ideas through their common circumstances.

## Conclusion

In order to achieve the goal of developing scientifically literate students, an effective PdP approach must be implemented and deployed to all students from the earliest stage of their education, regardless of their ability level. Consequently, effective learning and teaching resources or materials employing innovative teaching methods can assist in achieving this goal. Despite this, the implementation of the STEM Kids Module is not a simple task; it requires intensive training and initiatives involving educators, facilitators, and students. However, the alternative teaching and learning provided in the STEM Kids module is not impossible to implement in the formal teaching and learning of primary school and can be used as a teaching resource in the classroom, despite the study's limitations.

## Recommendations

It is indicated that the research could be enhanced through further study that includes qualitative data. This is necessary to ensure that more comprehensive data mining can determine in depth the effectiveness of the interventions. Aside from that, it is suggested that, due to the limited teaching period in the classroom, additional research on the intervention be conducted outside of formal class, which can be carried out over a longer period of time.

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## Content Analysis of the Letters Written by Ottoman and Allied Soldiers During the Battle of Gallipoli

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**Abstract:** The Battle of Gallipoli, one of the most important battles of the First World War, is an important turning point in world history. One of the spiritual and cultural heritage transferred from the Battle of Gallipoli to the present day is the letters written by the soldiers who fought in the Battle of Gallipoli to their families from the front. These letters are one of the sources that best reflect the psychology and emotional state of the soldiers. In this respect, letters have a critical role in understanding the war and the events that took place at the frontlines. The aim of this study is to analyze the content of the letters written by Ottoman and Allied soldiers who fought at the front during the Battle of Gallipoli to their families and loved ones, and to compare them by revealing the feelings, thoughts and psychological states of the soldiers reflected in the letters during the war. Content analysis method, one of the qualitative research methods, was used to examine the content of the letters written by Ottoman and Allied soldiers who fought in the Battle of Gallipoli. The themes related to the research topic in content analysis were created by examining the literature. The letters of seven Ottoman soldiers and eight Allied soldiers were subjected to content analysis and percentage frequencies were calculated. The results of the research showed that the letters written by Ottoman soldiers had more intense national and religious feelings, whereas these feelings were at a lower level in the letters written by Allied soldiers. In addition, it has been observed that despair, anxiety and fear were more dominant in the letters of the Allied soldiers, while Ottoman soldiers felt these emotions at a very low level.

**Keywords:** Keyword 1, Keyword 2, Keyword 3 (keywords should not exceed 5 words)

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### Introduction

One of the most important battles of the First World War is the Battle of Gallipoli. The Battle of Gallipoli, which took place between the Entente states and the Ottoman Empire, is a turning point in world history. The

Turks, who had been defeated and retreat for many years against the Western states, put a stop to this trend with the Battle of Gallipoli victory. The Dardanelles Strait, which was defended with the limited means of the Ottoman Empire, is the best example of the Turkish nation's faith, morale, love of homeland and heroism to the whole world (Balci, 2018). The greatest gift of the Dardanelles War for the Turkish nation is Mustafa Kemal Atatürk. Under the leadership of Atatürk, heroic Turkish soldiers achieved this victory by paying a heavy price.

The Battle of Gallipoli, also known as the Gallipoli Campaign, was a significant military endeavor that took place during World War I. This historic conflict unfolded on the Gallipoli Peninsula in the Ottoman Empire, now modern-day Turkey, and lasted from April 25, 1915, to January 9, 1916 (Balci, 2018). The battle is renowned for its intense and protracted nature, involving the Allied forces, predominantly composed of Australian and New Zealand Army Corps (ANZAC), British, French, and Indian troops, against the Ottoman Empire's defending forces. The Gallipoli Campaign was an ambitious attempt by the Allied powers to seize control of the Dardanelles Strait, secure a supply route to Russia, and weaken the Ottoman Empire's involvement in the war (Karal, 1996). However, what was envisioned as a swift and decisive victory turned into a harrowing and costly military campaign, with profound consequences for all parties involved. The Battle of Gallipoli holds immense historical significance, leaving a lasting impact on the nations involved and shaping the identities of the ANZAC forces in particular (Doganay, 1993). Tens of thousands of young Turkish soldiers and intellectuals were martyred in the war. This situation caused a shortage of educated manpower in the institutionalization and development of the new Turkish Republic established in 1923 and negatively affected the economic and cultural development of the country (Öztuna, 1983).

Turkish soldiers who participated in the war were sent off to the front with prayers, henna on their hands and sacrifices from all over the Ottoman Empire. On the other hand, the Ottoman army fought with the whole world during the war. In addition to British and French soldiers, the armies of the colonial countries of these countries, soldiers from Australia, New Zealand, India and Canada participated in the war (Durmuş & Akbıyık, 2008). Turkish soldiers from expatriate lands and enemy soldiers from all over the world sent news to their families and loved ones through letters, the only means of communication of the time, and reflected their situation and feelings at the front in these letters. Although 100 years have passed since the Battle of Gallipoli, the traces left behind by it remain fresh with all their vitality. Legends about this war, the material, spiritual and cultural traces left behind by the war have been passed down from generation to generation in different ways until today. One of the spiritual and cultural heritage transferred from the Battle of Gallipoli to the present day is the letters written by the soldiers who participated in the Battle of Gallipoli to their families from the front. There are many written works on the Dardanelles War (Yetisgin, 2015). Especially the chivalry, heroism and sacrifice of our soldiers were frequently described by enemy soldiers. The Turkish soldier deserved these worldwide accolades by winning the Battle of Gallipoli with victory. What were the feelings reflected in the letters written by Turkish and enemy soldiers who fought at the front in the Battle of Gallipoli? What was happening at the front? What did the enemy soldiers think about the Turkish soldiers? What did Turkish soldiers think about enemy soldiers? What were the beliefs, fears and aspirations of the soldiers fighting at the front? What was the psychology of Turkish and enemy soldiers as reflected in the letters they wrote? The answers to many questions such as these

have been the reason (inspiration) for this research.

Letters are messages that people who are physically separated from each other send to each other by mail in envelopes with the message they write with a pen on paper in order to communicate. The Turkish Language Association dictionary defines a letter as "a written paper, name, put in an envelope, sent to someone mostly by mail to inform, ask, ask, request or report feelings" (TDK, 2019). Letters are one of the frequently used sources in psychological studies (Altunay, 2014). According to Altunay (2014), the reason for this is that the individual who writes the letter reflects his/her inner speech and subconscious as it is, without being exposed to any external influence. The importance of the letters of soldiers in the Battle of Gallipoli cannot be overstated. These poignant and heartfelt correspondences offer a unique and personal perspective on the harsh realities of war and the emotional toll it takes on those who served. During the Gallipoli campaign, letters became a lifeline for soldiers, connecting them with their loved one's back home. Through these letters, soldiers could share their experiences, fears, and hopes, providing a glimpse into the daily challenges they faced on the battlefield. The soldier letters from the Battle of Gallipoli may provide valuable insights into the conditions endured by the troops, shedding light on the hardships of trench warfare, disease outbreaks, and the scarcity of essential supplies. They captured the camaraderie and resilience of soldiers, often expressing their determination to persevere despite overwhelming odds (Vassal, 1916). Beyond serving as a means of communication, these letters had a profound impact on public perception and support for the war effort. As they were shared with families, friends, and communities, the stark realities of battle reached the home front, evoking empathy and galvanizing public sentiment. Moreover, these letters preserved a slice of history that would have otherwise been lost. They now serve as invaluable primary sources for historians and researchers seeking to understand the human aspect of the Gallipoli campaign (Tok & Budak, 2017).

The letters of soldiers in the Battle of Gallipoli give a face and a voice to those who sacrificed so much for their country. They remind us of the true cost of war and the indomitable spirit of those who fought, making their relevance and importance endure throughout time. Furthermore, the letters written by the soldiers who fought at the front in the war have the feature of reflecting the inner speech and subconscious of these soldiers. The letters of soldiers who fought in the war are also of great value in terms of understanding the war and taking an example (Tok & Budak, 2017). Therefore, the psychological state, emotional state and character analysis of these soldiers can be made from the structure of the words and sentences used by the soldier who wrote the letter (Altunay, 2014). The power of letters from soldiers who fight in wars lies in their ability to provide a candid glimpse into the emotional and psychological states of those on the front lines. These heartfelt correspondences serve as a profound testament to the human experience amid the turmoil of armed conflict. Among the emotions poignantly revealed in these letters are religious feelings, national feelings, morale, courage, fear, longing, hope and anxiety during times of war. Religious feelings are often a central theme in soldiers' letters. Faced with the harsh realities of war and mortality, many soldiers find solace in their faith, turning to prayers and reflections on the divine for comfort and strength. Such expressions offer a window into the deep spiritual connections that soldiers establish in moments of great peril. National feelings run deep in the hearts of those who fight for their country. In their letters, soldiers passionately express their love and dedication

to their homeland, often intertwining their personal sacrifices with a larger sense of duty and patriotism. These sentiments reinforce the unwavering commitment soldiers have to defend their nation and its values. Courage, a hallmark of military service, shines through the letters. Soldiers frequently share accounts of bravery on the battlefield, both in their own actions and in the heroic deeds of their comrades. These narratives not only depict valor but also inspire others to face adversity with steadfastness and resolve. Amidst the chaos of war, letters also reveal a profound longing for loved ones left behind. Soldiers write of their yearning to reunite with family and friends, expressing their emotional struggles and the strength they draw from memories of home. These poignant expressions of longing remind us of the human cost of war on the hearts of those who serve. Fear, an inescapable companion in the theater of war, finds its voice in soldiers' letters. Honest and raw, these accounts lay bare the psychological toll of combat, as soldiers grapple with the uncertainty of survival and the horrors they witness. The letters offer a window into the vulnerability and resilience of the human psyche in times of extreme duress. Lastly, morale emerges as a recurring theme in soldiers' letters. Encouragement and morale-boosting sentiments are frequently exchanged, providing emotional support to fellow soldiers and bolstering a sense of unity within their ranks. These expressions of camaraderie reinforce the importance of morale in maintaining the collective spirit amidst the hardships of war.

The emotional and psychological states of the soldiers who fight are reflected in the letters as religious feelings, national feelings, courage, longing, fear, and morale (Tok & Budak, 2017; Altunay, 2014; Tetik, et al., 2009). Therefore, the themes of the emotional states of the soldiers in the content analysis of the letters were determined as religious feelings, national feelings, morale, courage, fear, longing, hope and anxiety. Religious emotion is defined as the internal resources that direct religious interest, desire and pursuits that lead to faith (Hökelekli, 2001). National sentiment is defined as love for the nation, nation and homeland (eOdev, 2019). Moral is defined as a person's spiritual power, spiritual power, spirituality (TDK, 2019). It is defined as the confidence and courage one finds in oneself when undertaking a difficult or dangerous task (TDK, 2019). Fear is defined as anxiety, sadness in the face of a danger or thought of danger (TDK, 2019). Longing defined as the desire to see someone, a place or a thing, and to be reunited with it (TDK, 2019). What is expected to happen or thought to happen is defined as hope (TDK, 2019). Anxiety or worry is defined as a feeling of tension that usually arises with the thought that something bad will happen and whose cause is unknown (TDK, 2019).

In conclusion, the emotional and psychological states of soldiers, laid bare in their letters, offer a profound insight into the human experience during wartime. The reflections of religious devotion, national pride, courage, longing, fear, and morale create a multifaceted and emotionally charged narrative, reminding us of the resilience and humanity that persist amidst the crucible of conflict. These letters serve as enduring testaments to the indomitable spirit of those who endure the trials of war while touching the hearts of generations to come. When the studies in the literature were examined, no previous study was found that included the content analysis of the letters of both Turkish and enemy soldiers who participated in the Battle of Gallipoli. In addition, although there are letters of Turkish soldiers who participated in the war, a limited number of translations of letters of enemy soldiers have been encountered, especially no complete translations have been found except partial excerpts

from the letters of enemy soldiers. Therefore, the aim of this study is to analyze the content of the letters written by Turkish and enemy soldiers who fought at the front during the Gallipoli War to their families and loved ones in terms of content and to reveal and compare the emotions, thoughts and psychological states of the soldiers reflected in the letters during the war. This study is the first research on the subject.

## Method

In this study, content analysis method, one of the qualitative research methods, was used to examine the content of the letters written by Turkish and enemy soldiers who participated in the Battle of Gallipoli to their loved ones. Qualitative research aims to explore people's subjective perspectives on events (Yıldırım and Şimşek, 2006). Content analysis is one of the most frequently used methods among qualitative data analysis types. Content analysis provides the opportunity to objectively interpret the statistical data obtained with the categories created (Koçak & Arun, 2006). In the content analysis, the themes related to the research topic were first developed by examining the literature. The themes for the content analysis of soldiers' letters were determined as religious emotion, national sentiment, morale, courage, fear, longing, hope and anxiety. The themes were finalized by taking the opinions of Turkish and Social Studies teachers who are experts in the field. Then, the letters belonging to 7 Turkish soldiers and 8 enemy soldiers were analyzed and the words included in these categories were counted and their percentages and frequencies were calculated.

The letters analyzed in the study were accessed by searching the Internet and books containing the Battle of Gallipoli Soldier Letters. Since the number of Turkish letters of foreign soldiers is quite limited, only two Turkish letters were accessed; in addition to these letters, five of the letters of enemy soldiers found on the Internet were selected and prepared in Turkish by using Google translation into Turkish and having the translations checked by experts in the field and subjected to content analysis. The coding of the themes determined for the content analysis of the letters was done by the researchers. In addition, in order to ensure the reliability of the research results, the consistency of the coding made by the Turkish and Social Studies teachers was checked and a consensus was reached. After the coding process was completed, the data obtained with the coding sheet were transformed into tables and graphs were drawn with the Microsoft Excel program.

## Results

The letters of 7 Turkish soldiers and 8 enemy soldiers who participated in the Battle of Gallipoli were analyzed and analyzed for content. Table 1 and Table 2 show the frequencies of the content analysis of the letters of Turkish and enemy soldiers, respectively. Table 1 shows the content analysis of the letters written by Turkish soldiers. When Table 1 is analyzed, it is observed that the rank of Turkish soldiers is pasha, lieutenant, corporal and collegeman. In general, the letters were written to their families. Only Lieutenant Mehmet Dursun wrote his letter to the Turkish people.

Table 1: Letters written by Turkish soldiers

Letter	Name of the soldier	Rank of Soldier	To whom? (Addressee)	National sentiment	Religious Emotion	Longing	Morale	Courage	Fear	Hope	Anxiety
1	Mehmet Tevfik	Lieutenant Colonel	Mother	2	7	2	1	1	0	1	2
2	İsmail	Pasha	Father	2	5	2		6	0	4	1
3	Selahaddin Adil	Lieutenant	Wife	0	2	3	1	0	0	4	2
4	Mehmet Dursun	Lieutenant	Turkish Public	6	2	0	4	6	0	1	0
5	Hasan Edhem	Corporal	Mother	4	6	4	5	1	0	6	0
6	Ömer	Corporal	Little Brother	0	3	2		1	0	0	0
7	Sani Kerim	Lieutenant	Brother Cemil Efendi	7	6	0	6	9	0	1	1
Total (Frequency)				21	31	13	17	32	0	17	6

Table 2 shows the content analysis of the letters written by enemy soldiers. When Table 2 is analyzed, it is seen that the ranks of most of the enemy soldiers were not specified and the ranks of those who were specified were officer, lieutenant and sergeant. Like Turkish soldiers, enemy soldiers also wrote letters to their families.

Table 2: Letters written by enemy soldiers

Letter	Name of the soldier	Rank of Soldier	To whom? (Addressee)	National sentiment	Religious Emotion	Longing	Morale	Courage	Fear	Hope	Anxiety
1	E. J. Cowles	Unspecified	Bay Rogers	0	0	1	1	1	4	1	3
2	SdneyHarrie Skinner	Unspecified	Robin Oliver	0	0	0	0	0	5	0	3
3	H.W. Cronin	Lieutenant	Father	0	0	0	0	0	3	0	3
4	İsimsiz Anzak	Unspecified	Family	0	0	0	0	0	2	0	1
5	Alistain John Taylor	Unspecified	Familye	1	0	0	0	0	4	0	4
6	Lance	Unspecified	Mother	0	0	0	2	0	2	0	0
7	Lieut Guy Nightingale	Officer	Mother	0	0	0	0	0	2	0	1
8	Richard Gilson	Sergeant	Mother	0	0	1	0	1	2	1	1
Total (Frequency)				1	0	2	3	2	24	2	17

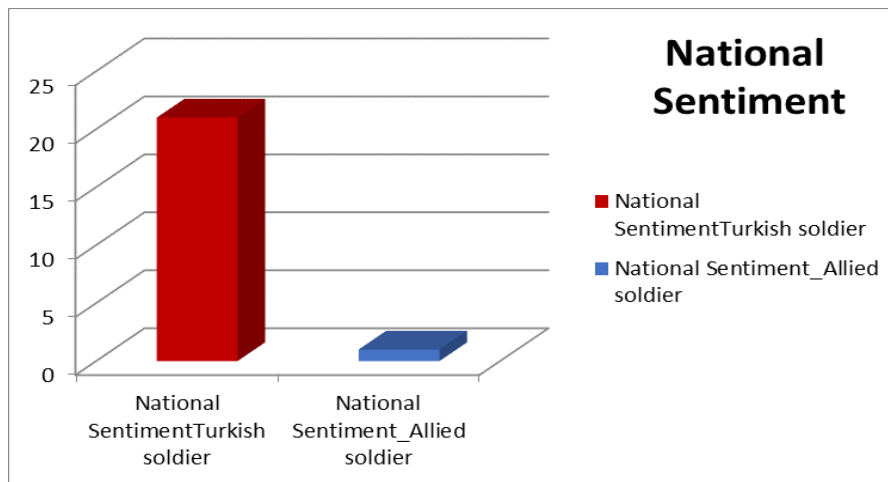


Figure 1. Distribution of the reflection of "National Sentiment" in the letters between Turkish and Enemy soldiers

When the contents of the letters are analyzed in terms of "National Sentiment", it is observed that there is a big difference between Turkish and enemy soldiers. It is observed that the national sentiment of Turkish soldiers is at the highest level, while the feeling of national sentiment among enemy soldiers is very low. At the same time, while Turkish soldiers fought against an occupation of their own homeland, enemy soldiers may have lacked national feeling because they came to a country that was not their homeland for imperialist purposes. For example, Lieutenant Mehmet Dursun expresses his national feeling in his letter as "I do not pity my arm sacrificed for my great Turkish nation and my sacred homeland".

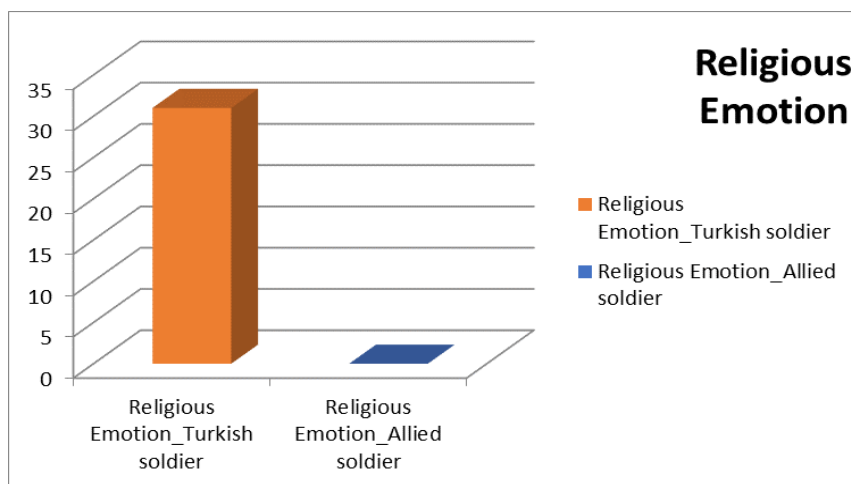


Figure 2. Distribution of "Religious Emotion" in the letters of Turkish and Enemy soldiers

When Figure 2 is analyzed, it is seen that the religious feelings of Turkish soldiers in the Battle of Gallipoli were at their peak. On the other hand, it is observed that enemy soldiers lacked religious feelings. It can be said that this is due to the belief in martyrdom in our religion and the strong religious beliefs of our soldiers. For example, in his letter, Mullazım-ı Sani Kerim Efendi expresses his religious feelings as "Efendi Allah Kerim,



the helper of the righteous is Allah".

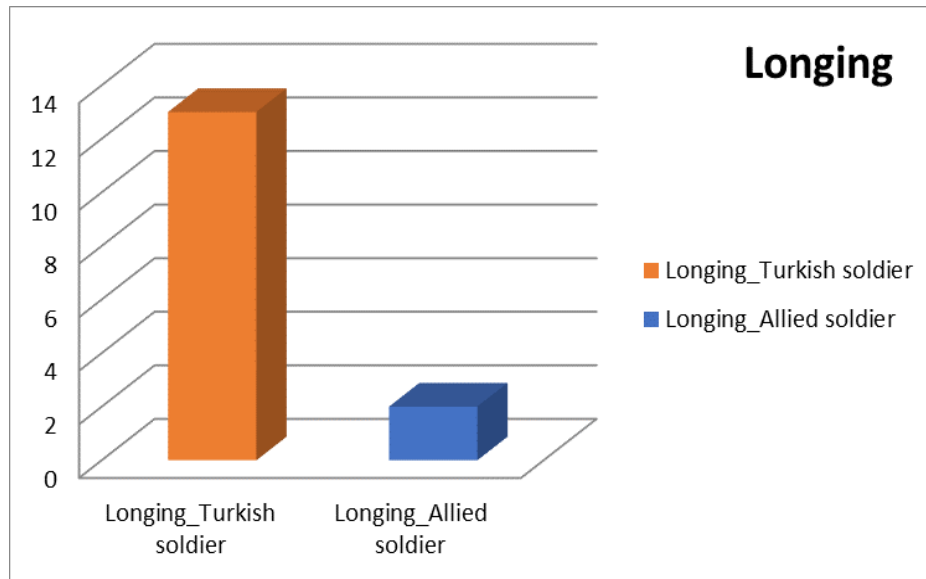


Figure 3. Distribution of the emotion "longing" in the letters of Turkish and enemy soldiers

For example, Selahaddin Adil Pasha expressed his longing in his letter as "I kiss your eyes and greet you all".

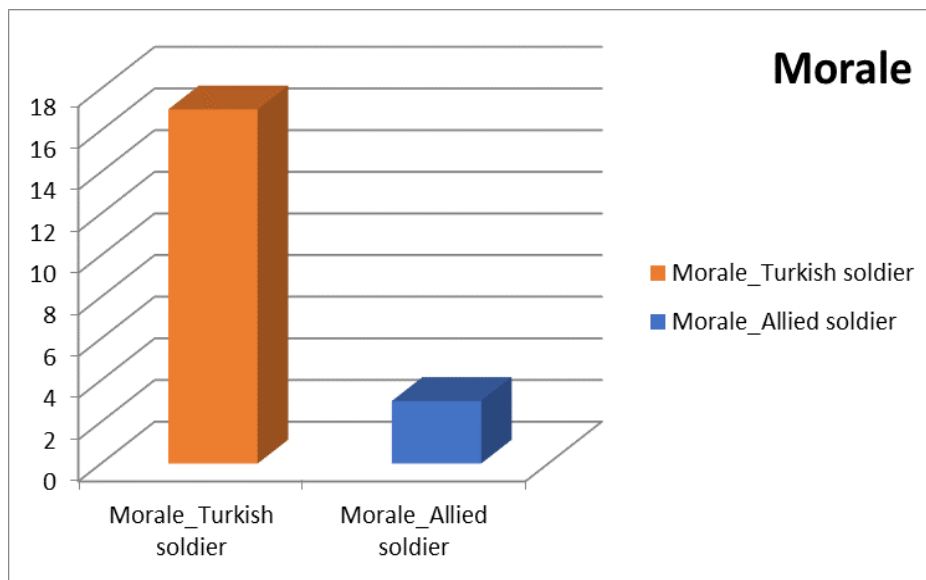


Figure 4. Distribution of "Morale" in the letters of Turkish and enemy soldiers

Figure 4 shows that the morale of Turkish soldiers is very high compared to enemy soldiers. This situation results from the fact that the religious and national feelings of Turkish soldiers are higher than those of enemy soldiers, which in turn leads to high morale. For example, Hasan Edhem expressed his high morale in his letter as follows: "I hope the enemy will send troops and take us with them and we will have a wedding, won't we".

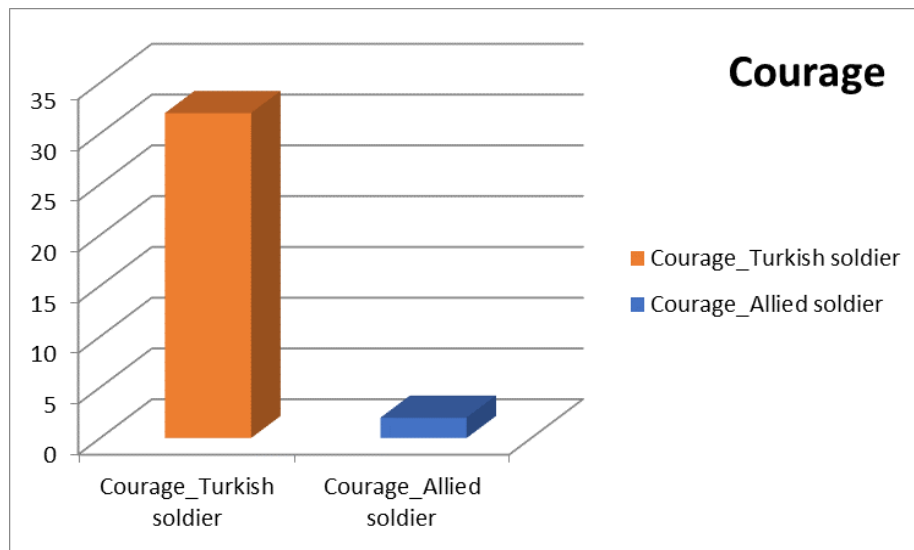


Figure 5. Distribution of "Courage" in the letters of Turkish and enemy soldiers

As can be seen in Figure 5, the high religious feelings and morale of the Turkish soldiers resulted in a high level of courage. In his letter, Mülazimi Sani Kerim wrote about his courage: "No Turk would want to use a gun against these scoundrels! He can only crush them with his fists, catch them with his steel claw and throw them into the sea".

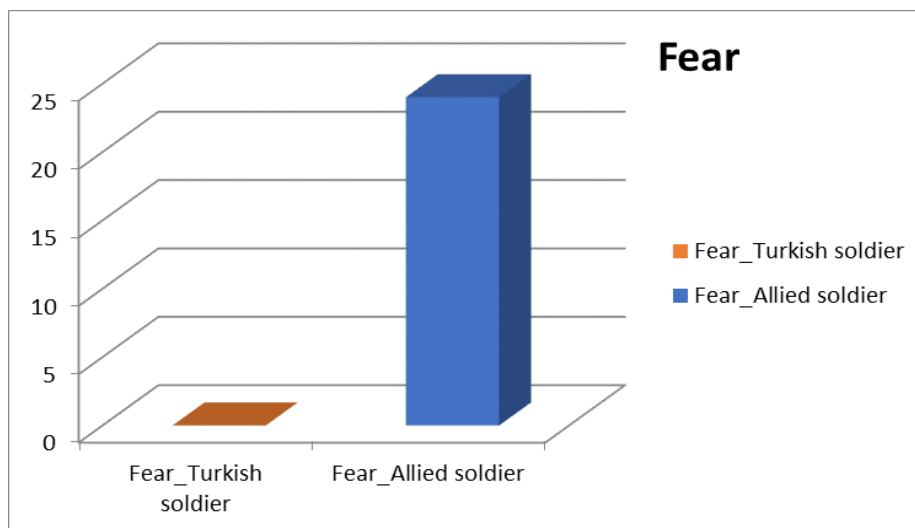


Figure 6. Distribution of "Fear" in the letters of Turkish and enemy soldiers

As can be seen in Figure 6, the level of fear of enemy soldiers is quite high. However, not the slightest trace of fear was found in the letters of Turkish soldiers. It is not surprising that enemy soldiers, who do not know what and for whom they are fighting in unfamiliar lands and who have weak religious feelings, have high levels of fear. In her letter, Sdney Harrie Skinner wrote of her fear: "It was terrible to see the soldiers like that. Their wounds were horrible", while Alistain John Taylor expressed his fear at the beginning of his letter as "Hello to you all from the hell of Gallipoli".

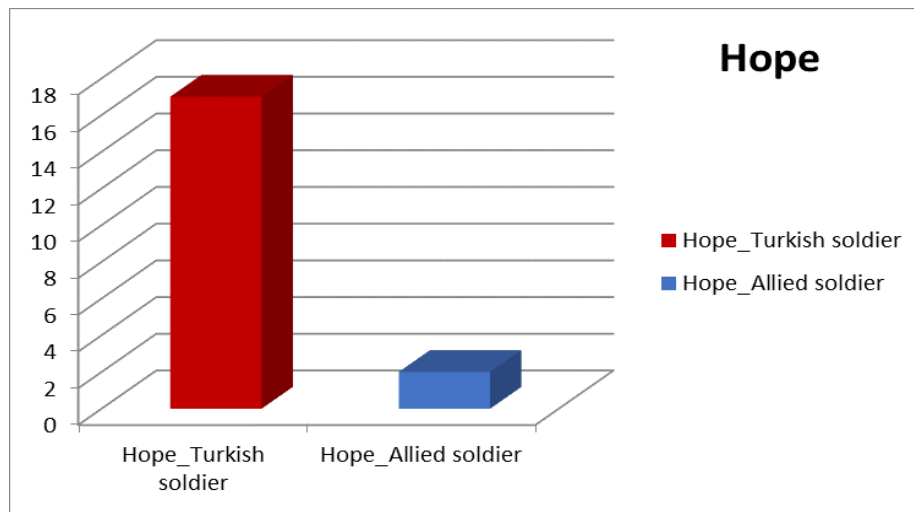


Figure 7. Distribution of "Hope" in the letters of Turkish and enemy soldiers

It was observed that Turkish soldiers reflected their hopes that they would win the war in their letters. The enemy soldiers, on the other hand, seem to be in despair. Ismail from Kastamon expresses his sense of hope as "I will be reunited with you and I will help you harvest the crops".

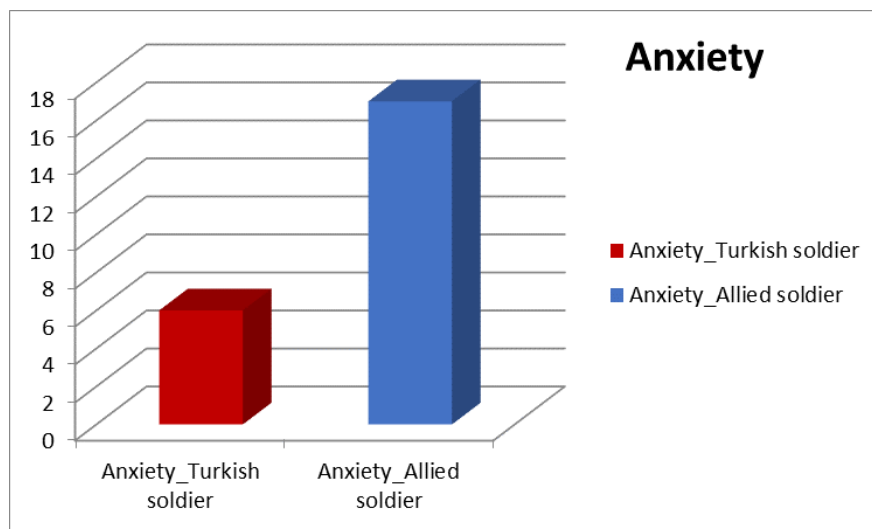


Figure 8. Distribution of "Anxiety" in the letters of Turkish and enemy soldiers

As can be seen in Figure 8, enemy soldiers did not refrain from reflecting their worries in their letters. This can be thought to be due to the fact that they are fighting on the soil of an unfamiliar country where they face death at any moment. The Turkish soldiers, on the other hand, were worried about not being able to pay their debts to their homeland, loved ones and families. In his letter, E.J. Cowles expresses one of his worries as "I hope we do not lose any more than the inspector soldiers we last saw". Also in his letter, Alistain John Taylor expressed his concern as "I am not sure that I want to talk to anyone anymore and see anyone's face". In another part of his letter, this soldier expresses his concern by saying "This is not my war, but I have no will to live".

The stark differences between Turkish and enemy soldiers' emotional states, as reflected in their letters, provide valuable insights into the varying factors influencing their conduct during the Battle of Gallipoli. The strong sense of national pride and religious devotion among Turkish soldiers served as powerful motivators, instilling a deep commitment to defend their homeland and enhancing their overall morale (Tok & Budak, 2017). On the contrary, the low levels of national sentiment and religious feelings among enemy soldiers might have contributed to their higher fear and despair, as evident in their letters. The lack of a unifying cause or motivation might have diminished their resolve to fight, resulting in lower morale and ultimately affecting their courage on the battlefield. The findings of this study underscore the significance of psychological and emotional factors in shaping the behavior and performance of soldiers during times of war (Altunay, 2014). It emphasizes the importance of cultivating a sense of national identity, religious values, and morale in military personnel, as these aspects can significantly impact their ability to withstand challenges and maintain courage under duress. However, it is crucial to acknowledge the limitations of the study, such as potential biases in the selection and preservation of the letters. Moreover, the individual differences among soldiers and the complexity of human emotions in the context of war make it essential to approach the topic with sensitivity and caution. In conclusion, this research contributes valuable knowledge about the emotional and psychological aspects of soldiers in the Battle of Gallipoli, offering important implications for understanding the dynamics of armed conflict and the factors that shape soldiers' experiences on the frontlines.

## Conclusion

The aim of this study is to analyze the content of the letters written by Turkish and enemy soldiers who fought at the front during the Battle of Gallipoli to their families and loved ones and to investigate the emotions, thoughts and psychological states of the soldiers reflected in the letters during the war. Many local and foreign works have been written about the Battle of Gallipoli. It has also been the subject of many movies and documentaries. However, one of the most important sources reflecting what happened at the front from the first network is the soldiers' letters. These letters are the sources that reflect the psychology and emotional state of the soldiers in the simplest way. In this respect, letters have a critical role in understanding the war and the events that took place at the front.

The findings of the research show that the letters written by Turkish soldiers reflect national and religious feelings more intensely than the letters written by enemy soldiers. It is seen that the letters of Turkish soldiers are written in a more emotional style compared to the letters of enemy soldiers. On the other hand, it is seen that despair, fear of death and anxiety are dominant in the letters of enemy soldiers. Turkish soldiers used expressions in their letters expressing their desire to be martyred at every opportunity. In addition, expressions showing their courage and hope come to the forefront in the letters of Turkish soldiers. While the enemy soldiers expressed the landings on the Gallipoli Peninsula and the negativities they experienced during these landings in a despairing language, they also gave information about the physical characteristics of the peninsula. For example, it is seen that bird sounds, natural beauties and sunsets are depicted on the Gallipoli Peninsula. On

the other hand, their complaints about the abundance of mosquitoes on the Gallipoli Peninsula during the war were also reflected in their letters.

The findings of this study shed light on the emotional and psychological states of soldiers during the Battle of Gallipoli, as reflected in the letters they wrote to their families and loved ones. The analysis reveals several significant differences between Turkish and enemy soldiers concerning their national sentiments, religious feelings, morale, courage, fear, hopes, and worries.

- The national sentiment among Turkish soldiers appears to be exceptionally high, while the enemy soldiers exhibited a significantly lower sense of national pride. This disparity likely stems from the strong patriotic fervor and commitment to defend their homeland that prevailed among the Turkish troops.
- Religious feelings were found to be profound among Turkish soldiers, but they seemed to be lacking among the enemy soldiers. The high level of religious devotion among Turkish soldiers likely played a role in bolstering their morale and resilience on the battlefield.
- The study highlights that the morale of Turkish soldiers was notably higher compared to the enemy soldiers. This can be attributed to their elevated religious and national sentiments, which likely contributed to their overall positive outlook during the war.
- The combination of strong religious feelings and high morale among Turkish soldiers seems to have resulted in a heightened level of courage. This courage enabled them to face the challenges of war with determination and resolve.
- Conversely, the letters of enemy soldiers revealed a high level of fear. This fear might have been exacerbated by the apparent lack of religious and national motivation found among these soldiers.
- Turkish soldiers expressed their hopes for victory in their letters, reflecting their optimism and determination to triumph in the war. On the other hand, enemy soldiers seemed to be plagued by despair, which might have been influenced by their fear and lower morale.
- The letters of enemy soldiers also indicated the presence of worries and anxieties, underscoring the mental and emotional strain they experienced during the conflict.

## Recommendations

- Since the power of spiritual feelings in the psychological state of the soldier in war has a very important effect on the morale of the soldier, more importance should be given to the development of these feelings in education.
- Letters are a part of a country's cultural heritage and shed light on history. For this reason, letters with historical value should be protected and introduced to future generations.
- A limited number of letters written by enemy soldiers during the Battle of Gallipoli have been translated by making quotations. It is important to translate all the letters of the enemy soldiers who participated in this war into Turkish in order to reveal the psychological conditions of these soldiers.

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## Gel Printing Technique in the Context of Alternative Printing Applications in Printmaking

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**Abstract:** Printmaking has made visual artworks reproducible and more accessible, allowing artworks to reach more masses. The art of printmaking, which has many different techniques and categories within itself, has attracted more attention over time, developed more and gained a distinctive place in art practices, while it was previously only a means of reproduction. In addition to printing techniques such as engraving, linoleum printing, mono-printing, and lithography, increasing material and technical possibilities today also lead to the emergence of more innovative applications. Gel printing, which we can call one of these new applications, based on the use of a soft surface as a printing area, is becoming increasingly widespread as an exploratory and entertaining printmaking technique used by many amateur and professional printers. The basis of this technique is the manipulation and transfer of paints, inks and other media to various surfaces using a soft printing plate. In essence, the printing plate is a rubber or gelatin surface that is thinned in certain areas. When paints, inks and other media are rolled across the plate by a roller, they can move between the thinned surfaces and create a variety of exciting shapes, colours, and textures. Gel printing can be an expressive, versatile, and economical alternative suitable for a variety of artists. Whether offering a simple design or an entire print, the affordability and universality of the technique make it an attractive option for any creator. This study aims to increase the recognition of the technique by examining the gel printing technique, which has recently been preferred by amateur artists and art students, in the context of alternative printmaking practices.

**Keywords:** Printmaking, Gel Printing, Monoprinting, Monotype, Art.

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### Introduction

There are many forms of art and printmaking is one of them. The art of printmaking has influenced art lovers and art historians, especially in the modern period. This art has been used in different situations from time to time. Printmaking art emerged in the 19th century and gained importance in the late 1800s. With printmaking,

which is defined as a powerful technique that can be used by art lovers, artists have started to create hard and sharp surfaces. By using technical groups, printmaking began to destroy the difficult physical boundaries used by artists (Öztürk & Demir, 2021; Ünal & Ciddi, 2022). The different printing habits used in the production of printmaking have been the subject of inspiration for other forms of art performance. The oldest technique of printmaking, the printing press, was invented in Central Europe in the 15th century (Jones, 2017). Printmaking is a term used to refer to paintings produced using printing techniques. Printing techniques enable the production of a large number of copies of paintings (Elder, 2019). In addition, printing techniques also enable the production of paintings in various materials and formats (Smith, 2018). Printing press printing enables text and images to be printed using letters made of metal. This technique is still in use today, but computer-aided printing techniques are becoming increasingly common (Williams, 2016).

Printmaking is a field of proven effectiveness for various social groups. In most societies, printmaking has helped to expand literature in a cultural and cultural language. Printmaking has promoted public relations, and political propaganda and strengthened art consciousness.

Gel printing is an exploratory and fun printmaking technique used by many printmakers, both amateur and professional. Gel printing involves the manipulation and transfer of paints, inks and other media to various surfaces using a soft rubber printing plate. In essence, the printing plate is defined as a rubber or gelatine surface that is thinned in certain areas. When paints, inks and other media are spread across the plate by a roller, they can move between the thinned surfaces and create a variety of interesting shapes, colours and textures. The art of printmaking has a long history and has offered a wide range of possibilities for creative expression. As an alternative to traditional printmaking techniques such as etching, lithography, block printing and screen printing, gel printing allows an artist to experiment with colours, textures, and shapes in unique ways. The absorbency and elasticity of the printing surface through which the colours, textures and shapes pass also create unique aesthetic effects that artists can play with and explore.

Gel printing is also accessible to almost anyone, regardless of skill level or budget. Most print artists can start by simply purchasing a soft printing plate, some inks, and a roller. Once the artistic materials have been gathered and a work surface has been created, the artist is free to experiment and begin creating their own unique artefacts. The printing plate itself is also relatively affordable, making gel printing a cost-effective option for most creatives. Moreover, different gel plate-making recipes for artists can be found in many sources. Artists can create their own plates with substances such as gelatine, which offers an organic binder and an elastic surface.

In addition, compared to other alternative printmaking methods, gel printing offers relatively little mess, making it an excellent choice for those who want to explore printmaking without creating an entire printmaking studio. The technique is also a great option for those who want to experiment, as it allows a great deal of physical freedom in the creation process. This freedom can be further enhanced when gel prints are used as transfer media for other works, such as photographs or drawings.



**Emergence of Gel Printing Technique and Hectography**

Gel printing is a relatively new printing technique that uses a flexible printing plate made of gelatine and is not a later invention. It is very similar to the hectograph technique of applying paint or ink to the plate and then transferring it to paper or other surfaces to create unique prints.

Nevertheless, to give some period information, it can be said that this technique dates back to the late 20th century when alternative printing methods were started to be tried by artists. This technique first emerged as a result of the search for a way to make a single print without having to use a printing press.

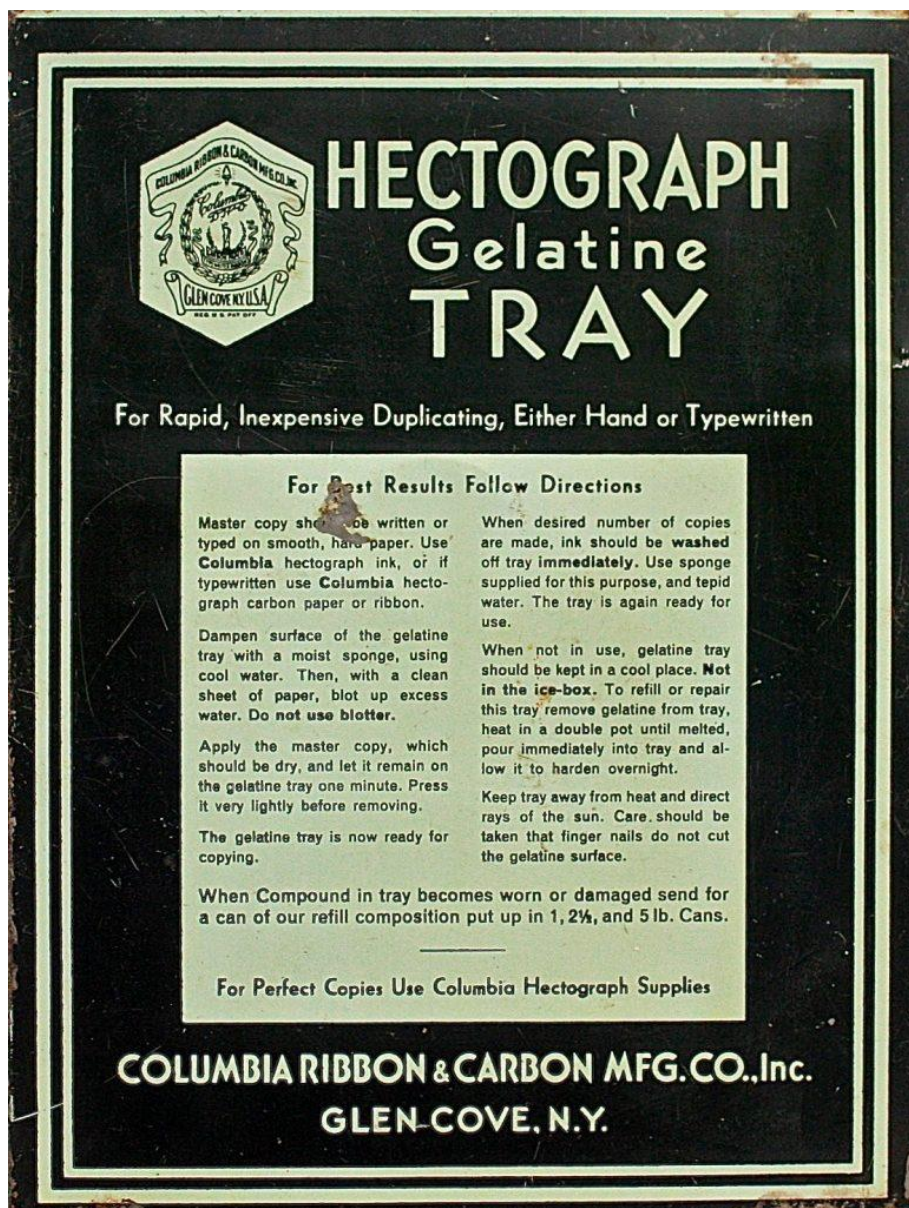


Figure 1. A metal advertising sign for hectography materials  
(Ribbon Tin Virtual Museum, 2023).

Hectography is a method of reproducing written or printed materials using gelatine-based ink and a special type of paper. Hectography was invented in the late 19th century and was generally used for small-scale printing and copying purposes (Kazantseva, 2021). In fact, hectography was an older printing technique, popularised in the 19th century, separate from gel printing. It is based on the principle of using a special type of paper coated with a layer of gelatine. The gelatine is then transferred to the paper by printing over the original image.

Hectography is a reproduction technique that was popularly used before the advent of modern photocopying and printing technologies. A special ink made from gelatine was used to create a master copy of the document. This master copy is then printed on a hectograph paper, which absorbs the ink and allows it to be transferred to subsequent copies. Nielsen states that a hectograph mass is essentially a glue-glycerol-water composition to which other compounds are added, usually in small quantities, to harden, protect and pigment the composition.

The old-fashioned pan hectograph has largely been superseded by the hectograph roll (i.e. a hectograph copying surface in the form of a roll, adapted for use on specialised machines for speed of copying). The roll is unrolled in the machine section by section on a copying roller and a new section is used for each different master. The rolls are long enough (approximately 16 feet) to allow multiple masters to be copied without changing the roll. The roll is rewound as it leaves the platen; any excess ink must be absorbed before the roll can be reused the next day (Nielsen, 1936). One of the advantages of hectography is its simplicity and low cost. It does not require any specialised equipment or electricity, making it an accessible technique for a wide range of users. However, hectography is not without its limitations.

The quality of copies produced using this method is generally lower than other printing methods and the number of copies that can be made from a single master is limited. The relationship between gel printing and hectography is based on the idea that both techniques use a gelatine-based printing plate. The difference is that in gel printing the plate is flexible and reusable, whereas in hectography gelatine is used only as a transfer medium on the plate surface. One of the advantages of gel printing is that it allows artists to experiment with different colours, textures, and patterns without having to worry about the limitations of traditional printing methods. The flexible printing plate allows greater control over the printing process, which can lead to more creative and spontaneous results.

Hectography, on the other hand, may require a more traditional approach, requiring a little more skill and precision. The process of transferring gelatine to paper requires careful handling and attention to detail, as well as a certain level of technical knowledge and skill. Despite these limitations, hectography continued to be used for several decades, especially in small-scale printing and copying applications. Eventually, it was replaced by more advanced printing technologies such as offset printing and photocopying, which offer higher quality and greater efficiency and are no longer used today.



Figure 2. Gel printing block (Heines, 2012).

The gel printing technique differs from hectography in terms of its working principle in that it offers a single print in the mono printing area. We can say that gel printing is a mono-printing technique. Although there are different descriptions of the gel printing plate, it is usually a flexible transparent block obtained from a mixture of alcohol, glycerine and gelatine (see. Figure 2). The gelatine block to be used as a gel printing mould can be purchased ready-made or can be made at home using different recipes. The mixture, which will be mixed in different proportions, will reach a thick and flexible consistency by waiting in a container for a certain period and will be ready for printing after complete drying. Hancill defines monoprinting as a versatile and expressive art form that involves creating unique prints through a combination of painting, drawing and printmaking techniques. According to him, it is a process that allows for experimentation and spontaneity, creating one-of-a-kind works of art (Hancill, 2023). According to Newell, the term "monoprint" refers to the fact that each print produced is unique and cannot be copied exactly. While traditional printmaking techniques often involve creating multiple identical copies, monoprinting allows for greater freedom and individuality in the artistic process (Newell, 2018). The process of creating a single print typically involves applying ink or paint to the surface. Artists can manipulate the ink or paint with various tools such as brushes, rollers, or even their hands to create the textures, patterns, and forms they desire. When the image is complete, a paper is carefully pressed over the inked surface and the image is transferred to paper. The result is a unique print that captures the artist's creative vision.

Mono printing offers artists a wide range of possibilities for experimentation and exploration. It allows the combination of different techniques and materials such as collage, stencilling and layering to create complex and visually engaging works of art (Adi & Marutama, 2019). Artists can make changes and additions to the image throughout the printing process, so this process also inherently involves spontaneity and improvisation. Degarrod points out that monoprinting is used as a research tool in ethnographic studies as well as artistic value.

Art-based ethnographies involving monoprinting techniques have been used to enhance ethnographic knowledge acquisition and encourage empathy between participants and researchers (Degarrod, 2013).

## Conclusion

Gel printing is an intriguing process that results in beautiful, one-of-a-kind, hand-printed papers with amazing colours, textures, and layers. Materials are widely available and easy to use, especially acrylic paints, which feature heavily in gel printing. It is easy to create colourful designs for monoprint artworks. The printing plate is portable. It can be used at home, in the workshop or outdoors. This technique is also an economical way of making printed art. Discovering new methods and materials for printmaking in individuals has always been an exciting and rewarding experience. One such material that has become increasingly popular in recent years is gel printing. Gel printing is a practical technique that can be used individually, allowing artists to create prints without using a traditional printing press. Flexible yet durable gel plates can be bought or obtained in a variety of sizes and shapes and can be reused multiple times. One of the main benefits of using gel-based plates for printmaking is their versatility. Unlike traditional printing methods, it allows for a more intuitive and experimental approach. Artists can use a variety of materials such as stencils, masks and found objects to create original prints. The technique can also be easily adapted to different surfaces such as paper, fabric, and wood. Another advantage of gel printing is its accessibility. While traditional printing methods can be costly and require specialised equipment such as printing presses and printing presses, the materials to be used in the gel printing technique can be more easily acquired by individuals. Only a few basic materials such as paint, brush, and the plate itself can be sufficient to print. This makes it an excellent option for artists who are new to the art of printmaking or who want to try a new technique economically.

Gel printing also provides a faster and more spontaneous approach to printmaking. Because the process is so versatile, artists can quickly experiment with different colours, textures and patterns and observe the results immediately. The technique, which can also be considered an environmentally friendly option for printmaking, can be applied using water-based inks and paints, unlike traditional printing methods that require the use of harsh chemicals and solvents. This makes it a safer and more sustainable option for artists who are concerned about the environmental impact of their work and an anti-toxic situation arises. Its flexibility, experimental approach, and the fact that it can be applied with different surfaces and mediums make it highly favourable for artists who want to explore new techniques and materials.

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# Photographic Representation of Carnival and Grotesque in The Works of Mothmeister

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**Abstract:** Mothmeister, the artistic duo of Belgian-American photographers Dirk Marivoet and Bart Vandevijvere, have left an indelible mark on the world of art and photography with their unique style and highly stylized photographic work. The surrealist visual aesthetic of their work is characterized by the incorporation of bizarre and grotesque elements into a vivid, hyperrealist representation of the world. This paper analyses the use of a grotesque-inspired photographic style in Mothmeister's work in a carnival atmosphere and its impact on contemporary image-making. Mothmeister's striking visual aesthetic is eclectic and memorable, presenting a mixture of hyperrealism and surrealism in an endeavour to create a unique visual experience. Their work is often embodied by contemporary grotesquerie, an aesthetic that aims to shock and jolt viewers by emphasizing the grotesque and exaggerated aspects of the human figure. Using irony and humour, the artists subvert traditional expectations of beauty, creating images that are both captivating and disturbing.

**Keywords:** Carnival, Carnavalesque, Grotesque, Photography, Art.

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## Introduction

When we look at the concept of art, we see that it is a human activity that requires imagination, talent and creativity. In other words, it is the unique creativity that results from the expression of an emotion, a thought or a design (Kasım & Öztürk, 2023; Kucukoner & Ozturk, 2022; Öztürk, 2021a, 2021b; Türe & Ozturk, (2021). It is accepted that today's art of painting began with pictures or symbols drawn and engraved on the walls of caves and rocks by the first people in order to express their fears, joys, beliefs or needs. To put it briefly, the relationship between human beings and art is a concept as old as human history (Dalkıran, 2012). The Mothmeister duo's photographic works often utilize dramatic lighting, oversized props, and exaggerated postures to create a nightmarish sense of unease. The viewer experiences the sensation of being drawn into a

landscape of unmapped and often intriguing locations, populated by figures that appear to be undergoing a strange transformation. This transition often acts as a foil for more conventional elements, blurring the lines between the real and the surreal. Mothmeister's innovative and unorthodox approach to photographic representation has earned them both critical acclaim and a wide following among fans of contemporary art.

In addition to their stylized portraits, Mothmeister also produces documentary-style images that extraordinarily capture everyday life. Using the same techniques of exaggeration and distortion, these images are often set in the unreal world of the artists' imagination, creating a unique and ultimately disturbing juxtaposition between reality and fantasy. In this way, Mothmeister's use of the grotesque creates images that are both mesmerizing and thought-provoking, providing a means to draw attention to traditionally overlooked aspects of human experience.

Mothmeister's grotesque and carnival-inspired photographic work has established the duo as one of the most influential voices in contemporary photography. Their use of exaggeration, distortion, and irony to create images that are both striking and disturbing has earned them both critical acclaim and a significant following among art and photography fans. With each new series and project, Mothmeister continues to push the boundaries of perception and challenge viewers to reassess and reinterpret their concepts of beauty and reality. In order to better convey the concept and style of the grotesque, it is necessary to address the concept of carnival, a concept of which it is an element.

### **Carnival and Its Representation in Photography**

The concepts of carnival and carnivalism have different origins and contexts. One of the oldest origins goes back to early modern theatre, where carnival and carnivalesque were present (Korhonen et al., 2000). In this period, carnival represented a temporary suspension of social norms and hierarchies, a reversal of roles, and a celebration of the absurd and grotesque. The carnivalesque spirit was embodied by characters such as the fool, the reformer, and the wild man. Hawkins and Edwards mention that anthropological studies of carnivals and tribal rituals, including pilgrimages and rites of passage, have also contributed to the understanding of carnivalism (Hawkins & Edwards, 2013). These rituals involve the suspension of normative assumptions and traditional practices, creating a liminal space where individuals can challenge and subvert social norms.

The historical roots of the concept of carnival are also based on the practice of guessing games in carnivals, as described in Sir Francis Galton's 1907 article (Goel & Lee 2016). Carnivalism or carnivalism is a concept that is represented in various ways in the art of photography as in other plastic arts. One aspect of carnivalism in photography has been the representation of social celebrations and power dynamics in these celebrations. Barnwell explores the representation of women and their power in Afro-Caribbean social celebrations, with a particular focus on the relationship of carnival to the history of Freedom Day in Toronto. This photographic research aimed to capture the concrete element of carnival's connection to history and to examine the representation of women in these celebrations (Barnwell, 2021).

In more contemporary contexts, carnivalism has been adapted into various industries and cultural practices. For example, the wrestling industry has used elements of carnivalism as a media strategy to simulate 'spontaneous' and 'real' events (Surowiec & Miles, 2020). This strategy originates from the culture of carnival workers. It can be said that the concept of carnival and carnivalism has various origins such as early modern theatre, anthropological studies on rituals, guessing games in carnivals, cultural appropriation in industries such as wrestling, resistance and an expression of alternative identities. It has evolved and continues to exist as a rich source of inspiration in various artistic and cultural practices.

Another aspect of carnivalism in photography is the use of visual carnivals and photomontage as a commentary on photography itself. Toman analyzed how photomontage can be used as a form of satire and commentary on the medium of photography. According to him, this approach allows photographers to challenge traditional notions of representation and create visual narratives that reflect the carnivalesque nature of the world (Toman, 2019). Photography is also capable of capturing the transformative and social change aspects of carnivalism. Cunningham et al. emphasize that photography and photojournalism are used as a means of realizing social transformation. These methods contribute to social change and challenge dominant narratives by allowing individuals to express their experiences and perspectives (Cunningham et al., 2020). Carnivalism can also be seen in the documentation of carnival events and traditions in photography. Gordon presented a photography and oral history project that captured the essence of the carnival in Jacmel, Haiti. This project uses costume, street theatre, narrative, and satire to reflect Haiti's history, cosmology, and current political body (Gordon, 2013).

### **Grotesque and Grotesque Image as a Concept**

The concept of the grotesque has its origins in various historical and cultural contexts. Lawson et al. suggest that the grotesque in art and literature has been explored throughout history. It is a term used to describe artistic representations that deviate from norms of beauty and harmony, often characterized by exaggerated, distorted or hybrid forms. The grotesque can be seen as a response to the limitations of traditional aesthetic ideals and a way of challenging traditional notions of beauty (Lawson et al., 1965). Taking another approach, Hodges states that the grotesque, with its focus on bodily caricature, can be traced back to the living traditions of popular humour and folk culture dating back at least to the Middle Ages. This shows that the origins of the grotesque can be found in the cultural practices and artistic expressions of earlier periods (Hodges, 2010). According to Zwan, the word "grotesque" is derived from the Italian term "grottesca" and he explains that it refers to the underground, cave-like ruins where some of the earliest examples of this art form were found. While these first manifestations of the grotesque were initially marginal ornaments, over time they became more prominent in artistic expressions (Zwan, 2023).

The grotesque image is characterized by its ability to evoke a sense of unease, discomfort and even disgust in the viewer. It often challenges traditional notions of beauty and forms are interpreted about the absurd and the macabre. The grotesque can be seen as a confrontation with social norms and expectations and as a defiance and



rebellion against these concepts. The concept of the grotesque in art has various origins, including the historical traditions of popular humour and folk culture, as well as the exploration of unusual forms and themes. It has evolved and remains an important aspect of artistic expression, challenging traditional notions of beauty and inviting viewers to confront the disturbing and unusual.

### **The Mothmeister Team and Their Art Style**

Arts groups and teams play an important role in the field of arts by offering a variety of benefits and perspectives. The collaborative nature of art groups allows artists to exchange ideas, share techniques and provide mutual support (Reid & Karambayya, 2009). The collaborative nature of art groups is an important feature that allows artists to exchange ideas, share techniques and provide mutual support (Teglbjaerg, 2011). By working together, artists can inspire and challenge each other, leading to the development of new artistic approaches and styles. Art groups also provide a sense of community and belonging, creating a supportive environment for artists to flourish.

Art groups may have different perspectives and attitudes towards abstract art. Some art groups or dyads may embrace abstract art as a way of expressing feelings, ideas or concepts that go beyond representational forms (Böthig & Hayn-Leichsenring, 2017). They may appreciate the freedom and experimentation that abstract art allows and value the exploration of colour, form, and texture. Abstract art can be seen as a way of conveying subjective experiences and challenging traditional artistic conventions. Stojilović and Markovic mentioned that art groups or duos can have different perspectives and preferences, favouring representational or figurative art over abstract art. They may prioritize the depiction of recognizable subjects and narratives, emphasizing storytelling and realism (Stojilović & Markovic, 2014). These artists may value the technical skill and craftsmanship required by representational art and find meaning in the depiction of the visible world. It is important to note that perspectives and attitudes towards abstract art can vary greatly between different art groups or duos. Some may embrace abstract art wholeheartedly, while others may have mixed views or preferences. The diversity of perspectives within art groups contributes to a rich and dynamic artistic landscape, encouraging dialogue and exploration of different artistic approaches.

Art groups and teams are of great importance in the arts, providing a supportive and collaborative environment for artists. Art groups or duos may differ in their perspectives and attitudes towards abstract art; some may embrace the freedom and experimentation of abstract art, while others may prioritize representational forms. The diversity of perspectives within art groups contributes to the richness and vitality of the art world. The Mothmeister team can also be considered in this way. Their unique concepts, the atmosphere they create, and their artistic expression make them strong in the context of artistic expression. Mothmeister is a mysterious and fascinating art duo that has been mesmerizing audiences with their unique and surreal creations for several years. The duo consists of two people who prefer to remain anonymous and are known for their unique style of combining taxidermized animals with intricate costumes and elaborate sets.

Belgian artist duo Mothmeister channel their love of post-mortem photography and stuffed animals into their unique style of imagery, typically depicting eerie, fairytale-like characters in post-apocalyptic landscapes. Their best work is now compiled in a book called *Weird and Wonderful Post-Mortem Fairy Tales*. The creative minds behind Mothmeister are a female graphic designer and a male art director from Antwerp, Belgium. But they insist on communicating as one person and presenting themselves as a singular subject. They choose to keep details of their real-life away from the public. "It's not about us, it's about our art. Yes, one of us is always in art but never recognizable, always masked or with his back to the camera. It's not about our real world, it's about the world we create in our minds, our afterlife tales" (Meerman, 2018). The name Mothmeister refers to the transformation of something unpleasant into something beautiful, such as the combination of poorly stuffed animals and creepy masks to create a wonderful artistic image. It also refers to the urban legend of the Mothman, a human-like creature with 10-metre wings that was reportedly seen in Point Pleasant, West Virginia in the 1960s.

Mothmeister's art is a fantastical blend of steampunk, gothic and otherworldly aesthetics that transports viewers into a surreal and mesmerizing world. Their works are often dark, disturbing, and surreal, but they also have a whimsical quality that adds a playful element to their work. One of the most intriguing aspects of the work is the use of taxidermized animals. Rather than displaying animals in a traditional way, the duo prefers to transform them into fantastical creatures that seem to have emerged from a different realm. Using animals as a canvas for their art, they add intricate costumes, masks, and other accessories to create a unique and mesmerizing experience. Their art has been featured in numerous galleries and exhibitions around the world. Their works can be described as "dark fairy tales". Preferring to remain anonymous, the duo prefers to let their art speak for itself. They rarely give interviews and are rarely in the public eye. For artists and academics, Mothmeister's work can be a fascinating case study of the power of imagination and creativity. Their ability to transform everyday objects and materials into otherworldly creations can be seen as a testament to the importance of artistic vision and the role of the artist in society.

As they are constantly pushing boundaries and exploring new avenues in their art, their work can also be an indication of the importance of experimentation in the creative process and approaching forms, objects, and spaces from experimental and different perspectives. A truly unique and mesmerizing art duo that has captured the imagination of audiences around the world, Mothmeister's surreal and haunting works transport viewers into a different world where taxidermy animals transform into fantastical creatures and the lines between fantasy and reality blur. For artists and scholars, Mothmeister's work can be seen as a testament to the importance of imagination and creativity in our lives.

## Results

The duo, who are known to use stuffed dead animal bodies (taxidermy), mummies and different objects resembling corpses in their works, are also observed to include masks and different accessories and costumes

that complement masks in their works. The artists, whose works are generally for photography, exhibit their works in exhibitions, books, and their own social media pages. The duo, who do not share detailed information about the medium and material while exhibiting their works, have also stayed away from naming their works. In Figure 1, we see a figure with closed eyes resembling a mummy.

The posture of the figure, the material used and the blackened texture on the face may indicate death. Death has been one of the constant subjects of photography since its invention. Photographers have captured images of death in many forms, from funerals to horrific accidents. The representation of death in photography has varied throughout history, from the romanticized images of death in the Victorian era to the more realistic depictions of death in contemporary photography.



Figure 1. Untitled, (Mothmeister, 2023)

One of the oldest forms of death photography has been post-mortem photography. These photographs were taken of deceased people, usually children, as a way of remembering them. The subjects often posed as if they were still alive, and the photographs were often the only visual record of their existence. In the 20th century, photographers began to take a more realistic approach to death photography. Images became more graphic and were often used to document tragic events or accidents. In recent years, there has been a trend towards using photography to explore the concepts of death and mortality in a more artistic and philosophical way. The concept of death is one of the most interesting aspects of photographic art, capable of provoking a range of

emotions in the viewer. It can be both beautiful and repulsive, both comforting and unsettling. After all, death has been one of the most universal experiences we all share. The theme of death reminds individuals of their own mortality and the fragility of life.

One of the most striking features of grotesque art is its depiction of the human form and its attitude towards kingship and authority. Grotesque art has a unique way of depicting authority figures such as kings, queens, and other powerful individuals. In most cases, these figures are displayed in a negative light with exaggerated facial features and grotesque expressions. This depiction reflects a sceptical attitude towards authority and power. One of the earliest examples of grotesque art is found in the medieval period when it was used to criticize the social and political structures of the time. Grotesque figures were often depicted as corrupt, greedy, and immoral, emphasizing the flaws and shortcomings of the ruling class. Art was a vehicle for social commentary and served as a way for ordinary people to express their dissent. In Figure 2, the Mothmeister's nobility is indicated by his costumes, and the figure is wearing a crown. Despite his shining costume and splendour, the figure lacks the flesh of a human being. Here, the presence of the expression "farewell to the flesh", one of the most prominent attitudes of grotesque and carnivalesque styles, is observed.



Figure 2. Untitled, (Mothmeister, 2023)

It is possible to come across various types of art in which cadavers or mummies are used as the main subject in the history of art. The use of cadavers and mummies in art dates back to ancient times and has been a subject of interest to many artists throughout history. Ancient Egyptians used mummies to represent the dead in their works of art. The Greeks used cadavers to study anatomy and create realistic sculptures. Renaissance artists also used cadavers to study human anatomy and create realistic paintings. In modern times, artists have used cadavers to create installations and performance art. Figure 3 shows a figure with dried flesh, sunken cheeks, and empty eye sockets. It can be said that the figure makes a reference to the concept of death embraced and accepted by the grotesque concept. At the same time, the figure holds a stuffed furry animal form in its lap. The costume and accessories of the figure, which is standing even after death and gives the impression of continuing its life, are not worn out and are represented in a very vivid and flamboyant way.



Figure 3. Untitled, (Mothmeister, 2023)



Figure 4. Untitled, (Mothmeister, 2023)

In the world of art, costumes, and clothing play an important role in the depiction and portrayal of characters, themes and ideas. From the intricately designed and ornate dresses of the Renaissance to the avant-garde and bold costumes of modern art, clothing has been used as a means to express and convey various narratives and emotions. One of the most interesting aspects of clothing in art is the use of noble and flamboyant costumes. Noble clothes, also known as court dress, were generally used by the aristocracy and nobility in Europe in the 17th and 18th centuries. These clothes were designed to display the wealth and status of the wearer and were usually made of luxurious fabrics such as silk, velvet, and brocade. In art, noble clothes were often used to

depict royalty and the upper classes. Paintings of kings, queens and other members of the aristocracy are often adorned with elaborate and ornate costumes symbolizing their power and status. Lavish costumes are often associated with theatre productions, masquerades, and carnivals. These costumes are designed to be bold, colourful and eye-catching, and often include intricate details and embellishments. In the arts, flamboyant costumes are used to express a wide range of emotions, from joy and celebration to darkness and despair.

Photographs and paintings depicting dead people pretending to be asleep have long been a popular subject in art history. From the Victorian era to the present day, artists have been fascinated by the idea of capturing the stillness and serenity of death in their work. The tradition of making paintings of the deceased dates back centuries. In ancient Egypt, for example, elaborate funeral masks were made to accompany the dead into the afterlife. Similarly, in medieval Europe, busts were often made to represent the deceased at funerals. However, photographing the dead became especially popular during the Victorian era. Known as post-mortem photography, these images were often the only visual record of a person's life and were cherished by loved ones as a way of remembering them.



Figure 5. Untitled, (Mothmeister, 2023)

In most cases, these photographs were taken shortly after death and the deceased was posed in a way that made it appear as if they were asleep. This was done to create a sense of peace and tranquillity in the image and to

help the bereaved come to terms with their loss. The popularity of post-mortem photography declined as the 20th century progressed, but the tradition of creating images of the deceased continued in other ways. Figure 5 shows a portrait sculpture. The portrait appears to be of a dead person, with the mouth open and the teeth exposed. The portrait is surrounded by floral ornaments, and the composition includes a headdress and a veil visible from the edges. The work, which creates the impression of an old woman with closed eyelids, again refers to death, death photography and dark themes.

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# Green Capacited Vehicle Routing Resolution using CORONA Virus Optimization Algorithm


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**Abstract:** In this research, the authors address the Green Capacitated Vehicle Routing Problem (GCVRP), which is a variant of the Vehicle Routing Problem that considers the environmental impact of transportation. The goal of the GCVRP is to minimize the emission of pollutants, particularly CO<sub>2</sub>, by considering factors such as fuel consumption, load to be delivered, distance traveled, and vehicle capacity. The authors use CORONA Virus Optimization algorithm and compare results with local search to solve the problem and consider the use of assignment probabilities as continuous variables. In this research, the authors address the Green Capacitated Vehicle Routing Problem (GCVRP), which is a variant of the Vehicle Routing Problem that takes into account the environmental impact of transportation. The goal of the GCVRP is to minimize the emission of pollutants, particularly CO<sub>2</sub>, by considering factors such as fuel consumption, load to be delivered, distance traveled, and vehicle capacity. The authors use metaheuristics, specifically local search and particle swarm optimization, to solve the problem and consider the use of assignment probabilities as continuous variables.

**Keywords:** Pollutants; CO<sub>2</sub>, Green Capacited Vehicle Routing Problem; Metaheuristics, transportation, sustainability.

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## Introduction

Current circumstances of the pandemic show new consumption patterns and the emergence of new actors during

sanitary confinement periods. The goods transportation evolves rapidly in the face of more constraints and specificities as preferred and authorized and time windows. It is a question of determining a circuit (routing) of several vehicles, to serve at minimal cost customers' network. This paper attempts to minimize the emission of carbon dioxide (CO<sub>2</sub>) from the heterogeneous charged trucks and to respect some other constraints such as capacity. To solve green capacitated vehicle routing recent metaheuristic is used as well as some known approached methods. For this reason, we present in the following section the problem. In the third section, we describe the three algorithms. In the fourth section, we will the discretization of the continuous methods.

## Green Capacitated Vehicle Routing Problem

### Green Vehicle Routing

Vehicle Routing Problems (VRPs) include among the most studied combinatorial optimization problems. The VRP representative models a situation in which a fleet of vehicles in a depot must serve a set of customers geographically dispersed. The goal is then to determine which clients should visit each vehicle and in what order so that the activity is carried out as efficiently as possible. It generalizes the well-known travelling salesman problem (TSP). The common purpose of the classical problem is then to minimize the number of vehicles and the total distance travelled to serve clients without violating constraints (Dekhici et al., 2019a).

In the literature there are many variants of VRP. Below are presented the most well-known ones: The Capacitated Vehicle Routing Problem (CVRP) is one of the variants characterized by the presence of vehicle capacity constraints and customer demands. The Vehicle Routing Problem with Time Windows (VRPTW), or VRP with time windows (Dekhici et al., 2019b), specifies that each client has a time window. This is a time interval during which its service is available. (e.g. loading or unloading of goods) must be completed. A vehicle may arrive early, but he must wait until the service is possible. If it arrives later the corresponding customer will be not satisfied, or the service is no longer possible. In this case, the problem is said to be "hard time window constraints". of windows of time. In the so-called soft stress models, vehicles can be used to the customer outside his time window but at the price some form of penalty. The time window may concern the opening hours of the depot or the hours of unavailability of the staff.

The Stochastic Vehicle Routing Problem (SVRP), is a Sales representative in which at least one element of the problem is random. The Multi-Depot Vehicle Routing Problem (MDVRP), has several depots in which the vehicles. Each tour of a vehicle must begin and end up at the same depot.

Green Vehicle Routing (GVRP) is a branch of green logistics which refers to vehicle routing problems where externalities of using vehicles, such as carbon dioxide-equivalents emissions, are explicitly taken into account so that they are reduced through better planning (Çağrı Koç et al. 2016). Bjorklund (2011) defines "Green Transportation" as a: "Transportation service that has a lesser or reduced negative impact on human health and the natural environment when com-pared with competing transportation services that serve the same purpose".

Recently, the concept of green transportation for sustainable development has soared due to governmental regulations and customers preference for green products. Consequently, transportation companies are reviewing their processes to take into account such concern. In some cases, transforming the traditional logistics systems to be environmentally friendly shall even lower the costs enabling it to meet classic logistics objectives. Moreover, the green transportation system could be completed by determining emission factors and quantifying trucks emissions to integrate them into the logistics systems networks.

### **Related works**

Since this is the trend in environmentally friendly industry and it is in fact necessary to think more efficiently in terms of the environment, in last years many researchers have been interested in GVRP rather than other variants of the vehicle routing problem. Green transportation and the minimization of pollutants in the vehicle routing problem have received significant attention. As an example, Bruglieri et al.(2016) considered intermediate stops to the Alternative Fuel vehicles. They used for the GVRP, two Mixed Integer Linear Programming formulations allowing multiple visits to the stations without introducing dummy copies of them. Their work where enriched in (Bruglieri et al., 2019) by dominance rule using exact methods and heuristic approach. Yunyun Niu et al.(2018) considered the Green open vehicle routing problem (GOVRP) in Beijing, China, where the vehicles do not return to the depot after servicing customers. A hybrid tabu search algorithm involving several neighborhood search strategies was designed to minimize fuel emissions costs and the CO2 emissions cost.

Rather than minimizing fuel cost of ordinary truck, Giusy Macrina et al.(2019) proposed a discrete metaheuristic to a specific version of the Green Vehicle Routing Problem, in which we assume the availability of a mixed vehicle fleet composed of electrical and conventional (internal combustion engine) vehicles. These are typically light- and medium-duty vehicles. They allowed partial battery recharging at any of the available stations. Yang Yu et al.(2019) proposed an improved branch-and-price (BAP) algorithm to solve the heterogeneous fleet green vehicle routing problem with time windows (HFGVRPTW). In one of the steps, they used a multi-vehicle approximate dynamic programming (MVADP) algorithm to evaluate the carbon emission of each vehicle. Computational experiments were done on the Solomon benchmark instances.

Recently, Giallanza et al.(2020) investigated a three-echelon fuzzy green vehicle routing problem (3E-FGVRP) for designing a regional agri-food supply chain on a time horizon. The credibility theory of fuzzy sets is used to implement a multi-objective fuzzy chance-constrained programming model, where the total costs and carbon emissions are minimized. The resolution of the 3E-FGVRP is conducted by using a non-dominated sorting genetic algorithm.

Ferani E. Et al. (2020) proposed a green vehicle routing problem (VRP) for perishable products which optimizes the operational cost, deterioration cost, carbon emissions and customer satisfaction. The proposed VRP model also considers time windows, different travelling time during peak hour and off-peak hour, and working hours.

They solved the proposed model using a many-objective gradient evolution (MOGE) algorithm.

The literature on the green transportation and the minimization of pollutants in the vehicle routing problem is growing rapidly, and the above-mentioned studies represent a small subset of the research in this area. Despite the increasing interest in this field, there is still much room for improvement, and further research is needed to address the challenges posed by the complexity of the problem and the trade-off between environmental sustainability and transportation efficiency.

### **Pollutant emission**

Freight transportation generates significant amounts of many types of pollutants, including particulate matter, carbon monoxide, ozone (nitrogen oxides (NOx) chemically reacted with volatile organic compounds) and hazardous air toxics( Çağrı Koç et al., 2016). Total emission emitted per tons of CO<sub>2</sub> depends on the number of vehicles, the average distance they travel, and the extent to which they are loaded. It is difficult to do an exact estimation because of the uncertain effects on climate change. When an engine is started below its normal operating temperature, it uses fuel inefficiently, and the amount of pollution produced is higher than when it is hot( Iodi et al.,2020). In other hypothesis, Elbouzekri et al.(2013) using genetics metaheuristics used another equation in the fuel optimization of Vehicle routing problem in order to calculate transportation cost between two points i and j. These observations lead to the basic relationship used in the calculation method (equation 1):

$$E(q, d) = d \times \left[ \left( \frac{e_{fl} - e_{el}}{Q} \right) q + e_{el} \right] \quad (1)$$

Where: E(q,d) the CO<sub>2</sub> emission from a vehicles in kg/km with a load q and distance d; e<sub>fl</sub> is the CO<sub>2</sub> emissions of a fully loaded (by weight) vehicle; e<sub>el</sub> is the CO<sub>2</sub> emissions of an empty vehicle and Q is the volume capacity of a vehicle.

### **Optimization Method**

#### **CoronaVirus Optimization Algorithm (CVOA)**

A recent metaheuristic called Corona viral Optimization Algorithm (Martínez-Álvarez et al., 2021) models how the virus spreads and how it infects healthy people. The CVOA is a novel optimization algorithm that is inspired by the behavior of the coronavirus. The algorithm uses a swarm-based approach to find the optimal solution in the Vehicle routing problem. The CVOA considers multiple factors such as the distance, travel time, and pollutant emission levels of the vehicles to determine the optimal solution. Unlike existing algorithms, the CVOA starts with a population of one solution and considers many parameters to ensure the spread of the levels. The standard algorithm used the 2020 viral statistics and a binary codification and was without a specific condition of termination. The technique was utilized to forecast a hydropower dam's deformation (Bui et al.2022, Torres et al. 2021,2022). Karthikeyan et al. 2022) investigated CVOA to Enhance the Output Power of the Partially. (Shamseldin, 2021) used it to maximize the performance brushless DC motor. The algorithm was

also used for breast cancer classification in (Nassif et al. 2021). The algorithm was hybridized in (PRIYA et al., 2022).

### **CVOA principles**

If no local optimum has been initialized, the algorithm starts by initializing patient zero (PZ) as the coronavirus and provides a random solution otherwise. An iteration's steps are as follows: Each infected person has a chance of dying (P DIE), and they are unable to spread the virus to other people. Undead people spread disease to new people. Individuals will infect more or less others based on whether they are categorized as "super-spreaders" (more) or "ordinary-spreaders," according to a fixed probability (P SUPERSPREADER) (fewer). Both categories of people "The'super-spreader' and 'ordinary spreader' can travel and study new solutions to ensure diversity of outcomes. Therefore, there is a chance (P TRAVEL) that the available solutions will be more varied.

And so there is a probability (P\_TRAVEL) to diversify the field of solutions. For this algorithm three (03) populations are updated: Each individual can die and goes into a list where it cannot infect any new individuals. Each infected individual is sent to the cured list after spreading the virus, there is a probability controlled chance of reinfection (P\_REINFECTION). An individual in the list of cured persons can, at any iteration, be reinfected. To simulate the quarantine of a person and for simplicity, if the probability of quarantine (P\_ISOLATION) is satisfied, the individual is directly put in the list of cured persons. The list of newly infected people, as the name suggests contains the newly infected individuals after each iteration. It is possible that there are two (02) similar individuals and in this case the new individual is deleted.

As mentioned above, one of the characteristics of this algorithm is that the search can stop without the need to control an external parameter as in most algorithms. This is due to the fact that the algorithm reaches a point where it can no longer infect new people because the population of dead and cured individuals is increasing. In addition, a predefined and specified number of iterations (PANDEMIC\_DURATION) can be added to prevent the opposite case.

### **Some parameters**

One of the strengths of this algorithm is that the input data is mostly predefined by the virus statistics (even if some statistics have changed since March 2020) and that the proper functioning of this metaheuristic depends on these data which are not arbitrarily chosen.

P\_DIE: The probability of death of an infected individual. It is 5%, therefore equal to 0.05.

P\_SUPERSPREADER: This probability also affects infected individuals. It is 10%, or 0.1.

ORDINARY\_RATE: This is the number of people an infected individual who is not a super-spreader infects. It infects a random number of people in the set [0,5].

SUPERSPREADER\_RATE: This is the number of people an infected super-spreader infects. It infects a random

number of people in the set [6,15].

P\_REINFECTION: This is the probability that a cured person can be infected again. And it is 02%, so equal to 0.02.

P\_ISOLATION: This is the probability that dictates whether a person enters quarantine when affected by the virus. It is essential for the algorithm to stop and is  $\geq 70\%$ , or 0.7.

P\_TRAVEL: The probability that an individual will travel after being infected.

It is equal to 10%, or 0.1.

PANDEMIC\_DURATION: This data simulates the duration of the pandemic and it can be unknown at the initialization.

SOCIAL\_DISTANCING: This is the minimum number of iterations before the quarantine process is triggered and P\_ISOLATION becomes viable. It is suggested to put it in the set [7,12].

### Pseudo-codes

The algorithm has several functions that make it work that we will show and explain for a better understanding of how the algorithm works, composed of five (05) nested functions:

**The cvoa() function.** This is the main function of the algorithm, which is the function that handles the three (03) populations. It initializes them and processes them by calling the other functions. The output is the best individual

---

Algorithm 1 Function CVOA (Martínez-Álvarez et al., 2021)

```
1: define infectedPopulation, newInfectedPopulation as set of Individual
2: define dead, recovered as list of Individual
3: define PZ, bestIndividual, currentBestIndividual, aux as Individual
4: define time as integer
5: define bestSolutionFitness, currentbestFitness as real 6: time  $\leftarrow$  0
7: PZ  $\leftarrow$  InfectPatientZero()
8: infectedPopulation  $\leftarrow$  PZ 9: bestIndividual  $\leftarrow$  PZ
10: while time < PANDEMIC DURAT ION AND sizeof(InfectedPopulation) > 0 do
11: dead  $\leftarrow$  die(InfectedPopulation)
12: for all i  $\in$  InfectedPopulation do
13: aux  $\leftarrow$  infect(i,recovered,dead)
14: if not null(aux) then
15: newInfectedPopulation  $\leftarrow$  aux
16: end if
17: end for
18: currentBestIndividual  $\leftarrow$  selectBestIndividual(newInfectedPopulation)
19: if fitness(currentBestIndividual) > bestIndividual then 20: bestIndividual  $\leftarrow$  currentBestIndividual
21: end if
```

---

```
22: recovered ← infectedPopulation
23: clear(InfectedPopulation)
24: InfectedPopulation ← newInfectedPopulation
25: time ← time + 1
26: end while
27: return bestIndividual
```

---

The **infect()** function decides whether the individual is an **ordinarySpreader** or a **superSpreader** or whether the individual is travelling or not by comparing a random number between 00 and 01 and sees if the value exceeds the probability of  $P\_TRAVEL$  and  $P\_SUPERSPREADER$  and then calls the **newInfection()** function with these parameters and returns a list, **newInfected**, of infected individuals as output.

This function allows the algorithm to run, after an initialization, with a loop that takes into consideration **time**, which is the variable that checks that the number of iterations has not yet been reached, and **infectedPopulation**, which is the list of infected people, if this list is empty the algorithm stops.

In the loop, the function first checks if any individuals have died with the **die()** function - we'll see more details on this function in a later point - then for each infected person we have, we infect with the **infect()** function new individuals and put them in **newInfectedPopulation** which updates the **infectedPopulation** list after each iteration.

Also at each iteration, the best individual is selected and put into **bestIndividual**.

**The infect() function** . This function is the function that allows the infection of new individuals

**The newInfection() function**. This is the function that actually infects people and works directly with individuals. The function starts by taking a list of individuals (an auxiliary list used just for moving individuals) and calls the replicate() function which is a function that is not defined by the CVOA algorithm but which is to be changed according to the function we have (we will see later how it was used in this project). Then check that this individual is not in quarantine by using the same method as the one that determines if the individual is travelling. Then this function returns the list newInfected.

**The die() function**. The die() function allows checking if an individual is dead or not. This function takes the **dead** list as a parameter and returns an update of this same list.

**The bestIndividual() function**. The **bestIndividual()** function is a utility function that compares the solutions and evaluations of the objective function.

In this work; the CVOA has been modified to meet the problem domain. In the **cvoa()** function, the **dead** population update was added at the end to avoid the case where patient zero **PZ** dies first without the possibility of infecting new individuals. The **replicate** function was implemented using hill- climbing search to generate new Redundancy optimization Problem solutions.

## Solution Representation

To exploit the continuous optimization metaheuristics, a discrete solution coding is used in (Dekhici et al.,2019)

$X_{ikl}$ : solution

$i=1 \dots$  to the number of particle i.e. Population size;

$k=1 \dots$  to the number of vehicles

$l=1 \dots$  to the number of client

Where  $X_{ikl}$  represents for the particle  $i$  the priority of assigning the vehicle  $k$  to the client  $l$

After sorting  $X_{ikl}$  for each fixed  $l$ , take the line  $k'$  of  $\max_i x_{ikl}$  and add it to  $S_{ik}$  which is the sequencing of care  $i$  assigned to the vehicle  $k'$ .

Then calculate the starting and ending dates on  $S_{ik}$  according to the duration of treatment and the distances between clients. The initial population is generated as follows:

$$X_i = X_{min} + (X_{max} - X_{min}) * rand () \quad (5)$$

Rand () is the generator of random floats from 0 to 1.

$X_{min}$  can be 1 and  $X_{max}$  can be taken as the number of clients.

This work will use the penalty function to evaluate the capacity hard constraints in CVRP. The penalty function is formed by adding to hard constraint a large positive number C as an example equal to 999999.

The weight for CO2 emission E is  $\lambda_1$  As we have not soft constraints this coefficient can be equal to 1.

$$f = \lambda_1 E + 999999 \text{ penalty} \quad (6)$$

## Experimentations and Discussion

### Data set

Data were customized from VRP benchmark

Table 1. Data of first example of the VRP

parameters	Value
Trucks	5
customers	32
Capacity	100
Nbr, generations	25
Example	A-n32-k5 xrp

The coefficients efl the CO2 emissions of a fully loaded (by weight) vehicle; eel the CO2 emissions of an empty vehicle and Q the volume capacity of a vehicle were added (Djebbar et al., 2020).



## Results

In the application interface, for each vehicle, the road is described with distance and pollutant emission (figure

1)

Route	Liste des clients	Contrainte Capacité	Nbr. Clients	Cap. Total	Distance	Taux CO <sup>2</sup> (%)
Route #4	13 37 40 52 60 66	Accépté	6	99	394.268	328.976
Route #5	5 11 15 16 36 41 47 51 55	Accépté	9	93	616.59	519.166
Route #6	12 18 42 46 59 9 25	Accépté	7	96	444.418	372.021
Route #7	30 43 48 62 29	Accépté	5	91	230.029	189.494
Route #8	3 4 8 14 53 54 56 57	Accépté	8	100	412.319	351.349
Route #9	6 7 21 28 35	Accépté	5	89	394.948	311.617

Figure 1. Roads description with the list of customers, constraints respect , number of customers, total load, distances and CO2 rate

For the first example and with 5 simulations, results shown in table 2 were obtained.

Table 2. Results of the first example of the GCVRP

Simulations	CO2 Emission		Distance	
	Local Search	CVOA	Local Search	CVOA
<b>1</b>	955,89	594,87	2351,74	1947,84
<b>2</b>	877,13	633,44	2302,03	1964,16
<b>3</b>	968,44	757,88	2430,63	1146,6
<b>4</b>	873,65	601,01	2263,98	1944,88
<b>5</b>	704,4	639,11	2069,18	1995,07
<b>avg.</b>	875,902	645,262	2283,5122	1799,71
<b>min</b>	704,4	601,01	2069,18	1146,6
<b>max</b>	968,44	757,88	2430,63	1995,07

For CO2 Emission, the average CO2 emissions for the Local Search method is 875.902, while for the CVOA method it is 645.262. The minimum CO2 emissions achieved in any simulation is 704.4 for the Local Search method and 601.01 for the CVOA method. The maximum CO2 emissions observed in any simulation is 968.44 for the Local Search method and 757.88 for the CVOA method.

For the routing total distance, the average distance traveled for the Local Search method is 2283.5122, while for the CVOA method it is 1799.71. The minimum distance covered in any simulation is 2069.18 for the Local Search method and 1146.6 for the CVOA method. The maximum distance traveled in any simulation is 2430.63 for the Local Search method and 1995.07 for the CVOA method.

Overall, the CVOA method shows better performance in terms of reducing CO2 emissions and distance traveled compared to the Local Search method, as it achieves lower average values and better minimum results.

To test the method effectively, well-balanced and poorly balanced sets are also used. Then balanced terms describe instances in the context of the Vehicle Routing Problem (VRP) based on certain characteristics of the problem instances, such as the distribution of customers, demand, or geographical layout. Well-balanced instances are often characterized by a more even distribution of customers and demands, while poorly balanced instances may exhibit irregularities, such as clustering of customers or highly imbalanced demands. Table 3 shows the results of CVOA optimization compared to initial solution.

Across both well-balanced and poorly balanced instances of the GCVRP, the CVOA method consistently outperformed the initial solutions, resulting in significant improvements in both CO2 emissions and distance traveled. The CVOA approach showcased notable enhancement rates, with an average improvement rate of approximately 12.82% for both CO2 emissions and distance.

Table 3. Results others well and bad balanced GCVRP

Set type in CVRP benchmarks	Truck capacity	customers	Generations	Initial solution CO2	Initial solution distance in km	CVOA	CVOA	
						Co2	distance	
A	9	100	65	25	3695,973	4420,232	3229,626	3844,008
A	10	100	80	25	4500,135	5373,909	4045.283	4841,285
A	9	100	70	25	3855,384	4557,46	3370.722	3885,282
B	7	100	52	25	2805,403	3303,104	2392,845	2825,282
/	/	100	/	avg.	3330,3935	3930,282	2392,845	3355,282

These results underscore the effectiveness of the CVOA method in optimizing the routing solutions and reducing the environmental impact of the GCVRP. By achieving substantial reductions in both CO2 emissions and distance traveled, the CVOA method demonstrates its potential to drive more sustainable and efficient vehicle routing practices. These findings highlight the importance of utilizing advanced optimization techniques, such as CVOA, to improve the overall performance and environmental sustainability of vehicle routing problems like the GCVRP.

The convergence of CVOA is shown in figure 2.

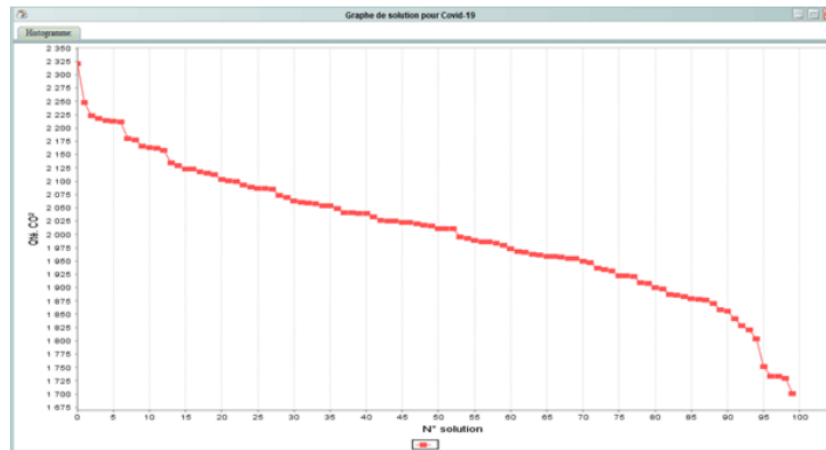


Figure 2. convergence of CVOA algorithm

Experiments and simulations were conducted on customized VRP benchmark adding specific GVRP coefficients demand and capacities to evaluate the performance of the CVOA in the GCVRP.

The results showed that the CVOA significantly outperformed existing algorithms in terms of pollutant emission reduction for a green transportation. The CVOA was able to find the optimal solution in a shorter distance, and the solution had a lower pollutant emission level compared to existing algorithms. These results demonstrate the potential of the CVOA as a promising solution for green transportation and pollutant minimization in the VRP.

### Conclusion

In this paper, an approach based on priority was utilized to discretize continuous algorithms for addressing the Green Capacitated Vehicle Routing Problem (GVRP). The objective of this approach was to minimize pollutant emissions from a fleet of heterogeneous trucks by considering factors such as the number of trucks, distance travelled, and product load to be dispatched. The study focused on well-established optimization algorithms and explored a recent metaheuristic.

The Corona Virus Optimization Algorithm (CVOA) was proposed as a solution for achieving green transportation and minimizing pollutant emissions in the VRP. The CVOA introduced a unique approach by incorporating a spread rate and an initial population of one solution called patient zero. Through experiments and simulations, it was demonstrated that the CVOA outperformed existing algorithms in terms of reducing pollutant emissions and promoting environmentally-friendly transportation. This study opens up new avenues for future research in the field of green transportation and pollutant minimization in the VRP, utilizing the Corona Virus Optimization Algorithm as a valuable tool.

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## Algorithm of Diagnosis and Treatment of Patients with Chronic Hemorrhoids

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**Abstract:** Algorithm of diagnosis and treatment of patients with chronic hemorrhoids including any others steps: General Considerations, Clinical Findings, Differential Diagnosis, Complications, Treatment, Prognosis. Essentials of Diagnosis “Hemorrhoids”: a) rectal bleeding, protrusion, discomfort; b) mucoid discharge from rectum; c) possible secondary anemia; d) characteristic findings on external anal inspection and anoscopic examination. General Considerations for chronic hemorrhoids including investigations of external hemorrhoids and internal hemorrhoids. Clinical Findings including analysis of symptoms and signs on examination. Differential Diagnosis patients with chronic hemorrhoids in first time application with similar manifestation for rectal cancer and other diseases for anorectal zone. Complications of chronic hemorrhoids: bleeding, prolapse recti and acute phlebotrombosis. Treatment may be any other for concrete of studies chronic hemorrhoids: First-degree, Second-Degree, Third-Degree and Fourth-Degree. Concrete of treatment program may be for patients with complications: for bleeding, for prolapse and for acute phlebotrombosis. Treatment Program for patients with hemorrhoids may be: Medical Treatment with application medicament's drugs, Rubber Band Ligation, Hemorrhoidectomy with application traditional and any others modern methods for excision, Sclerotherapy and Cryosurgery with application more any others mini-invasive methods. Prognosis for patients with chronic hemorrhoids after medicaments or surgical treatment is favorable.

**Keywords:** Hemorrhoids, Patients, Algorithm, Diagnosis, Treatment

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### Introduction

Hemorrhoids are one of the most common proctological diseases in the world. Its prevalence reaches up to 40% of the general population, with a higher incidence among middle-aged people with high socioeconomic status. It is estimated that about 50% of the general population experience symptomatic hemorrhoids at some point in their lives. In addition, pregnant women are at high risk of developing hemorrhoids. The prevalence of hemorrhoids in pregnant women ranges from 25% to 35%, and up to 85% of pregnant women suffer from hemorrhoids in the third trimester. Other subjects at increased risk of developing hemorrhoids are the elderly and those with a high body mass index. The severity of hemorrhoids is divided into four stages. Medical

treatment and lifestyle modification are appropriate for stage I-II hemorrhoids, which account for the vast majority (>90%) of all reported cases, while later stages III-IV of the disease require surgery. treatment, which may have a number of complications. In particular, changes in diet and lifestyle that require strict adherence by the patient to the regimen are usually considered the first step towards any conservative treatment of hemorrhoids. Drug treatment is mainly based on the use of topical preparations containing anti-inflammatory components, including steroids, anesthetics and / or antiseptics. However, in most cases, randomized trials have not been conducted to evaluate the efficacy and safety of various substances, which in some cases - for example, steroids - are associated with the potential onset of adverse events.

### **General Considerations**

Essentials of Diagnosis “Hemorrhoids”: a) rectal bleeding, protrusion, discomfort; b) mucoid discharge from rectum; c) possible secondary anemia; d) characteristic findings on external anal inspection and anoscopic examination. General Considerations for chronic hemorrhoids including investigations of external hemorrhoids and internal hemorrhoids.

### **External Hemorrhoids**

Symptomatic external hemorrhoids often present as a bluish-colored painful lump just outside the anus and they tend to occur spontaneously and may have been preceded by an unusual amount of straining. The skin overlying the outside of the anus is usually firmly attached to the underlying tissues. If a blood clot or thrombosis develops in this tightly held area, the pressure goes up rapidly in these tissues often causing pain. The pain is usually constant and can be severe. Occasionally the elevated pressure in the thrombosed external hemorrhoid results in breakdown of the overlying skin and the clotted blood begins leaking out. Patients may also complain of intermittent swelling, pressure and discomfort, related to external hemorrhoids which are not thrombosed.

### **Internal Hemorrhoids**

Painless rectal bleeding or prolapse of anal tissue is often associated with symptomatic internal hemorrhoids. Prolapse is hemorrhoidal tissue coming from the inside that can often be felt on the outside of the anus when wiping or having a bowel movement. This tissue often goes back inside spontaneously or can be pushed back internally by the patient. The symptoms tend to progress slowly over a long time and are often intermittent. Bleeding attributed to internal hemorrhoids is usually bright red and can be quite brisk. It may be found on the wipe, dripping into the toilet bowl. Not all patients with symptomatic internal hemorrhoids will have significant bleeding. Instead, prolapse may be the main or only symptom. Prolapsing tissue may result in significant irritation and itching around the anus. Patients may also complain of mucus discharge, difficulty with cleaning, or a sense that their stool is “stuck” at the anus. Patients without significant symptoms from internal hemorrhoids do not require treatment based on their appearance alone.

Internal hemorrhoids are classified by their degree of prolapse, which helps determine management:

**Grade One:** No prolapse

**Grade Two:** Prolapse that goes back in on its own

**Grade Three:** Prolapse pushed back in by the patient

**Grade Four:** Prolapse that cannot be pushed back in

### **Clinical Findings**

The most common manifestation of hemorrhoids is painless rectal bleeding associated with bowel movement, described by patients as blood drips into toilet bowl. The blood is typically bright red as hemorrhoidal tissue has direct arteriovenous communication. Positive fecal occult blood or anemia should not be attributed to hemorrhoids until the colon is adequately evaluated especially when the bleeding is atypical for hemorrhoids, when no source of bleeding is evident on anorectal examination, or when the patient has significant risk factors for colorectal neoplasia. Prolapsing hemorrhoids may cause perineal irritation or anal itching due to mucous secretion or fecal soiling. A feeling of incomplete evacuation or rectal fullness is also reported in patients with large hemorrhoids. Pain is not usually caused by the hemorrhoids themselves unless thrombosis has occurred, particularly in an external hemorrhoid or if a fourth-degree internal hemorrhoid becomes strangulated. Anal fissure and perianal abscess are more common causes of anal pain in hemorrhoidal patients.

The definite diagnosis of hemorrhoidal disease is based on a precise patient history and careful clinical examination. Assessment should include a digital examination and anoscopy in the left lateral position. The perianal area should be inspected for anal skin tags, external hemorrhoid, perianal dermatitis from anal discharge or fecal soiling, fistula-in-ano and anal fissure. Some physicians prefer patients sitting and straining in the squatting position to watch for the prolapse.

Although internal hemorrhoids cannot be palpated, digital examination will detect abnormal anorectal mass, anal stenosis and scar, evaluate anal sphincter tone, and determine the status of prostatic hypertrophy which may be the reason for straining as this aggravates descent of the anal cushions during micturition. Hemorrhoidal size, location, severity of inflammation and bleeding should be noted during anoscopy. Intrarectal retroflexion of the colonoscope or transparent anoscope with flexible endoscope also allow excellent visualization of the anal canal and hemorrhoid, and permit recording pictures (*Lohsirawat, 2012*).

### **Differential Diagnosis**

Differential Diagnosis between chronic hemorrhoids, anal fissure, rectal prolapse and rectal cancer.

#### *Chronic hemorrhoids*

External hemorrhoids:

External hemorrhoids are painful as the skin below the punctate line is sensitive to pain.

Blood clots may form in external hemorrhoids.

Thrombosed external hemorrhoids cause bleeding, painful swelling, or a hard lump around the anus.



When the blood clot dissolves, extra skin is left behind. This skin can become irritated or itchy.

Excessive straining, rubbing, or cleaning around the anus may make symptoms, such as itching and irritation, worse.

**Internal hemorrhoids:**

The most common symptom of internal hemorrhoids is bright red blood on stool, on toilet paper, or in the toilet bowl after a bowel movement.

Internal hemorrhoids that are not prolapsed are usually not painful.

Prolapsed hemorrhoids often cause pain, discomfort, and anal itching

**Skin examination:**

Inspection of the anal verge may show scratch marks and skin tags.

Inspection also may reveal external hemorrhoids or prolapsed internal hemorrhoids.

**Digital rectal examination:**

Digital rectal examination reveals the size and location of hemorrhoids.

Thrombosed hemorrhoids are tender to palpation.

Internal hemorrhoids are not palpable by digital rectal examination and the use of anoscope is mandatory.

### *Anal fissure*

Anal fissure usually presents with tearing pain with every bowel movement.

Pain usually lasts for minutes to hours after every bowel movement.

Patient is typically afraid of going to the bathroom to avoid the pain, which leads to a vicious cycle.

The fissure worsens the constipation and the constipation (hard stool) aggravates the fissure.

About two-thirds of the patients present with bright red blood streaks on toilet papers or on the surface of stools.

May be accompanied by pruritis and discharge.

Most fissures occur in the posterior mid-line of the anal canal.

Skin tags in the perianal area may accompany in chronic anal fissures.

### *Rectal prolapse*

Rectal prolapse most commonly occurs in multiparous females over 40 years old.

Appears as a progressive mass protrusion from the anus. The protrusion first appears with straining and defecation, then progresses to the degree when it is no longer replaced back.

It presents with abdominal discomfort and incomplete defecation.

Fecal incontinence and anal discharge.

Pain is not usually present.

Mass protruding from the anus.

Concentric mucosal rings are characteristic of rectal prolapse.

### *Rectal cancer*

Rectal bleeding is the most common presentation.

Mass sensation in the anus.

Mucoid discharge may occur.

Patient may give a history of anal condyloma.

Fecal incontinence.

On digital rectal examination, solid hemorrhagic mass that is firmly fixed to the surrounding structures is noted.

Femoral and inguinal lymph nodes may show lymphadenopathy secondary to spread of cancer.

### **Complications**

Complications of chronic hemorrhoids: bleeding, prolapse recti and acute phlebotrombosis.

Hemorrhoids can be chronic and painful, but they do not usually cause complications. Rarely, a thrombosed hemorrhoid may rupture. This might cause more bleeding and pain, but the site of the rupture usually heals on its own. In some cases, a skin tag might form at the location of a thrombosed hemorrhoid that has healed.

It is rare, but significant blood loss from chronic hemorrhoids has been associated with the development of anemia. Another rare complication is a strangulated hemorrhoid, where the blood flow to an internal hemorrhoid is cut off, which can cause extreme pain. Strangulated hemorrhoids present a risk of infection, so it's important to seek care in order to prevent this outcome. (*Sanchez, Chinn, 2011*).

### **Treatment**

Treatment Program for patients with hemorrhoids may be: Medical Treatment with application medicament's drugs, Rubber Band Ligation, Hemorrhoidectomy with application traditional and any others modern methods for excision, Sclerotherapy and Cryosurgery with application more any others mini-invasive methods.

#### *Medicament Treatment*

Medical treatment is mainly based on the use of topical preparations containing anti-inflammatory components, including steroids, anesthetics and / or antiseptics. However, in most cases, randomized trials have not been conducted to evaluate the effectiveness and safety of various substances, which in some cases - for example, steroids - are associated with the potential onset of undesirable manifestations.

### *Rubber Band Ligation*

Rubber band ligation is a procedure in which the hemorrhoid is tied off at its base with rubber bands, cutting off the blood flow to the hemorrhoid. This treatment is only for internal hemorrhoids.

To do this procedure, a doctor inserts a viewing scope (anoscope) into the anus. The hemorrhoid is grasped with a small tool. Then a device places a rubber band around the base of the hemorrhoid. The hemorrhoid then shrinks and dies and, in about a week, falls off.

A scar will form in place of the hemorrhoid. The scar will hold nearby veins so they don't bulge into the anal canal.

The procedure is done in a doctor's office. You will be asked if the rubber bands feel too tight. If the bands are extremely painful, a medicine may be injected into the banded hemorrhoids to numb them.

The procedure takes about 30 minutes. You can go home when it's done. Some people are able to return to regular activities right away. Others may need to take a few days off from work.

After the procedure, you may feel pain and have a sensation of fullness in your lower belly. Or you may feel as if you need to have a bowel movement.

Make sure not to lift anything heavy until you heal. It's also important not to strain when you have a bowel movement. Treatment is limited 1 hemorrhoids at a time if done in the doctor's office. Several hemorrhoids may be treated at one time if the person has general anesthesia. More areas may be treated at 4- to 6-week intervals. (*American Gastroenterological Association, 2004*).

### *Sclerotherapy*

Injection sclerotherapy for all grades of inter hemorrhoids in various situations and co-morbidities has become popular method of treatment. Several types of surgical operations both conventional and stapled hemorrhoidectomy has many and serious described side effects. On the contrary, proctoscopic injection sclerotherapy using some of the modern sclerosants and thin bore needle injections is an office-based ambulatory method of treatment of internal hemorrhoids; it is low in cost, devoid of any major complications besides it is quite successful as reported.

### *Cryosurgery*

In favor of cryosurgery is the fact that it can be applied on an outpatient basis—admittedly at the price of a fair amount of discomfort—and that it can provide successful destruction of hemorrhoids in roughly 70 per cent of patients who would otherwise be candidates for hemorrhoidectomy. Some of the 30 per cent of patients who do not secure satisfactory results might conceivably be helped by repeat cryosurgery, but the discomfort associated with the first treatment has tended to militate against a repetition of this form of therapy. (*Goligher, 1976*).

### *Mini-invasive methods*

Procedure for Prolapse and Hemorrhoids (PPH):

PPH is also called a stapled hemorrhoidectomy. The doctor will use a stapler-like device to reposition the hemorrhoids and cut off their blood supply. Without blood, they'll eventually shrivel and die.

It can treat hemorrhoids that have and have not prolapsed, or slipped down out of the anus.

This procedure moves the hemorrhoid to where there are fewer nerve endings, so it hurts less than a traditional hemorrhoidectomy. You'll also recover faster and have less bleeding and itching. And there are generally fewer complications.

Hemorrhoidal Artery Ligation and Recto Anal Repair (HAL-RAR):

Hemorrhoidal Artery Ligation and Recto Anal Repair (HAL-RAR) is a new procedure in which a miniature Doppler sensor is inserted in the anus to detect the arteries supplying blood to hemorrhoids.

The surgeon can pinpoint the arteries supplying the hemorrhoids and can tie them off to cut the blood supply.

The hemorrhoids are reduced almost immediately and within weeks, are no longer noticeable. The procedure is effective and virtually painless.

Transanal Hemorrhoidal Dearterialization (THD):

Hemorrhoids are enlarged, bulging veins within and around the anal canal. The two groups of hemorrhoids are external and internal hemorrhoids which are differentiated by their location. The internal hemorrhoid problems can be classified as per the severity, ranging from grade 1 without prolapse to grade 4 in which hemorrhoid remains prolapsed outside of the anus. Although several treatment options are available, a number of patients prefer a minimally invasive approach. The combination of advances in the technology and the outstanding experience of the colorectal surgeons now offer a minimally invasive technique called Transanal Hemorrhoidal Dearterialization (THD) as a novel treatment alternative. Compared to other surgical options, the superiority and advantages of THD include; less pain and fewer procedure-related complications as well as minimizing the chance of recurrence.

### *Hemorrhoidectomy*

A hemorrhoidectomy is performed in the following settings:

Symptomatic grade III, grade IV, or mixed internal and external hemorrhoids

Where there are additional anorectal conditions that require surgery

Strangulated internal hemorrhoids

Some thrombosed external hemorrhoids

Where patients who cannot tolerate or fail minimally invasive procedures.

## Prognosis

Hemorrhoids can be uncomfortable or even painful, but most of the time, you won't experience any noticeable symptoms, and complications are very rare.

Internal or external hemorrhoids that don't prolapse or thrombose are more likely to heal without causing any symptoms or complications. Prolapsed and thrombosed hemorrhoids are much more likely to cause discomfort or increase your risk of complications.

Seek emergency medical attention if your hemorrhoids cause pain and discomfort or if you notice any symptoms like bleeding or prolapse. Hemorrhoids that are treated quickly have a better chance of healing without causing any further complications.

## Method

184 patients of both sexes (86 women, 98 men) with chronic hemorrhoids were involved in our observations based on the Regional Proctology Center (Dnipro, Ukraine) for the years 2018-2022, devoted to the comparative analysis of the results of the use of drugs from different manufacturers for the local medical treatment of hemorrhoids. who received medical local therapy with Procto-Glyvenol®, Recordati, Italy, and 793 patients (403 women and 390 men) who underwent hemorrhoidectomy with the LigaSure device and EK-3000M (electrobiological tissue welding method).

### Method with Procto-Glyvenol® Therapy

It has been confirmed that tribenoside is a saccharide derivative that is widely used for the treatment of hemorrhoids. Several studies have shown that tribenoside has a unique spectrum of pharmacological activity, including anti-inflammatory, analgesic, anti-toxic, wound-healing, promoting fibrinolysis, anti-arthritis action, release of amines, stabilization of membranes.

Membrane-stabilizing and venotropic properties were reported. It should be noted that, unlike corticosteroids or nonsteroidal anti-inflammatory drugs, tribenoside does not adversely affect the gastrointestinal tract, connective tissue, or the immune system and does not affect prostaglandin synthetase.

Tribenoside apparently has positive pharmacological properties characteristic of glucocorticoids and non-steroidal anti-inflammatory drugs (NSAIDs), but at the same time it does not show an undesirable effect on the gastrointestinal system, connective tissue or the body's defense system. It is noteworthy that tribenoside exhibits anticoagulant and inhibitory activity against inflammatory mediators, such as histamine and prostaglandins, thereby improving microcirculation, reducing capillary permeability, and improving vascular tone.

In an *in vitro* study specifically to study the molecular mechanisms underlying the effectiveness of tribenoside in the treatment of hemorrhoids, the expression of laminin a5—a major component of basement membranes whose integrity is disrupted in this disease—was 4 times higher in cells treated with tribenoside, than in the control cell culture. (Lorenc, Gokce, 2016). These data are confirmed by a comparative analysis of the results of the use of various local drugs in our observations of 184 patients with chronic hemorrhoids who received local combination therapy with tribenoside lidocaine with a significant healing effect, thanks to the improvement of microcirculation, strengthening of vascular tone and reduction of capillary permeability. Taken together, these data suggest that tribenoside interacts with epidermal cells and regulates laminin expression and localization, thereby helping to reconstruct the basement membrane during hemorrhoidal wound healing.

On the other hand, lidocaine is a widely used local anesthetic that relieves pain, burning, and itching caused by hemorrhoids. This molecule is characterized by a rapid (several minutes) onset of its surface anesthetic action, providing rapid relief of pain and itching. Thus, this combined therapy combines the rapid local anesthetic action of lidocaine with the effectiveness of tribenoside in accelerating local healing and restoring local blood vessels to normal.

This dual mechanism of action allows you to control both subjective (eg, pain and discomfort) and objective (eg, prolapse and bleeding) symptoms of hemorrhoids, reducing inflammation and improving vascular tone.

Currently, the standard topical treatment for hemorrhoids is steroids.

However, they have an unfavorable toxicity profile due to the risk of systemic adsorption, which may limit their use in the medium term or in some specific groups of patients, such as pregnant/lactating women, the elderly,

patients with certain infections (eg, mycosis, HSV, local viral infections, tuberculosis) or athletes.

The combination tribenoside + lidocaine is a single composition (cream or suppositories) containing two different molecules that have a complementary effect.

Tribenoside can improve microcirculation, promote the healing of the basement membrane, and improve local microcirculation and vascular tone, thereby eliminating the objective symptoms of hemorrhoids. On the other hand, lidocaine is a widely used local anesthetic capable of causing rapid relief of subjective symptoms, such as local pain and discomfort, which may be perceived by patients as the most bothersome.

### **Method with Surgical treatment**

Hemorrhoids are a disease that often requires surgical treatment. Hemorrhoidectomy methods are accompanied by quite a large number of postoperative complications, such as pain syndrome, urination disorders, bleeding, local edema, narrowing of the anus, which leads to additional patient suffering and increases the cost of

treatment.

The use of the LigaSure (Covidien) and EK-3000M (SVARMED) electrocautery generators for the removal of hemorrhoids and cauterization of blood vessels in hemorrhoidectomy can also be complicated by stricture of the anus. We studied the dependence of the development of anal strictures on the method of anesthesia during surgery.

Application of the LigaSure method in the treatment of 793 patients diagnosed with "Chronic hemorrhoids". After divulsion of the anal sphincters, the anal canal is revised. The internal node is tightened with a clamp and the bent electrode of the LigaSure apparatus is placed on its stretched base, including the vascular pedicle.

Electrocoagulation of the base with a vascular pedicle is carried out at an intensity of 2 or 3 LEDs, after which the internal hemorrhoidal node is removed with a clamp knife without inserting the vascular pedicle. The external hemorrhoidal node is tightened and electrocoagulation of its base is carried out, the node is removed with a clamp knife. 655 patients underwent local anesthesia with bupivacaine administration, 138 patients - intravenously.

## **Results**

### **Results for Procto-Glyvenol® Therapy**

The above-described personal comparative observations conducted by us on 184 patients who received combined treatment of chronic hemorrhoids with the drug Procto-Glyvenol® (tribenoside + lidocaine) indicate a rapid and pronounced reduction in the symptoms of hemorrhoids (burning, discomfort, pain, bleeding during defecation, falling formations from the anus).

Reduction or cessation of burning, discomfort, pain in the area of the anus during the act of defecation occurred in all patients 10-30 minutes after using the drug. The cessation of bleeding during the act of defecation and the loss of hemorrhoidal nodes occurred on the 5-6th day after the start of local medical treatment with Procto-Glyvenol® in 102 patients, on the 9th-10th day - in all patients.

Since the use of steroids is not recommended for long periods due to possible side effects, tribenoside + lidocaine can be a fast, effective and safe way to treat hemorrhoids. It is noteworthy that this combination is particularly suitable for some groups of patients with a high risk of hemorrhoids, for whom steroids may be contraindicated. In particular, tribenoside + lidocaine can be safely prescribed to pregnant women after the first trimester of pregnancy and during breastfeeding. In addition, the combination of tribenoside + lidocaine may be suitable for athletes or patients with certain types of infections who cannot be prescribed steroids.

It should be noted that the efficacy and safety of tribenoside + lidocaine were stable regardless of the specific formulation and dosage regimen, and were also observed in women with hemorrhoids due to recent childbirth or pregnancy. The dosage of the combination was optimized for specific compositions (cream or suppository) during the product development stage.

### **Results for Surgical treatment**

Out of 655 patients, a complication occurred - stricture of the anus in 20 (3%) after hemorrhoidectomy by the LigaSure and EK-3000M methods under local anesthesia with bupivacaine administration. Hemorrhoidectomy by the LigaSure and EK-3000M methods under intravenous anesthesia in 138 patients had no complications in the form of anal stricture. The use of local anesthesia led to the formation of edema of the perianal area during the operation and could be the cause of improper or insufficiently controlled removal of excess tissue mass by the doctor. This could lead to the formation of strictures of the anus, which required postoperative bulging, and in 8 cases repeated surgery to remove the scar.

To prevent the formation of anal strictures after hemorrhoidectomy, we suggest performing operations using intravenous anesthesia, and in cases where local anesthesia is used, especially carefully control the limits of removal of pathologically changed tissues.

### **Discussion**

Hemorrhoids are swollen, enlarged veins that form inside and outside the anus and rectum. They can be painful, uncomfortable and cause rectal bleeding. Hemorrhoids are also called piles. We're all born with hemorrhoids, but at baseline, they don't bother us. It's only when they become swollen and enlarged that they produce irritating symptoms.

Hemorrhoids, or piles, are a common problem. These swollen veins inside the rectum or outside the anus can cause pain, anal itching and rectal bleeding. Symptoms often improve with at-home treatments but on occasion people need medical procedures. Eating more fiber can help prevent hemorrhoids.

The choice of treatment for patients with chronic hemorrhoids may depend on the manifestation of the severity of the disease, however, in stage III-IV disease, two methods can be mainly used: medical treatment and options for hemorrhoidectomy.

### **Conclusion**

There is no best treatment for hemorrhoids. Every patient is different, and the physician and patient need to



understand each other's expectations, weigh the risks and benefits and arrive at a mutual decision. A good patient-doctor relationship is essential.

It should be noted that the efficacy and safety of tribenoside + lidocaine were stable regardless of the specific formulation and dosage regimen, and were also observed in women with hemorrhoids due to recent childbirth or pregnancy. The dosage of the combination was optimized for specific compositions (cream or suppository) during the product development stage.

Given the variety of available treatments, head-to-head comparisons are difficult. Moreover, the efficacy and applicability of each technique changes with the grade of the lesion or lesions and the skill of the practitioner. Lacking comprehensive studies comparing conservative, office-based and surgical management, no decisive statements can be made based on current evidence.

## Recommendations

We recommend using the proposed technologies in the practices of surgeons-proctologists for medicaments treatment or surgical operations of patients with chronic hemorrhoids.

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## Investigation of Results Laboratory and Instrumental Methods for Differential Diagnosis of Ulcerative Colitis

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**Abstract:** Ulcerative Colitis (UC) is a diffuse inflammatory disease confined to the mucosa initially. Abscesses form in the crypts of Lieberkuhn, penetrate the superficial submucosa, and by spreading horizontally cause the overlying mucosa to slough. Vascular congestion and hemorrhage are prominent.

Cardinal symptoms: rectal bleeding and diarrhea.

The most difficult differential diagnosis is between mucosal Ulcerative Colitis and Cronh`s Disease (CD) or Colon Cancer (CC).

Application laboratory methods of investigation: results of general clinic blood analysis, results of biochemical blood analysis, results of general clinic urine analysis.

Imaging studies: barium enema examination with x-ray.

Colonoscopy finding with biopsies:

Morphology - confluent involvement, rectum usually involved, mesocolon not involved and nodes enlarged, widespread ragged superficial ulceration, inflammatory pseudo-polyps, no thickening of bowel wall and other pathological results;

Microscopic – inflammatory reaction usually limited to mucosa and submucosa; only in severe disease are muscle coats involved; no fibrosis; granulomas rare.

Investigation of results laboratory and instrumental methods for differential diagnosis of Ulcerative Colitis and other similar diseases: Cronh`s Disease and Colon Cancer, and application in work for gastroenterologists, proctologists, oncologists and rheumatologists.

**Keywords:** Investigation, Differential, Diagnosis, Ulcerative Colitis.

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## Introduction

Ulcerative Colitis (UC), including extraintestinal manifestations of joint and spine lesions, is a necrotizing, destructive inflammation of the mucous membrane and submucosa of the large intestine of a nonspecific nature, of unknown etiology. (*Bourikas L. A., Papadakis K. A., 2009*).

The primary incidence of UC is 1,5-15,0 per 100,000 population, the prevalence is 20-130 per 100,000 population. UC is characterized by chronic inflammation. Although this inflammation primarily affects the lower part of the digestive tract, the symptoms of these disorders can vary greatly depending on the condition and may also impact other parts of the body.

The exact causes of UC remain unknown. In general, inflammatory bowel disease (IBD) is thought to be caused by interactions between genetic factors and immunologic factors, as well as between a person's environment and lifestyle and the bacteria in the gut (macrobiotic). Although psychological factors and stress may trigger flare-ups in people who already have Ulcerative Colitis, they are not thought to be underlying causes of the disease based on current research.

The etiology of UC is unknown, and the pathogenesis is little studied. The mechanism of primary damage is based on the development of reactions of hypersensitivity and auto-aggression, which lead to degenerative-necrotic changes in the epithelium and disruption of micro-circulation in the wall of the large intestine.

Etiological factors:

Genetic factor (HLA system: genetic HLA markers of UC, CD were found in various populations; using HLA-DNA genotyping, markers of predisposition and resistance to UC were identified.

Microbial factor (high degree of immunization of patients with UC 0 antigen Esherichia Coli 014; E.Coli has a high adhesive ability to epithelial cells of the mucous membrane and can initiate their resolution; positive effect of probiotics containing Escherichia coli strain Nissle 1917).

Violation of the permeability of the intestinal barrier.

Environmental factors (Nicotine: UC is less common in heavy smokers than non-smokers; in CD, smoking increases the risk of the disease several times; drugs: NSAIDs; malnutrition: a significant increase in this pathology in countries where "fast foods" are used in the diet.

Violation of the immune response (dysregulation of the local immune response underlies the development of an

inflammatory reaction in the intestinal wall)

Thus, genetic predisposition, the possibility of an immune response, exposure to exogenous factors in the presence of a number of endogenous disorders leads to the development of chronic inflammation of the mucous membrane in Ulcerative Colitis.

Although the disease can be diagnosed at any age, the highest number of new cases (incidence) are diagnosed in people between the ages of 20 and 40 years old. Men and women are about equally affected by the disease.

The following factors play a role in the development of inflammation:

Violation of the biocenosis of the intestinal flora

Genetic defects (MDR1 gene)

Violation of the immune response

Environmental risk factors (tobacco smoking reduces the risk), medicinal drugs - non-steroidal anti-inflammatory drugs, nutritional disorders.

The spread of inflammatory-necrotic changes from the rectum in the oral direction leads to a violation of the absorptive, secretory, reservoir, and evacuation functions of the large intestine, and in total vitamin-synthesizing colitis, which is manifested by diarrhea, tenesmus, and bleeding into the lumen of the intestine.

All digestive organs are involved in the development of the pathological process. Homeostasis is disturbed: dysproteinemia, imbalance of electrolytes and carbohydrates occurs. The development of dysbacteriosis and the addition of superinfection further disrupt the metabolism.

As a result of constant endogenous intoxication and autosensitization, secondary lesions of the liver, kidneys, pancreas and central nervous system, joints and spine occur.

### **Classification**

*According to the severity of the disease (according to the DAI index) (see Table 1):*

mild (up to 5)

medium (5-9)

severe (9-12)

*According to the clinical course:*

acute (lightning)

chronic relapsing

chronic continuous course

*By anatomical type:*

proctitis

proctosigmoiditis

left-sided colitis

pan-colitis (total colitis - all colon).

The lesion begins most often from the rectum - the dentate line and spreads in the proximal direction. In the early stages of colitis, a vascular reaction is noted with a further violation of the integrity of the epithelium, the addition of ulceration of the mucous membrane. The resulting ulcers capture only the submucosal layer; as a rule, they do not spread into the depths of the intestinal wall. In the active phase, ulcers of various sizes spread to the edematous, plethoric mucosa.

Sometimes it is a continuous ulcerative surface, covered with a film of fibrin. But most often, a large number of small erosions and ulcers are noted on the mucous membrane, including pseudopolyps, the development of which is associated with the destruction of the mucous membrane, regeneration of the epithelium. The severity of morphological changes increases in the distal direction (most pronounced in the descending and sigmoid colon). In 15-30%, the terminal ileum may be affected.

Table 1. Disease Activity Index (DAI)

The number of defecations during last week	Normal (as in remission)	0
	By 1-2 > norms	1
	On 3-4 > norms	2
	At > 4 > norms	3
Bloody stools (for last week)	There is none	0
	Blood veins	1
	Obvious impurities of blood	2
	Mainly blood	3
Appearance of mucous membrane	Normal	0
	Increased vulnerability of the mucous membrane	1
	High vulnerability of the mucous membrane	2
	Exudation, spontaneous bleeding	3
Assessment of the degree of activity a doctor	Norm	0
	Mild degree	1
	Moderately heavy	2

### **Clinical manifestations of UC**

Defecation of feces with pathological impurities (blood, mucus, pus, fibrin) occurs due to ulcerative defects of the intestinal wall.

The primary symptom of Ulcerative Colitis is diarrhea containing blood and pus which occurs at night as well as during the day. Other symptoms include abdominal pain, which is often centered at one specific spot in the gut (frequently in the lower left abdomen) but can spread to the entire abdomen.

Frequent defecation as a result of accelerated transit of intestinal contents and entry into the intestinal lumen of exudate and transudate, which is secreted by the inflamed mucous membrane. (*Lukavetskyj O., 2018*).

Abdominal pain, tenesmus.

The disease typically begins gradually, although some people may also have severe and acute symptoms (called fulminant disease) at the time of their diagnosis.

Manifestations of intoxication (hyperthermia, loss of appetite, body weight).

Extraintestinal manifestations may even cause symptoms before the actual inflammation of the digestive tract has started.

Extraintestinal manifestations (arthritis, iridocyclitis, uveitis, vascular lesions, amyloid nodules, primary sclerosing cholangitis).

### **Laboratory and instrumental research**

#### *Laboratory methods:*

Laboratory diagnostics is aimed at determining the degree of anemia, leukocytosis, accelerated ESR. These tests can be combined with other ones like the erythrocyte sedimentation rate (ESR) to collect information about the intensity of the inflammation. Hypoproteinemia, hypoglobulinemia, electrolyte imbalance are also detected. An increase in the level of C-reactive protein can be one of the markers of disease activity.

Other laboratory tests may be performed to gather additional information. These tests can include general blood tests as well as tests for inflammation parameters like the C-reactive protein (CRP). An analysis of gut bacteria may also be needed.

Examination of feces - coprology, pathogenic flora, dysbacteriosis for the purpose of differential diagnosis with intestinal infections and correction of dysbacteriosis.

*Instrumental methods:*

Endoscopic examination is the main method of examination of patients with UC. The mucous membrane is granular, there is no vascular pattern due to swelling, pronounced contact bleeding. In case of a severe course, ulcers and erosions are determined.

During remission, "pseudo-polyps" can be identified, which are islands of preserved mucous interstitium with ulcers. During the endoscopic examination, it is necessary to establish border inflammation to determine the anatomical type of colitis and, accordingly, drug therapy. Also, during colonoscopy, biopsy material is taken to determine the possible morphological picture of ulcerative colitis during histological examination.

Endoscopic examination of the colon (in the acute phase, it is carried out without prior preparation with enemas). Colonoscopy are one of the main research methods, since the rectum is affected in 95% of cases. Characterized by the presence of mucus, blood, pus that close the mucosa.

The study notes: swelling and hyperemia of the mucous membrane of the sigmoid and rectum; the vascular pattern characteristic of the normal mucous membrane of the large intestine is lost; haustration of the colon disappears. Various in size and shape of erosion and ulcers with undermined edges and bottom covered with pus and fibrin.

The presence of a solitary ulcer should be a concern for cancer. With a long course of the disease, edema and excessive regeneration of the epithelium with the formation of pseudopolyps are observed in the remaining islands of the mucous membrane. UC mild degree manifests itself in the form of mucosal granularity.

Colonoscopy allows you to assess the extent and severity of the lesion, especially if you suspect the presence of malignancy.

In special cases, additional tests like an X-ray of the abdomen may be necessary. The doctor may also order a CT (computed tomography) or MRI (magnetic resonance imaging) scan to clarify specific issues. (*Leclerc-Jacob S., Lux G., Rat A.C., et al., 2014*).

Irrigography is used, during which it is possible to detect the absence of haustration, pseudopolyps, which together give the intestine the shape of a "water pipe", ulcers will form a symptom of a "moth-eaten row". Acute toxic dilatation and the presence of free gas in the abdominal cavity are contraindications to irrigoscopy.

## Method

An analysis was made of the results of laboratory and instrumental studies of treated patients 255 (men 157 and women 98) in the Regional Proctology Center of the Dnipro for 2017-2022 with diagnoses of Ulcerative Colitis (115 patients), Crohn's Disease (34 patients) and Colon Cancer (106 patients) on the basis of the department Surgery No. 1 of the Dnipro State Medical University.

Blood tests do not confirm a diagnosis of Ulcerative Colitis, but may show that a person has anemia, an increase in white blood cells (seen with inflammation), low albumin protein and an increased erythrocyte sedimentation rate (ESR) or elevated C-reactive protein, which also indicates an active inflammation. The doctor may also order tests to evaluate the function of the liver and other organs and systems.

Such changes may also be due to the presence in a patient with ulcerative colitis of various types of extraintestinal articular manifestations and damage to other organs and systems.

Crohn's Disease is characterized by: anemia (usually of mixed origin: anemia of chronic diseases with iron deficiency), leukocytosis, thrombocytosis, accelerated ESR and increased C-reactive protein. Perhaps a decrease

in iron, serum ferritin, vitamin B12 (in case of damage to the proximal intestine and stomach), dysproteinemia with hypoalbuminemia (as a result of malabsorption in the intestine). In the immunogram: often - an increase in hypergammaglobulemia (IgG), sometimes there is a selective deficiency of IgA. ASCA detection (antibodies to *Saccharomyces cerevisiae*), for diagnostically difficult cases, helps to confirm, can serve as an additional serological marker in the diagnosis of Crohn's Disease.

Laboratory studies are carried out to detect anemia, hypoalbuminemia, electrolyte imbalance. Assess liver tests; an increase in alkaline phosphatase and gamma-glutamyl transpeptidase in widespread colon damage suggests primary sclerosing cholangitis. Leukocytosis and an increase in acute phase parameters (erythrocyte sedimentation rate, C-reactive protein) are not specific signs, but can be used to control disease activity.

Perinuclear antibodies against neutrophilic cytoplasm are present in 60–70% of cases in ulcerative colitis and only in 5–20% in CD. Antibodies to *Saccharomyces cerevisiae* are relatively specific for Crohn's Disease. However, these studies do not reliably differentiate between the 2 diseases and are therefore not recommended for routine diagnosis. Additional antibodies such as anti-OmpC and anti-CBir1 are currently available for investigation, but the clinical relevance of these additional tests is uncertain; some studies suggest that high titers of these antibodies have a negative prognostic value.

Sometimes the first sign is an abnormal lab test (for example, anemia due to Colon Cancer).

Ulcerative colitis and Crohn's Disease are two types of inflammatory bowel disease (IBD) that lead to chronic inflammation in the digestive tract.



The mechanism leading to inflammation in IBD is not well understood, but is thought to involve a complex interaction between the immune system, gut, and gut microbes. New evidence suggests that gut microbial composition is different and possibly abnormal in IBD patients, and that correcting this variation may help control inflammation in UC and CD patients. Fecal administration from healthy donors to patients with UC or CD is an intervention aimed at restoring a healthier balance of gut microbes and controlling IBD.

According to the endoscopic picture of Ulcerative Colitis, four degrees of inflammation activity in the intestine are distinguished: minimal, moderate, pronounced, and pronounced.

I degree (minimum) is characterized by mucosal edema, hyperemia, lack of vascular pattern, mild contact bleeding, small punctate hemorrhages.

II degree (moderate) is determined by edema, hyperemia, granularity, contact bleeding, the presence of erosion, confluent hemorrhages, fibrinous plaque on the walls.

III degree (expressed) is characterized by the appearance of multiple confluent erosions and ulcers against the background of the changes in the mucous membrane described above. In the lumen of the intestine pus and blood.

IV degree (sharply pronounced), in addition to the listed changes, is determined by the formation of pseudopolyps and bleeding granulations.

Rakhmilevich Index - Endoscopic Index (*Rakhmilevich, 1989*):

1. Light-scattering granulations on the surface of the mucous membrane (granularity): no - 0, yes - 2.
2. Vascular pattern: normal - 0, deformed or blurred - 1, absent - 2.
3. Bleeding of the mucous membrane: absent - 0, small contact - 2, pronounced (spontaneous) - 4.
4. Damage to the surface of the mucous membrane (erosion, ulcers, fibrin, pus): absent - 0, moderately pronounced - 2, significantly pronounced.

Colonoscopy for Crohn's Disease (with biopsy, sampling for intestinal pathogens, and inspection of the terminal ileum if possible). Upper gastrointestinal endoscopy may show signs of mild lesions even in the absence of upper gastrointestinal symptoms. (*Mendoza J.L., Lana R., Taxonera C., et al., 2005*).

In the vast majority of cases, Colon Cancer is formed from precancerous formations - polyps. They are growths that grow into the intestinal cavity from the mucous membrane. Polyps are clearly visible during a colonoscopy. Thanks to this procedure, the doctor examines the mucous membrane, the image of which is displayed on the monitor in an enlarged form.

Two types of polyps are classified: adenomatous and hyperplastic. It is adenomatous that can become malignant over time. For most people, the process of their transformation into tumors takes at least 10 years.

Colonoscopy is the only method that allows you to thoroughly examine the mucous membrane of all parts of the colon. For this procedure, a special device is used - a colonoscope. It is a thin flexible tube with an optical system at the tip, due to which the image is enlarged by more than 100 times and displayed on the monitor.

This procedure requires special preparation, the task of which is to completely cleanse the intestines. For this, a liquid solution is used that causes temporary diarrhea. Before doing a colonoscopy, the patient takes antispasmodics and anesthetics. These drugs allow you to relax and experience less discomfort during the diagnosis.

During the procedure, the patient lies on his side, and a colonoscope is inserted into his anus, after which air is supplied to the intestines. Due to this, the walls of the organ straighten out and the doctor can conduct a thorough examination of the intestines. Sometimes the doctor performs a biopsy - taking a piece of tissue from suspicious areas.

This sample is sent to a laboratory where it is examined for cancer cells. If polyps or oncological formations are found, the doctor can remove them right during the colonoscopy.

How often should Colon Cancer screening be done?

The frequency of colonoscopy is based on the presence of risk factors in each individual. In general, this procedure is shown to all people who are over 50 years old. After reaching this age, diagnostics should be carried out every 10 years. If a person falls into the high-risk category, you should not wait until the age of 50. In this case, colonoscopy should be performed at an earlier age and more frequently.

If 1 first-line relative (father, mother, sibling or sister) had cancer or was diagnosed with adenomatous polyps before the age of 60, the first colonoscopy should be performed at 40. You need to repeat the procedure once every 5 years.

If 2 relatives of the first line were diagnosed with cancer or adenomatous polyps at any age, the diagnosis should be performed starting from the age of 40 - once every 5 years.

If 1 first-degree relative had colorectal cancer or was diagnosed with adenomatous polyps at age 60 or older. In this case, screening should be done at age 40, but colonoscopy should be repeated every 10 years.

If 2 or more second-line relatives (grandparents, aunt or uncle) suffered from bowel cancer. In this case, the first examination of the intestine by colonoscopy should also be carried out at the age of 40. You need to repeat the procedure once every 10 years.

People who are at very high risk due to familial adenomatous polyposis, hereditary non-polyposis cancer, or inflammatory bowel disease need a separate approach. These patients should be under the supervision of a doctor and undergo a whole range of measures to prevent colon cancer. (*Pan J., Xin L., 2016*).

The frequency of colonoscopy should only be determined by an experienced gastroenterologist and surgeon-proctologist.

## Results

The result of the analysis of laboratory and instrumental studies of 255 patients treated (157 men and 98 women) in the Regional Proctology Center of the Dnipro for 2017-2022. with diagnoses: Ulcerative Colitis (115 patients), Crohn's Disease (34 patients) and Colon Cancer (106 patients) on the basis of the Department of Surgery No. 1 of the Dnipro State Medical University, there were data that confirm generally accepted international information.

These data confirm that the results of general clinical laboratory and instrumental studies are sufficient for effective differential diagnosis of Ulcerative Colitis with Crohn's Disease and Colon Cancer.

Effective for differential diagnosis were the results of laboratory and instrumental studies: general clinical blood test, biochemical blood test (including C-reactive protein), colonoscopy with biopsy and histological conclusion, irrigography.

Undoubtedly, the most important were the results of performed colonoscopies with biopsy material sampling and obtaining a histological conclusion, which maximally contributed to the differential diagnosis between Ulcerative Colitis, including extraintestinal articular manifestations, Crohn's Disease and Colon Cancer.

## Discussion and Conclusion

In discussing our work, it should be noted that the results of laboratory and instrumental studies that were used for the differential diagnosis of patients with Ulcerative Colitis, Crohn's disease and Colon Cancer convincingly and reliably differentiate these diseases, including those with possible extraintestinal manifestations.

Our observations on the results of laboratory and instrumental studies of 255 patients who were treated (157 men and 98 women) in the Dnipro Regional Proctology Center for 2017-2022. with diagnoses: Ulcerative Colitis (115 patients), Crohn's Disease (34 patients) and Colon Cancer (106 patients) at the Department of Surgery No. 1 of the Dnipro State Medical University, which are confirmed by other international data, allow a short discussion and proceed to the conclusion.

In conclusion, realizing that Ulcerative Colitis, which may be accompanied by extraintestinal articular manifestations, as well as Crohn's Disease and Colon Cancer, remain dangerous diseases that require correct and

informative diagnosis, including differential diagnosis.

Satisfactory differential diagnosis of Ulcerative Colitis, Crohn's Disease and Colon Cancer with the help of informative laboratory and instrumental studies allows for timely and effective treatment of patients with this pathology.

## Recommendations

We recommend using the proposed technologies in the practices of gastroenterologists, rheumatologists and surgeons-proctologists for differential diagnosis of patients with Ulcerative Colitis, Crohn's Disease and Colon Cancer.

## Acknowledgments

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## Treatment Program for Patients with Ulcerative Colitis

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**Abstract:** Manifestation for Ulcerative Colitis – essential of diagnosis: diarrhea, usually bloody; abdominal cramps; fever, weight loss, anemia; absence of specific fecal pathogens; endoscopic and radiography abnormalities.

Treatment program for patients with Ulcerative Colitis including more steps.

Conservative treatment depended from active process of disease:

- a) mild attack – diet, 5-ASA 2-8 g/d, corticosteroids 100 mg;
- b) severe attack – severe or fulminating Ulcerative Colitis requires hospitalization; corticosteroids are given intravenously initially as hydrocortisone (100-300 mg/d) or prednisolone (20-80 mg/d) + 5 ASA-therapy;
- c) maintenance – hospitalization; 5-ASA-therapy + corticosteroids therapy + immunosuppressive therapy.

Surgical treatment including analysis two situations:

1. Indications:

- a) acute disease and b) chronic disease.

2. Surgical procedures:

- a) laparotomy or b) laparoscopy operations.

Prognosis:

The mortality rate of Ulcerative Colitis has dropped sharply in the last decade or two, and older figures no longer apply.

**Keywords:** treatment, program, Ulcerative Colitis.

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### Introduction

Ulcerative Colitis (UC) is a necrotizing, destructive inflammation of the mucous membrane and submucosal base of the large intestine of a non-specific nature, of unknown etiology. The etiology of UC is unknown, and the pathogenesis is little studied. Mechanism of primary injury is based on the development of reactions of hypersensitivity and autoaggression, which lead to degenerative-necrotic changes in the epithelium and

microcirculation disorders in the colon wall intestines.

Anatomical type and severity should be taken into account when prescribing treatment for UC disease. When prescribing immunosuppressants and biological therapy should be excluded TBC infection, to prevent the dissemination of tuberculosis:

1. Diet 4
2. Preparations of 5 aminosalicylic acid (5ASA- Salofalk, Pentasa, Asacol) in a dose 3-4 g/day per os, in a dose of 0.5-1 g/day locally in the form of suppositories (in case of proctitis oral administration of the drug is not used)
3. Corticosteroids: Prednisolone at a dose of 1 mg/kg of body weight/day per os, Budesonide (Budenofalk) 9 mg/day
4. Biological therapy: anti-TNF- $\alpha$ , - Remicade 5 mg/kg, IV drip
5. Immunosuppressants: Azathioprine - 2.5-4 mg/kg per day, for 2-4 months. Cyclosporine - 4 mg/kg parenterally, or in tablets of 10 mg/kg.

Ulcerative Colitis is an autoimmune-mediated colitis which can present in varying degrees of severity and increases the individual's risk of developing colon cancer. While first-line treatment for UC is medical management, surgical treatment may be necessary in up to 25–30% of patients.

With an increasing armamentarium of biologic therapies, patients are presenting for surgery much later in their course, and careful understanding of the complex interplay of the disease, its management, and the patient's overall health is necessary when considering the appropriate way in which to address their disease surgically.

Ulcerative Colitis is one form of inflammatory bowel disease (IBD) that affects the mucosa and lamina propria of the colon. Although there is a large range of potential clinical presentation for patients with UC, typically they will have episodes of disease exacerbations separated by periods of remission.

During the acute phase, exacerbation events vary from abdominal pain to fulminant colitis. Chronically, even the periods of remission may still be marked by indolent inflammation and altered bowel function.

Medical treatment ranges from probiotics to calcineurin inhibitors and needs individual adjustment for each patient. Mild-to-moderate active proctitis and left-sided colitis can be treated with topical mesalamine alone or, in case of a mild-to-moderate pancolitis, in combination with oral mesalamine. If mesalamine or other 5-ASA agents are ineffective, systemic steroid therapy should be used to try and induce remission.

Anti-TNF $\alpha$  antibodies or calcineurin inhibitors should be administered if no remission is achieved after 3–4 days. Vedolizumab has also been found effective against UC but should be reserved for less severe cases due to its late onset of effect. To maintain remission, mesalamine should be given for at least 2 years. Probiotics such

as *Escherichia coli* Nissle have a similar efficacy as mesalamine for maintaining remission and can be given in case of mesalamine intolerance. Immunosuppressives should be administered in addition to aminosalicylates in case of frequent relapses, relapses despite the use of reserve medication, or steroid dependence (*Danese S. et al., 2014*).

After 3 months of immunosuppressive treatment, usually azathioprine or 6-mercaptopurine, steroid dose reduction should be attempted. Anti-TNF $\alpha$  antibodies can be continued in order to maintain remission, and in general a combination of anti-TNF $\alpha$  antibodies with thiopurines is more effective than a monotherapy. Vedolizumab, an integrin receptor antagonist, can be an alternative for refractory disease (*Panaccione R. et al., 2014*).

The primary treatment of UC is conservative, and substantial therapeutic progress has been made in the past few decades. Meanwhile, biologicals have become a mainstay in the treatment for steroid-refractory UC.

Despite further development of drug therapy and an increased time span to operation, a significant proportion of patients with UC require surgical intervention. Surgical intervention needs to be carried out in medically refractory cases, imminent or malignant transformation, or complications. This article discusses the impact of modern drug therapy on surgery for UC.

IBD are multifactorial chronic diseases. The primary treatment of IBD is conservative (medical), and decisions regarding surgery should always be made in the context of a multidisciplinary care model. Despite further development of drug therapy and an increased time span to operation, a significant proportion of patients with UC require surgical intervention.

Indications for surgical intervention:

- Suspicion of colon perforation.
- Cases that do not respond to targeted complex therapy, i.e occurrence of acute toxic dilatation of the colon.
- Rare cases of profuse bleeding from the colon.
- Inefficiency of persistent complex treatment of UC.
- Cancer on the background of the inflammatory process.

Operative interventions. The goal of surgical intervention is total colectomy, even in cases where the patient does not have a total lesion. In the case of leaving the minimum segment of the large intestine, inflammation will continue in this segment.

Approximately 20–35% of patients with UC will undergo surgery during the course of their disease. The fulminant form of UC is characterized by mortality rates between 27 and 57% in case of primary treatment failure. Restorative proctocolectomy with ileal pouch-anal anastomosis (IPAA) has become established as a standard surgical treatment for UC over the past 30 years.

Ileo-anal pouch surgery provides the best possible quality of life for the patient with an average of 5–6 bowel movements per day and maintenance of continence in over 90% of patients (*Luo WY, et al., 2021*).

When forming of reservoir anastomoses, the mucous membrane of the anal canal is desolated. Acquires the spread of laparoscopic surgery techniques.

- Colectomy with ileoanal anastomosis, with reservoir formation
- Coloproctectomy with permanent ileostomy.

Restorative proctocolectomy with ileal pouch-anal anastomosis has become established as a standard surgical treatment for UC over the past 30 years. Ileo-anal pouch surgery provides the best possible quality of life for the patient with an average of 5–6 bowel movements per day and maintenance of continence in over 90% of patients. Surgery is generally a total proctocolectomy either with pelvic pouch reconstruction or permanent ileostomy; however, this may need to be spread across multiple procedures given the complexity of the surgery weighed against the overall state of the patient's health. Minimally invasive surgery, employing either laparoscopic, robotic, or transanal laparoscopic approaches, is currently the preferred approach in the elective setting. There is also some emerging evidence that appendectomy may delay the progression of UC in some individuals. Those who treat these patients surgically must also be familiar with the numerous potential pitfalls of surgical intervention and have plans in place for managing problems such as pouchitis, cuffitis, and anastomotic complications.

## Method

An analysis was made of the results of studies of treated patients 115 (men 65 and women 50) in the Regional Proctology Center of the Dnipro for 2017-2022 with diagnoses of Ulcerative Colitis on the basis of the department Surgery No. 1 of the Dnipro State Medical University.

## Medicament treatment

We performed medical treatment without surgery in 37 patients (20 men and 17 women) diagnosed with Ulcerative Colitis.

### *Anti-inflammatory medications*

Anti-inflammatory medications are often the first step in the treatment of Ulcerative Colitis and are appropriate for most people with this condition. In recent years, modern drug therapy has changed the timing, approach, and outcomes of surgery for UC. Most of the studies showed a decrease in surgery rates over time while the rate of emergency colectomies remains unchanged.



So far, no convincing surgery-sparing effect of newer medications has been established, and it remains debatable if surgery rates have decreased because of improved management for UC in general or due to the introduction of biologicals. These include:

11. **5-aminosalicylates.** Examples of this type of medication include sulfasalazine (Azulfidine, Salofalk), mesalamine (Delzicol, Rowasa, others), balsalazide (Colazal) and olsalazine (Dipentum). Which medication you take and how you take it — by mouth or as an enema or suppository — depends on the area of your colon that's affected.

12. **Corticosteroids.** These medications, which include prednisone and budesonide, are generally reserved for moderate to severe Ulcerative Colitis that doesn't respond to other treatments. Corticosteroids suppress the immune system. Due to the side effects, they are not usually given long term.

### *Immune system suppressors*

These medications also reduce inflammation, but they do so by suppressing the immune system response that starts the process of inflammation. For some people, a combination of these medications works better than one medication alone.

Immunosuppressant medications include:

- **Azathioprine (Azasan, Imuran) and mercaptopurine (Purinethol, Purixan).** These are commonly used immunosuppressants for the treatment of inflammatory bowel disease. They are often used in combination with medications known as biologics.
- Taking them requires that you follow up closely with your provider and have your blood checked regularly to look for side effects, including effects on the liver and pancreas.
- **Cyclosporine (Gengraf, Neoral, Sandimmune).** This medication is typically reserved for people who haven't responded well to other medications. Cyclosporine has the potential for serious side effects and is not for long-term use.
- **"Small molecule" medications.** More recently, orally delivered agents, also known as "small molecules," have become available for IBD treatment. These include tofacitinib (Xeljanz), upadacitinib (Rinvoq) and ozanimod (Zeposia). These medications may be effective when other therapies don't work. Main side effects include the increased risk of shingles infection and blood clots.

The U.S. Food and Drug Administration (FDA) recently issued a warning about tofacitinib, stating that preliminary studies show an increased risk of serious heart-related problems and cancer from taking this medication.

If you're taking tofacitinib for Ulcerative Colitis, don't stop taking it without first talking with your health care provider.

### *Biologics*

This class of therapies targets proteins made by the immune system. Types of biologics used to treat ulcerative colitis include:

- **Infliximab (Remicade), adalimumab (Humira) and golimumab (Simponi).** These medications, called tumor necrosis factor (TNF) inhibitors, work by neutralizing a protein produced by your immune system. They are for people with severe Ulcerative Colitis who don't respond to or can't tolerate other treatments. TNF inhibitors are also called biologics.
- **Vedolizumab (Entyvio).** This medication is approved for treatment of Ulcerative Colitis for people who don't respond to or can't tolerate other treatments. It works by blocking inflammatory cells from getting to the site of inflammation.
- **Ustekinumab (Stelara).** This medication is approved for treatment of Ulcerative Colitis for people who don't respond to or can't tolerate other treatments. It works by blocking a different protein that causes inflammation.

### *Other medications*

You may need additional medications to manage specific symptoms of ulcerative colitis. Always talk with your health care provider before using over-the-counter medications. Your provider may recommend one or more of the following.

- **Anti-diarrheal medications.** For severe diarrhea, loperamide (Imodium A-D) may be effective. If you have Ulcerative Colitis, do not take anti-diarrheal medications without first talking with your health care provider.
- These medications may increase the risk of an enlarged colon (toxic megacolon).
- **Pain relievers.** For mild pain, your provider may recommend acetaminophen (Tylenol, others) — but not ibuprofen (Advil, Motrin IB, others), naproxen sodium (Aleve) and diclofenac sodium, which can worsen symptoms and increase the severity of disease.
- **Antispasmodics.** Sometimes health care providers will prescribe antispasmodic therapies to help with cramps.
- **Iron supplements.** If you have chronic intestinal bleeding, you may develop iron deficiency anemia and be given iron supplements.

### **Surgical treatment**

We performed surgical treatment on the background of drug therapy in 78 patients (45 men and 33 women) diagnosed with Ulcerative Colitis.

Although surgery offers a curative solution for UC, medical treatment remains the primary treatment strategy. The goal of such therapy is to induce disease remission and promote mucosal healing. As such, different medications with varying immunosuppressive capabilities are used depending on the severity of disease (*Croft A, et al., 2013*).

Whereas mild disease may be treated with mesalamine suppositories/enema, oral 5-aminosalicylic acid, oral sulfasalazine, thiopurines (6-mercaptopurine, azathioprine), or topical corticosteroids, moderate to severe disease often requires the usage of a monoclonal antibodies such as infliximab (Remicade) or adalimumab (Humira) and the addition of intermittent oral steroid therapy. For severe exacerbations, the first-line therapy is usually intravenous corticosteroids followed by careful endoscopic evaluation although early initiation of infliximab and cyclosporin has also been tried with variable success.

There are several indications for surgery in the treatment for UC. These include fulminant colitis, toxic megacolon, perforation, inability to tolerate medical therapy, nonresponse to medical therapy, dysplasia or malignancy, stunting of growth in children, or the need to improve certain extraintestinal manifestation of UC (i.e., uveitis, pyoderma, arthritis, etc.). While early surgery for Ulcerative Colitis has been proven to be relatively safe, often surgery is not discussed until after initiation of medical therapy and sometimes not at all (*Gan SI, et al., 2003*).

#### *Urgent surgery.*

Of all indications, those which require an urgent operation are fulminant colitis, toxic megacolon, uncontrolled hemorrhage, perforation, and medication failure. These indications are not mutually exclusive of each other and can present in combination. In all cases, it is important to have close communication with the patient's gastroenterologist to weigh the risks and benefits of starting immunosuppressive agents in the acutely ill patient versus proceeding with total abdominal colectomy.

Toxic megacolon is a life-threatening condition presenting in patients with systemic toxicity and a distended (transverse colon > 6 cm or cecum > 9 cm) and thickened colon. These patients can have diarrhea or constipation and are at high risk for perforation. They present with systemic inflammatory response syndrome (SIRS) and require immediate medical attention (*Kimura H, et al., 2016*).

Initial treatment is aggressive fluid resuscitation and broad-spectrum antibiotic therapy as well as proper adjustment of medications to avoid anti-diarrheal drugs. Infectious diarrhea workup needs to be initiated to guide steroid therapy; however, the decision for surgery remains a clinical one. Any signs of hemodynamic instability, peritonitis, or stagnancy in clinical improvement for 48–72 h despite maximal medical therapy are indications for surgery.

Fulminant colitis presents similarly with SIRS and thickened colon but without the colonic distension. Fluid

resuscitation, broad-spectrum antibiotics, intravenous steroids, and infectious workup should be promptly initiated. Inpatient administration of infliximab should also be considered as there are data suggesting it is superior to intravenous steroid therapy.

However, indications for urgent surgery remain an independent clinical decision based on hemodynamic instability, peritonitis, or the lack of clinical improvement despite very maximum medical therapy over 48–72 h. Lower gastrointestinal bleeding is very common in patients with UC due to the inflamed and friable colonic mucosa. Life-threatening bleeding fortunately happens less than 5% of the time. These symptoms will usually subside with effective medical treatment, and ongoing bleeding is usually a sign of medical failure.

However, in roughly 10% of patients, massive gastrointestinal hemorrhage is cited as the reason for total abdominal colectomy with an additional 12% of these patients having ongoing rectal hemorrhage after . There is no agreed upon criteria on how much hemorrhage is required prior to offering the patient surgery, and it should be taken in consideration with the whole clinical picture (*Feuerstein JD, et al., 2016*).

## Results

Data on the treatment of 115 patients (65-year-old men and 50-year-old women) in the regional proctological center of Dnipro for the years 2017-2022 with a diagnosis of Ulcerative Colitis on the basis of Department Surgery No. 1 of Dnipro State Medical University.

As a result of the study, 37 patients (20 men and 17 women) with a diagnosis of Ulcerative Colitis were treated without surgery.

In the drug treatment of patients with Ulcerative Colitis, we used drugs of the following groups: Anti-inflammatory medications, Immune system suppressors, Biologics and other medications.

According to the results of the study, surgical treatment against the background of drug therapy was carried out at our base for 78 patients (45 men and 33 women) diagnosed with Ulcerative Colitis.

For the surgical treatment of patients with Ulcerative Colitis, we used the drug treatment and following planned and urgent surgical interventions: types of colectomy (left-sided, right-sided, more often – total), colectomy with ileoanal anastomosis (with reservoir formation), coloproctectomy with permanent ileostomy.

## Discussion

The presented results of medical and surgical treatment of patients with Ulcerative Colitis allow us to assert the need for complex and combined treatment of this category of patients with the obligatory consideration of the stage of severity of the disease and its course. At the same time, the medicinal component should consistently

consist of groups of modern drugs that can effectively treat the exacerbation of Ulcerative Colitis, and prevent the need for surgical intervention, which can sometimes lead to the invalidation of patients. The surgical component of the complex-combined treatment of patients with Ulcerative Colitis, especially in the planned mode, will significantly reduce the development of severe complications of the disease and the need for urgent operations.

## Conclusion

Concluding our work on treatment options for patients with Ulcerative Colitis, which can be accompanied by extraintestinal articular manifestations, as well as possible dangerous complications that can lead to the death of patients, we insist on the need for complex combined medicament and medicament-surgical treatment.

Effective and justified drug therapy with the use of all necessary groups of modern medical drugs allows to avoid the transition of Ulcerative Colitis to more severe stages with the possibility of developing complications, and timely planned surgical intervention allows to prevent them, and in the case of the development of urgent conditions, to eliminate these complications with urgent operations.

## Recommendations

We recommend using the proposed technologies in the practices of gastroenterologists, rheumatologists and surgeons-proctologists for effective medicament and surgical treatment of patients with Ulcerative Colitis and extraintestinal manifestations.

## Acknowledgments

We wish to gratefully acknowledge the advice and support of representatives and staff Dnipro City Hospital, Dnipro State Medical University and Regional Proctology Centre in the preparation of our work and this text.

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## Heparin Epitope Imprinted Via Sol-Gel Process on Silica Surface: Effect of Template: Monomer Ratio Studies


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**Abstract:** Heparin, a sulfated glycosaminoglycan (GAG) is one of macromolecule natural compounds and widely used as an anticoagulant drug, anti-thrombotic agent and hemodialysis (patients undergoing kidney dialysis). Since it is derived from animal source, heparin can contain several natural contaminants. Thus, molecular imprinting technology is introduced for purification and separation of heparin. An epitope extraction was implemented consist of low molecular weight heparin (LMWH) as template to capture large molecule of heparin which prepared by sol-gel process on the surface of macromolecule silica using 3-aminopropyltriethoxysilane (APTES) and tetraethoxysilane (TEOS) and functional monomer and cross-linker respectively. Here, the effect of template: monomer ratio was evaluated and result shown that the (1:2) ratio of template to functional monomer successfully adsorb and enrich the heparin protein. The imprinted polymer was characterized with Fourier Transform Infrared (FTIR) spectroscopy, Thermogravimetric Analysis (TGA), Brunauer-Emmet-Teller (BET) and Field Emission Scanning Electron Microscopy (FESEM). The adsorption behaviours of epitope imprinting indicated that Langmuir-Freundlich (single-site) was considered as the model with better fit and kinetic batch studies showed pseudo-first-order kinetic model via physicochemical process. The results obtained good imprinting comparable of epitope imprinting effect.

**Keywords:** Epitope Imprinted, Heparin, Molecular Imprinted Polymer, Sol-Gel Process

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## Introduction

In 2008, a contamination of isolated heparin supply caused a number of death in at least 10 countries. The contamination came from the by-product which is oversaturated chondroitin sulfated (OSCS) (McMahon et al., 2009; Sommers, Mans, Mecker, & Keire, 2011). Several techniques were introduced to purify the heparin such as cation exchange resin. However, this technique required a lots of solvent, costly, low versatility and selectivity. Thus, a biological molecule purification by solid phase extraction using an imprinting approach as a sorbent is developed.

Molecular imprinted polymer (MIP) is a form of polymeric network, in which the specific analyte is used as a template in the MIP polymerization. The main advantages of this approach is to allow separation and purification procedure, facile, efficient, cost effective, inexpensive and green. In many years, MIP has effectively been applied in various areas for the specific recognition of small analytes. Recently, recognition of macromolecules such as protein or polysaccharide acquired much attention in the molecular imprinting technology. However, macromolecule imprinting remains a challenge due to the inherent properties of the protein or polysaccharide template molecules and adsorption-desorption of macromolecule template within the polymer cavities (Kryscio & Peppas, 2012; Turner & Jeans, 2006). Therefore, many imprinting methods were designed to enhance the macromolecule imprinting such as surface imprinting (Li et al., 2015; Yuan et al., 2014) and epitope imprinting. To date, epitope imprinting has been proven to improve and efficiently enhance protein recognition. The epitope imprinting is the imprinting of short sequence of protein that represents a small and exposed fragment of the whole protein. This polymer not only could recognize a small protein template, but also the entire bulk of protein (Brown & Puleo, 2008; Li et al., 2013; Yarman et al., 2015).

In the present study, a non-covalent epitope imprinted polymer was prepared by sol-gel process for the separation and purification of heparin. In this method, macromolecule silica gel was used as a surface binder for the non-covalent polymerization to occur. The LMWH was used as a template in the epitope imprinting. Optimization of template: monomer imprinting ratio were investigated. The synthesized epitope imprinted polymer was characterized and assessed by batch sorption experiments in detail to improve and enrich the heparin adsorption.

## Experimental

### Chemicals and reagents

The silica-gel (230-400 mesh, 0.040-0.063 mm in size) used as the support material for surface imprinted



polymer was purchased from Merck, Germany. Template, Low Molecular Weight Heparin (LMWH) and heparin were obtained from Easybuyer Ltd. Shanghai, China and AinMedicare, Malaysia respectively. 3-aminopropyltrimethoxysilane (APTES) and Tetrarhoxysilane (TEOS) were obtained from Sigma Aldrich, Germany. Meanwhile, HCl was obtained from Fisher Scientific, USA. The analytical grade methanol was used as washer solution supplied from HmbG, Germany.

### **Preparation of Heparin Epitope Imprinted Polymer on the Silica Surface**

The silica gel surface was activated with 6 M HCl for 10 hours with stirring. Then, the resulting mixture was filtered and washed thoroughly with deionized water until it was neutral before dried in oven at 70 °C overnight. LMWH was dissolved in 20 mL water. Later, different amounts of template:APTES (1:2, 1:4, 1:8 mmol) was added to the mixture and 1.8048 mmol of TEOS was added into the solution with continuous stirring for another 30 minutes. Next, 2 g of activated silica gel and 0.2 mL of 0.012 M HCl were added sequentially, under stirring and then the suspension was polymerized at 30-40°C for 24 hours. After the polymerization, the product was filtered and washed with ethanol and neutralized with water.

The template was extracted by ultrasonic extraction for 30 minutes with 50 mL MeOH:HCl (10% in water) in ratio (1:1), then with MeOH, and lastly with water until it could no longer be detected by UV. Finally, the epitope imprinted polymer was collected by filtration and dried at 80 °C overnight. The NIP was also prepared by using the identical procedure without template.

### **Characterization**

The infrared spectra was performed by using Perkin Elmer Spectrum 100 Series FT-IR spectrometers from 600  $\text{cm}^{-1}$  to 4000  $\text{cm}^{-1}$ . The morphologies of heparin epitope imprinted polymers were carried out by using FESEM imaging from Nova NanoSEM 450 from Field Emission Inc. USA and sputter-coated with platinum for 20 minutes. Thermogravimetric-Differential Thermal Analyzer (TG-DTA) was conducted by using Pyris Diamond TG-DTA by Perkin Elmer, USA where, 5 mg of polymer sample was heated from 30 °C to 600 °C at ramp of 5 °C/min. BET surface area was conducted by using Micromeritics TriStar, USA using  $\text{N}_2$  as the adsorption gas.

### **Adsorption experiment**

50 mg of imprinted polymer was placed into the 4 mL vial. 3 mL of rebinding analyte (Heparin or LMWH) dissolved in water at different concentrations were added in the range of 0.0626-1.0 mg/mL for 240 min. Meanwhile, in adsorption kinetic study, the 0.25 mg/mL of heparin was used within 15 to 240 mins. The supernatant was filtered before it was measured by UV-Vis spectrometer (Varian Cary 50 UV-Vis Spectrometer, Agilent, US) at wavelength 202 nm and 230 nm for heparin, and LMWH respectively.

The binding capacity was calculated by using the following formula:

$$Q_e = \frac{(C_0 - C_e)V}{M} \quad (1)$$

where,  $Q_e$  represents the binding capacity (mg LMWH or heparin/g of imprinted polymer),  $C_0$ , and  $C_e$  represent the initial and equilibrium concentration of LMWH or heparin (mg/L) respectively,  $M$  is the mass of polymer in each adsorption sample (g) and  $V$  is the volume of the rebinding solution (L).

The Imprinting Factor was calculated based on the following equation:

$$IF = \frac{Q_{MIP}}{Q_{NIP}} \quad (2)$$

where  $IF$  represents the imprinting factor,  $Q_{MIP}$  and  $Q_{NIP}$  represent the binding capacity (mg/g) of MIP and NIP respectively.

Four types of adsorption models have been used to characterize the MIPs surface such as Langmuir, Freundlich, single-site Langmuir-Freundlich, and dual-site Langmuir-Freundlich isotherm model. Meanwhile, two kinetic models, namely the pseudo-first order and pseudo-second order have been used for the adsorption of solute from a liquid solution.

$$Q = \frac{q_{max} K_L C_e}{1 + K_L C_e} \quad (3)$$

$$Q = K_F C_e^{1/n} \quad (4)$$

$$Q = \frac{q_{max} K_1 C_e}{(1 + K_1 C_e)^n} \quad (5)$$

$$Q = \frac{q_{max-1} (K_1 C_e)^{n_1}}{1 + (K_1 C_e)^{n_1}} + \frac{q_{max-2} (K_2 C_e)^{n_2}}{1 + (K_2 C_e)^{n_2}} \quad (6)$$

where,  $Q$  is the binding amount in adsorbent at equilibrium (mg/g),  $q_{max}$  is the maximum monolayer saturation capacity (mg/g), while  $n$  is the heterogeneity parameter. Meanwhile,  $C_e$  is the concentration in equilibrium of the solute in the bulk solution (mg/L).  $K_F$ ,  $K_L$ ,  $K_1$  and  $K_2$ , are dissociation isotherm constant of Freundlich (mg/g), Langmuir (L/g), Langmuir-Freundlich (L/g) single and dual site respectively.

Two kinetic models, namely the pseudo-first order and pseudo-second order have been used for the adsorption of solute from a liquid solution as described by equation (7) and (8) respectively.

$$Q_t = Q(1 - e^{-k_1 t}) \quad (7)$$

$$Q_t = \frac{Q^2 k_2 t}{(1 + Q k_2 t)} \quad (8)$$

where  $Q$  and  $Q_t$  are bound amount on adsorbent at equilibrium (mg/g) and bound amount on adsorbent at any time  $t$  (min) respectively. Meanwhile,  $k_1$  and  $k_2$  are pseudo-first (1/min) and pseudo-second (g/mg/min) order rate constant respectively.

The nonlinear regression models were applied for the utilization in adsorption and kinetic performance. The best fit of the corresponding models was calculated and selected according to the statistical test as of  $RSS$  and  $F_{test}$ . These parameters were calculated according to the nonlinear regression methods using Microsoft Excel function

by minimizing the sum of square errors and largest value of  $F_{test}$ .

## Results and Discussion

### Synthesis and characterization of heparin epitope imprinted polymers

The preparation of epitope imprinted surface of silica particles by sol-gel process was started by silylation of  $\text{SiO}_2$  surface. The polysilicate network of LMWH-epitope-imprinted polymer was produced by the hydrolysis and polycondensation of TEOS (cross-linker) with APTMS (functional monomer) by non-covalent bond to the LMWH (template) molecules. The structural change before and after modifications of silica was confirmed by FTIR spectra as shown in Figure 1.

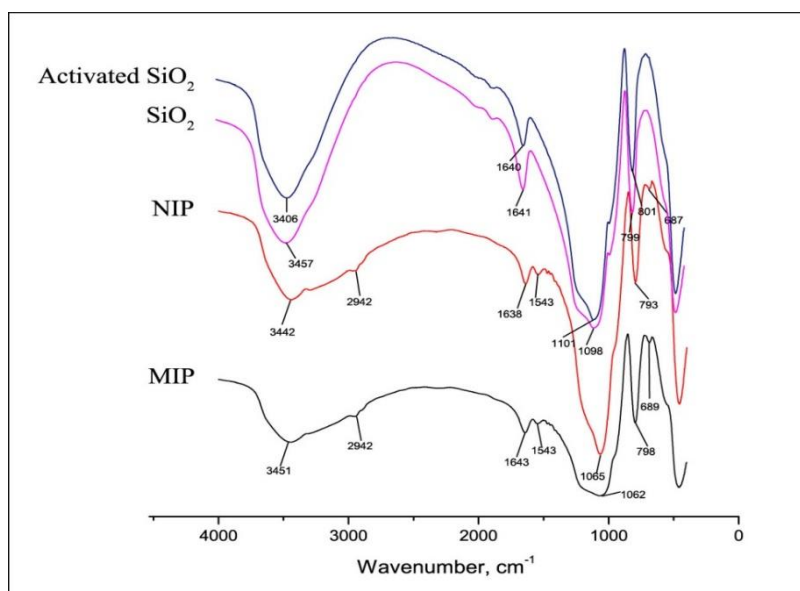


Figure 1: FTIR spectra of MIP and NIP in water.

FTIR spectra of untreated silica, activated silica, MIP, and NIP were shown in Figure 1. A strong and sharp band at  $1101\text{-}1098\text{ cm}^{-1}$  was observed for all samples, which was related to Si-O-Si valent vibration of silica thus, indicating that the main structure was not changed by the modification reaction. The band at  $1640\text{ cm}^{-1}$  may indicate the presence of bending of water molecules, which are adsorbed on the surface of silica by hydrogen bonding with silanols. The intensity of both activated  $\text{SiO}_2$  and  $\text{SiO}_2$  higher compared to both imprinted polymers. This suggests that modification reaction occurred at the silica surface by APTMS which is caused by the C-N vibration and  $\text{NH}_2$  deformation from APTMS at  $1543\text{ cm}^{-1}$ . The similar observation were consistent with other finding of silica modified by aminopropyl group (Rostami et al., 2011; Zhang et al., 2010). The N-H stretching peak overlapped with Si-OH stretching vibrations at  $3406\text{-}3451\text{ cm}^{-1}$  and it was observed at all samples. Small absorption bands at  $2942\text{ cm}^{-1}$  were attributed to the methyl C-H stretching due to the presence of propyl groups in APTMS in which the bands was undetected at both activated  $\text{SiO}_2$  and  $\text{SiO}_2$ . All these observations particularly both peaks at  $1543\text{ cm}^{-1}$  and  $2942\text{ cm}^{-1}$ , in MIP and NIP samples confirm that the

existence of a chemically attached by APTMS to the silica surface.

### Effect of template-monomer molar ratio

The epitope imprinted surface of silica particles were treated in three different templates of monomer molar ratio from 1:2 to 1:8 and further characterized by TGA, as shown in Figure 2. Three phases of weight loss were discovered. In first phase of weight loss at temperature below 100 °C, in which all samples initially lost their weight and other two phases of degradation were discovered at temperature range 200-500 °C and 500-700 °C. The decomposition of aminopropyl moieties occurred rapidly, starting at 200 °C followed by dehydroxylation of the silica surface at 500 °C to 700 °C. The decomposition of aminopropyl silane moieties led to formation of ammonia, ethylene, hydrazine, and methane (Rostami et al., 2011), while the dehydroxylation of the silica surface was caused by condensation of silanol group to siloxanes (Wan et al., 2010).

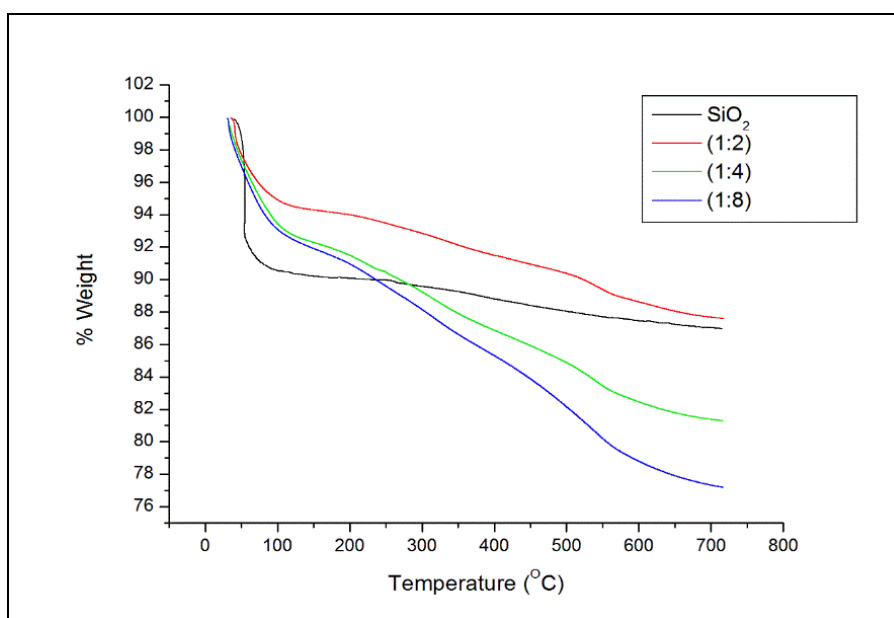


Figure 2: TGA spectra of MIP prepared in different templates-monomer molar ratio.

SiO<sub>2</sub> had shown highest weight loss at first phase of decomposition. This situation could be attributed to the release of physically adsorbed water remaining in the SiO<sub>2</sub> particles due to its properties as a water absorbent. In the second degradation phase, three clear decomposition phases of aminopropyl moieties were identified. MIP in template of monomer molar ratio (1:8) has the greatest total weight loss followed by MIP (1:4), and MIP (1:2), with weight loss of 9%, 7%, and 3% respectively at temperature range 200-500 °C. After 500 °C, all three sample had similar weight loss (~1% weight loss).

The template to monomer molar ratio of template is important to ensure feasible copolymerization. For this purpose, the porosity of the different templates to monomer molar ratio was evaluated by nitrogen gas sorption

method onto the solid surface known as BET analysis, to each epitope or partial surface imprinted polymer prepared under the same condition (Table 1).

Table 1: BET data for different template to monomer molar ratio

MIP Material (template to monomer molar ratio)	Specific surface area (m <sup>2</sup> /g)	Pore volume (cm <sup>3</sup> /g)	Pore size diameter (nm)
(1:2)	93.4226	0.1877	0.8036
(1:4)	302.1464	0.5923	0.7841
(1:8)	119.3441	0.2379	0.7975

Both surface area and pore volume were increased with increase of template to monomer molar ratio from 1:2 to 1:4. The increment was attributed to the increase of the preassembled interaction (hydrogen bonding interaction) between the template and functional monomer in the prepolymerization. Meanwhile, by increasing the template to monomer molar ratio to 1:8, the surface area and pore volume were slightly reduced due to the increasing competition of preassemble interaction between aminopropyl silane monomer and water in prepolymerization. Moreover, the interaction between cross-linker and functional monomer became more restricted to reduce the pore volume and surface area of the polymer. Thus, polymer material with higher degree of organic precursors had less surface area and porosity. The situation was attributed to the relationship that existed between the porosity of the sol-gel materials and their hydrophobic/hydrophilic nature (Guardia, Badía-Laño, Díaz-García, Ania, & Parra, 2008). Dissimilar finding was observed for the pore size diameter, where in low template to monomer molar ratio (1:2), the pore diameter was high (0.8036 nm). It was observed that when lowering the proportion of functional monomer, it might reduce the preassembled interaction between the template and functional monomer and at the same time increase hydrogen bonding between the template and water to enlarge the pore diameter.

The morphological features of the epitope or partial surface imprinted polymer prepared in different template-monomer molar ratio were observed using FESEM and were displayed in Figure 3. The MIPs were present as nano-sized bead particles, which agglomerated and coated on the silica microparticle surface.

It was shown that increase in the proportion of functional monomer served to increase the spacing between growing colloidal particles; thus, reduce coagulation rate. Therefore, as in the Figure 3 (A) to (C) by increasing the monomer molar ratio shows the morphology change from uniformly cluster spherical particle to agglomerate spherical particles like a bunch of grapes structure. A similar observation obtained by Guardia et al., (2008) and Clausen et al. (2014). In large amounts of alkoxysilane precursor on the modification of molecularly imprinted silicas shows, of globular structures in form of spherical particles obtained due to the cross-linking of the polymer became more restricted with the incorporation of pendant ligands. Meanwhile, in high ratio of monomer, the particles presented greater diameters, appear to be less cohesive and with lower aggregation

degree which resembled a bunch of grapes thus providing higher average pore diameter.

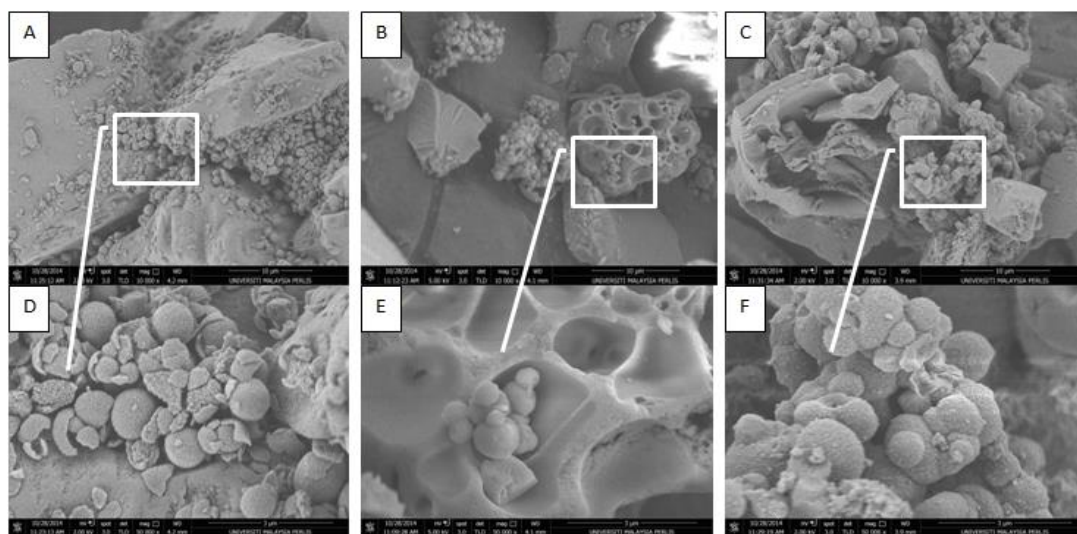


Figure 3: FESEM images of epitope MIP prepared in different template:monomer molar ratio. Surface of template to monomer (1:2) (A and D); (1:4) (B and E), and (1:8) (C and F). 10,000x magnification for A-C and 50,000x magnification for D-E.

### Effect of Template-Monomer Ratio to the Binding Capacity of LMWH and Heparin

Since there were significant differences in surface area, porosity, and morphology of the epitope imprinted polymers due to the change on template, the binding interaction will be dependent on it. The performance of binding interaction was investigated by batch rebinding test as shown in Figure 4.

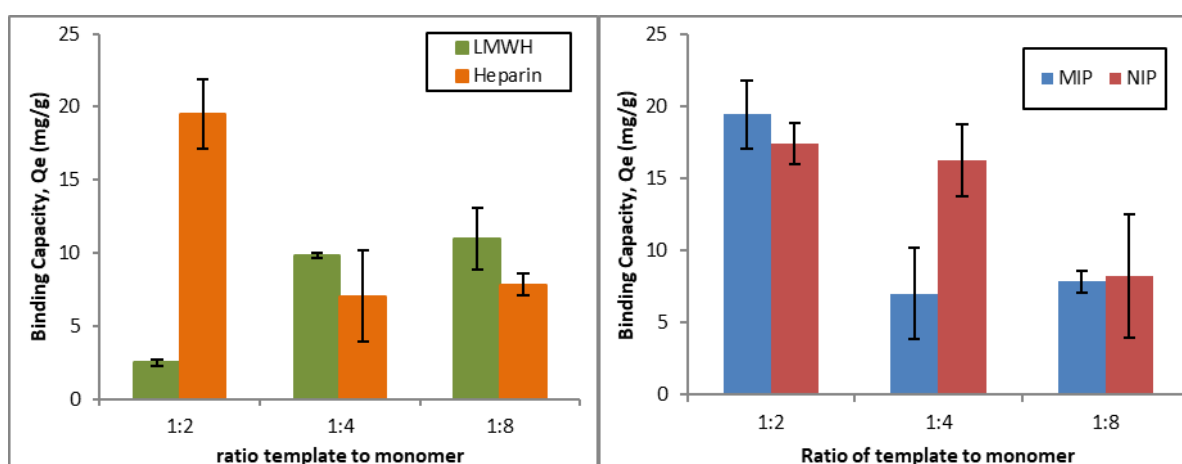


Figure 4: (a) Binding capacity between LMWH and heparin, (b) Binding capacity of heparin in different template-monomer ratio.

An increase in the functional monomer concentration from (1:2) to (1:8) resulted in the increment of the binding

capacity for LMWH from 2.50 to 10.98 mg/g (Figure 3.4(a)). Increase in the functional monomer concentration provided more recognition cavities or sites; thus, demonstrated remarkable enrichment of LMWH. Moreover, the excess of functional monomer caused an abundance of free amine acquired on the surface of polymeric silica gel particles thus, increasing of LMWH binding due to a secondary interaction occurs between the LMWH template and free amine on the surface of the imprinted polymer. An opposite trend was discovered in heparin adsorption. The binding capacity of heparin decreased from 19.48 to 7.85 mg/g by increasing functional monomer concentration. The trend was attributed to the physical characteristic of the heparin. The large structure of heparin (5-40 kDa) tends to adsorb and fit better on the cavity active site in the polymeric silica gel particles. This phenomenon could be explained by low functional monomer lack of free amine obtained on the surface of polymeric silica gel particles thus, increasing the binding of heparin to the only cavity active site in the polymeric silica gel particles which is known as main interaction.

The template recognition performance of the epitope, which was prepared in different template to monomer molar ratio was investigated by batch binding test and expressed by the imprinting factor (IF). The batch binding test was performed on the epitope imprinted polymer (MIP) and non-epitope imprinted polymer (NIP), as shown in Figure 4(b).

The MIP with template to monomer molar ratio 1:2 showed highest binding capacity at 19.48 mg/g compared to MIP (1:4) and MIP (1:8), with only 7.04 and 7.05 mg/g respectively. The highest heparin adsorption was observed at template to monomer molar ratio 1:2 with binding capacity of 19.48 and 17.45 mg/g for MIP and NIP respectively. The ratio of 1:2 also obtained highest imprinting factor followed by 1:8 and 1:4, with IF of 1.12, 0.96, and 0.43 respectively. Similar observations were also observed by Zhou et al. (2009) and Li et al. (2008) in their research on optimization of surface imprinting via sol-gel process. Both researches obtained confirmed that the binding capacity of BSA decreased as the concentration of aminosilanes (APTES) increased. These findings were supported by Singabraya et al. (2012) in the optimization of conditions on heparan sulfate MIP. They reported that the loss of sorption capability and specificity by increasing the monomer concentrations was due to the increasing amine density, which can generate monomer dimerization; thus, reduce formation of effective binding site.

In the Figure 4(b), it was also shown that the NIP had highest heparin adsorption compared to MIP when the template to monomer molar ratio increased from 1:4 to 1:8. Thus, it showed that a non-specific interaction occurred when increasing functional monomer concentration in the epitope imprinted polymer and consequently formed a lower affinity towards heparin. The situation could be explained by the strong hydrogen interaction between carboxylic or hydroxyl groups from the heparin to the amine functionalities that was mainly abundant at the polymer surface which, hindered the access route of the heparin into the imprinting cavities. Moreover, the NIP has no cavities, thus abundant free amine functionalities is present at the polymer surface which, increased secondary interaction by strongly hydrogen bonding of the heparin to increase the binding performances (Ikeda et al., 2008; Lin et al., 2009).

## Equilibrium Isotherm and Kinetic Rebinding of Heparin

Based on the template to monomer molar ratio studies, binding isotherm was conducted on both epitope MIP and NIP with a series of different heparin initial concentration (62.50 to 1000 mg/L). Here, Langmuir, Freundlich, single-site Langmuir-Freundlich, and dual-site Langmuir-Freundlich isotherm model were considered. These four isotherm models were demonstrated to the experimental data in order to characterize the binding site and isotherm parameters.

Langmuir-Freundlich (single-site) and Langmuir gave minimum values of  $\sum \text{RSS}$  and largest  $F_{\text{test}}$  on epitope MIP. However, the  $F_{\text{test}}$  of Langmuir-Freundlich (single-site) showed larger values compared to Langmuir, which were 38.0991 and 38.0977 respectively. Therefore, Langmuir-Freundlich (single-site) was considered as the better-fit model of epitope MIP from highest value of  $F_{\text{test}}$  and closer data between the calculated  $q_e$  and experimental data. The model considers two different sorts of binding site with high and low affinity, showing a more complex binding (Gómez-Pineda et al., 2011). It was indicated that the adsorption can occur on homogeneous and heterogeneous site of the epitope NIP. For this assumption, this model recognizes that at high adsorbate concentrations, it predicts a monolayer adsorption capacity characteristic of the Langmuir isotherm, in which the adsorption is on the other binding sites such as amine-functioned silane monomer (Clausen et al., 2014). Whereas at low adsorbate concentration, it is effectively reduced to Freundlich isotherm, in which the adsorption process can take place preferentially on high-energy site at free silanol group (Si-OH) from inorganic precursor. The statement was supported by value of RL and heterogeneity (n) which, obtained between 0 and 1 and  $n = 1$  respectively, indicated the model is more favorable to adsorption with homogeneous site.

Similar findings had also been observed in epitope NIP, in which Langmuir-Freundlich (single-site) and Langmuir gave minimum values of  $\sum \text{RSS}$  and largest  $F_{\text{test}}$ . However, in epitope NIP, Langmuir showed highest value of  $F_{\text{test}}$  compared to Langmuir-Freundlich (single-site), which was 64.0715 and 64.0602 respectively. Thus, the adsorption behavior of heparin onto epitope NIP belonged to the Langmuir isotherm model. This model assumes that adsorption occurs on homogeneous site. The adsorption process only takes place at amine-functioned silane monomer, which is a single site adsorption (Clausen et al., 2014). These nonlinear fitting results were illustrated by the regression curves of experimental and calculated model data as shown in Figure 5.

Figure 5 shows that epitope MIP and epitope NIP followed Langmuir-Freundlich (single-site) and Langmuir isotherm. The maximum adsorption capacities  $q_{\text{max}}$  for epitope MIP and epitope NIP were found to be 19.1091 and 13.6218 mg/g respectively, which were close to the calculated values, which were 20.9394 and 14.4813 mg/g. in this study, approximately less than 10% of LMWH (15 monosaccharide units per molecule) used as template showed effective specific heparin (45 monosaccharide unit per molecule) binding with 19.1091 mg/g adsorption capacity obtained. Thus, it was proven that LMWH had high binding site to heparin. The binding capacity on this study was still low compared to latest epitope imprinting discovered by Yang et al. (2014) where the epitope imprinting was performed on the surface of silica nanospheres embedded CdTe quantum dots (QDs). About 1.3% of protein (C-terminus of BSA, residues 599-607) as a template had successfully captured



bovine serum albumin (BSA, 67kDa) with almost 70.0 mg/g of adsorption capacity obtained. This showed that size of the support where surface imprinting takes place plays an important role to maximize binding performance.

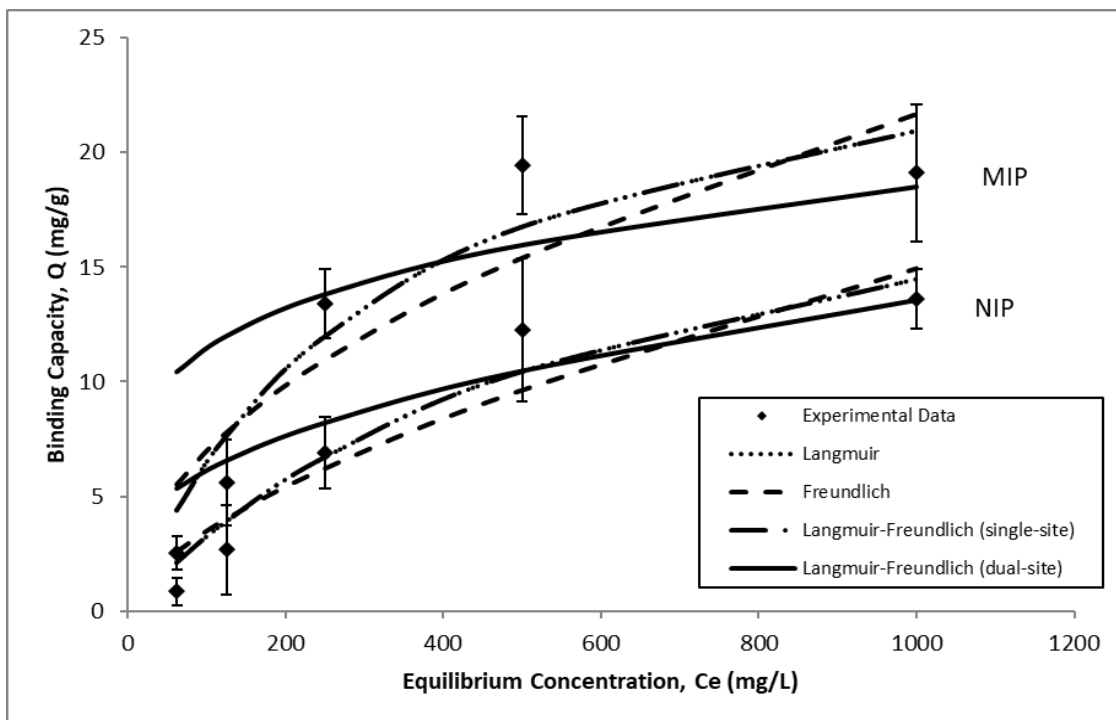


Figure 5: Adsorption isotherm curve fitting of heparin on epitope MIP and NIP

The mechanism of the kinetic adsorption process such as pseudo-first-order and pseudo-second-order kinetic models were applied to fit the kinetic data by applying the adsorption kinetics equations (7) and (8). The MIP fitted to pseudo-first-order kinetic model due to the small and largest value of the  $\sum RSS$  (0.4497) and  $F_{test}$  (227.1135) respectively. The model assumed that the kinetic adsorption involve the interaction force of physisorption caused by van der Waals force in very week energy interaction or charge-transfer complex between template and the adsorbent active site. The contrasting result was obtained in NIP where, it followed the pseudo-second order kinetic model. The model assumes that the physicochemical interactions of the rate limiting step were possibly involved in the adsorption process through sharing or exchange of electrons between the adsorbate and adsorbent (Özacar et al., 2008; Xie et al., 2015). These nonlinear fitting results were illustrated by the regression curve of experimental and calculated model data as shown in Figure 6.

Figure 6 shows that epitope MIP and epitope NIP of kinetic isotherm curve fitting followed pseudo-first-order model and pseudo-second-order model respectively. The maximum adsorption capacities  $q_{max}$  for epitope-MIP and epitope-NIP were found to be 17.8700 and 13.6000 mg/g respectively, which were close to the calculated data, which were 17.8943 and 12.7476 mg/g respectively.

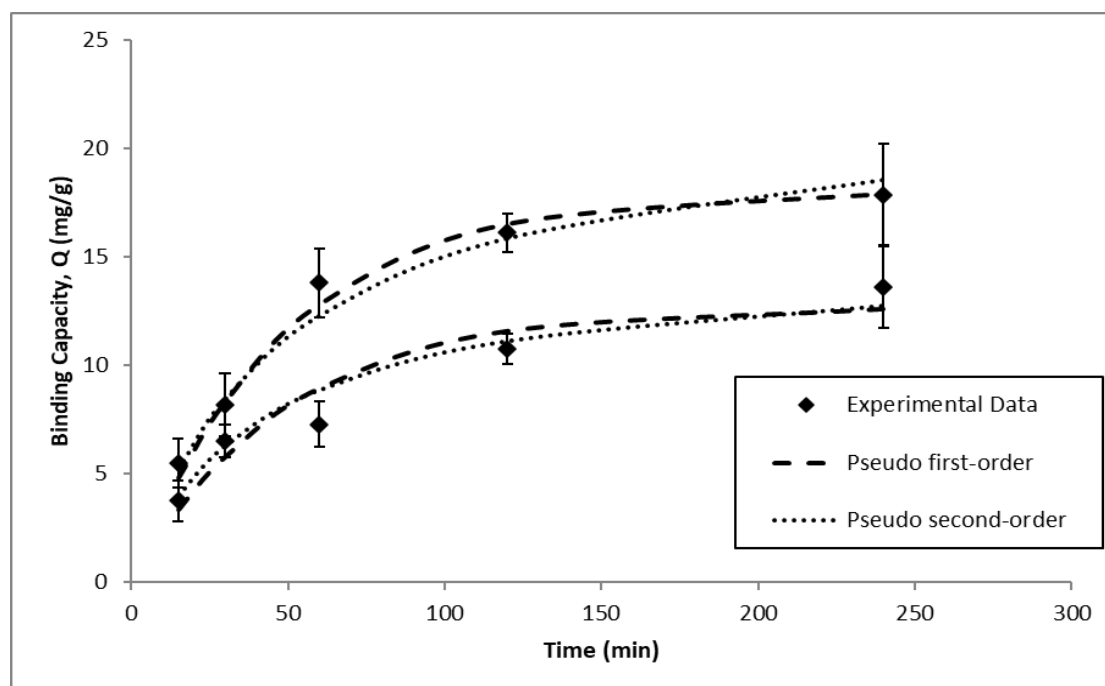


Figure 6: Kinetic isotherm curve fitting of heparin on epitope MIP and NIP

## Conclusion

An epitope imprinted for heparin recognition was designed and synthesized by surface imprinting using amine silane as monomer, tetraethoxysiloxane (TEOS) as a cross-linker, LMWH as a template, and silica microparticle as a surface binder by sol-gel process. A ratio of template to functional monomer were optimized to obtain higher binding capacity. The higher binding capacity of heparin compared to LMWH suggested that the epitope surface imprinted successfully adsorbed and enriched the heparin. Moreover, it was also sensitive, rapid, and had high repeatability for extraction and purification of heparin. It can be a promising practical candidate for industrial use in the pharmaceutical industry.

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## Has Humanizing the Drug Discovery and Development Process with Organ-On-Chips Contributed to Breaking Eroom's Law?

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**Abstract:** The drug discovery and development process is time and cost intensive. Eroom's law published with data up to 2010, stated that total costs of research and development (R&D) on new drugs approved by the US Food and Drug Administration had risen exponentially for 60 years. However, the changes in the costs associated with failed new molecular entities have started to decline, which led to the breaking of the rule. In this study, organ-on-chips are hypothesized as another valid reason, breaking Eroom's Law as key parameters related to molecular, cellular and physiological features of human disease progression have been considered while developing such models. Although animal models have been widely used, interspecies differences result in contradictions in clinical translation. Indeed, organ-on-chips have arisen as powerful tools to overcome these limitations. Organ-on-chips populated by human primary cells and/or stem cells can recapitulate in vivo organ level physiology and pathophysiology by recreating tissue and organ level functions in vitro. Cancer metastasis-on-chip models used to assess the efficacy of drug therapies are elaborated. In the short to medium term, more efforts are anticipated in engineering advanced microfluidic systems to develop organ-on-chip platforms for predictive translation of preclinical findings into clinical studies.

**Keywords:** Drug discovery, Eroom's law, Microfluidics, Organ-on-chip, Cancer models

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### Eroom's Law

Eroom's Law, a term derived from "Moore's Law" in the computer industry, reflects a trend seen in the pharmaceutical sector. It was first published with data up to 2010 and said total research and development (R&D) costs for new drugs approved by the US Food and Drug Administration have been rising at the fastest rate for six decades. This alarming pattern raised concerns about the sustainability and efficiency of the drug discovery and development process (Scannell et al., 2012). However, in recent years, there have been significant

changes in the costs associated with failed new molecular entities, indicating a departure from Eroom's Law. These cost declines have broken the previously established rule (Ringel et al., 2020). Several factors have contributed to this positive change, offering potential explanations for this encouraging development. One of the main reasons behind the change is the use of human genetic data to gain a deeper understanding of diseases. Advances in genetic research, such as the Human Genome Project, have offered significant knowledge into the underlying genetic factors that contribute to various medical conditions (Morgan et al., 2018). This knowledge has paved the way for more targeted and efficient drug development efforts. By identifying specific genetic targets, researchers and pharmaceutical companies can focus their resources on developing therapies that address the underlying causes of diseases. This approach enables a more precise and personalized approach to medicine, potentially reducing the costs associated with trial-and-error drug development (Mathur and Sutton, 2017). In addition, major pharmaceutical companies have implemented better decision-making processes that include setting clear thresholds for terminating unsuccessful programs at earlier stages. Historically, many drug development programs have continued for an extended period of time, despite showing signs of limited efficacy or safety concerns. This led to significant financial investment in projects with low chances of success. However, with a better understanding of disease mechanisms, better predictive models, and an increased focus on evidence-based decision-making, pharmaceutical companies are becoming more adept at recognizing undemanding drug candidates at early stages of development (Tollman et al., 2016). By eliminating these failed programs early, companies can redirect their resources to more promising methods, ultimately reducing overall costs. These advances in understanding diseases at a genetic level, along with improved decision-making processes, have begun to reverse the previously exponential increase in R&D costs associated with failed drug candidates (Sun et al., 2022). While it is important to note that drug development remains a complex and expensive enterprise, these positive changes represent a step toward more efficient and cost-effective pharmaceutical innovation. The ongoing integration of human genetic data and the implementation of better decision-making processes have great potential to optimize the drug discovery and development process, ultimately leading to the creation of safer and more effective treatments for patients in need (Heilbron et al., 2021).

## Drug Development Process

The drug discovery and development process is a complex and demanding endeavor that involves a series of complex steps, making it inherently time-consuming and financially burdensome. From the initial identification of a potential drug target to its eventual market approval, each step requires a significant investment of time, resources, and expertise (Mohs and Greig, 2017). The process usually begins with extensive research and analysis to identify a specific target, such as a disease-causing protein or biological pathway that can be modified to achieve therapeutic effects. This step alone involves the collaboration of multidisciplinary teams of chemists, biologists, pharmacologists, and other specialists, who spend countless hours conducting experiments, analyzing data, and searching for potential drug candidates (Schenone et al., 2013). Once a promising molecule is identified, the drug development phase begins, which includes preclinical studies to evaluate its safety,

efficacy, and pharmacokinetics. These studies, conducted using in vitro and animal models, aim to provide important data on drug interactions with biological systems, potential adverse effects, and dose adaptation. This phase requires significant time to ensure that the drug candidate is effective and safe before proceeding to human trials. Human clinical trials are another critical and time-consuming aspect of the drug development process (Yadav et al., 2021). These trials are generally divided into three phases, each with its own objectives and requirements. Phase I trials focus primarily on evaluating drug safety and dosing, often involving a small number of healthy volunteers. Phase II trials involve a larger sample size and aim to further evaluate the drug's efficacy and potential side effects in patients with the target condition. Finally, phase III trials involve an even larger population and attempt to confirm the drug's effectiveness and monitor its long-term side effects.

During the clinical trial phase, extensive data collection, analysis and regulatory compliance must be carefully performed to ensure patient safety and ethical considerations. These trials are not only time-consuming, but also demand substantial financial investments covering costs such as patient recruitment, medical monitoring, data management, and regulatory filings (Rubin and Gilliland, 2012). In addition, the drug development process requires adherence to strict regulatory frameworks set by health authorities such as the Food and Drug Administration in the United States or the European Medicines Agency in Europe. These agencies enforce strict guidelines to ensure patient safety, efficacy and quality control. Complying with these regulations adds additional time and cost burdens, as companies must provide extensive documentation, meet specific manufacturing standards, and navigate complex regulatory review processes (Teixeira et al., 2020). Moreover, despite intensive efforts and significant investments, the drug development process often faces setbacks and failures. Many drug candidates do not go through the rigorous stages of testing and evaluation due to issues such as lack of efficacy, unexpected side effects, or challenges in manufacturing. These failures contribute to the overall cost intensity of the process, as resources invested in unsuccessful candidates do not yield a return on investment (Sun et al., 2022). Consequently, the drug discovery and development process is a time- and cost-intensive journey that demands careful research, extensive preclinical and clinical evaluations, and adherence to strict regulatory standards. The complexities and uncertainties involved in each step, along with the need for extensive resources and expertise, contribute to the considerable investment of time and finance required to bring a new drug from concept to market. Despite these challenges, the process is critical to advancing medical science, improving patient care, and addressing unmet medical needs (Zagotto and Bortoli, 2021).

## **Organ-on-Chips and Disease Modeling**

Understanding how a substance is absorbed, distributed, metabolized, and excreted within the body is critical to predicting its effectiveness and potential side effects. However, biological differences between species often result in inconsistent results when attempting to extrapolate data from animal models directly to humans. Factors such as differences in drug metabolism enzymes, receptor profiles, and organ-specific physiology can significantly affect the pharmacokinetics and pharmacodynamics of a compound (Zhang and Tang, 2018). Taking a closer look at the drug development process, animal models have long been a cornerstone of

preclinical research in the pharmaceutical industry, offering crucial perspective into drug efficacy and safety. However, it is widely recognized that interspecies differences between animals and humans can lead to contradictions and limitations because they often fail to fully replicate human-specific responses due to intrinsic biological differences between species when trying to translate the results of animal studies into human randomized trials and clinical application (Van Norman, 2020).

To address these challenges, organ-on-chip (OoC) technology has emerged as a powerful tool in biomedical research, offering promising insights into drug development and potentially contributing to breaking Eroom's Law. OoC represents a state-of-the-art approach that involves building microscale models of human organs on microfluidic devices that mimic the structural and functional properties of human organs, to study drug responses and toxic effects, providing a more physiologically relevant platform (Ingber, 2022). OoCs are frequently composed of flexible materials, have microfluidic channels that allow living cells to be incorporated and simulate the movement of blood and other fluids within an organ. These chips can be used to replicate the microenvironment and cellular interactions unique to human anatomy by embedding human cells or tissue samples (Zhang et al., 2018). Starting with the first lung-on-a-chip developed by Huh et al. in 2010, various organs have been integrated into microfluidic platforms over the years such as liver (Deng et al., 2019), kidney (Wang et al., 2022), intestine (Donkers et al., 2021), heart (Yang et al., 2021), brain (Saglam-Metiner et al., 2023), bone (Mansoorifar et al., 2021), blood vessels (Franco and Gerhardt, 2012) and various tissue barriers (Koch et al., 2022). While a single organ may be the focus of OoC platforms, the interaction of different organs with each other can be investigated with body-on-a-chip platforms where more than one organs are included on the same platform (Zhao et al., 2019). The translational value of preclinical investigations can be increased by adopting OoC technology to acquire data that more accurately reflect the intricacies of human biology. The ability to more accurately predict drug responses and potential side effects can help streamline the drug development process and reduce reliance on animal models, ultimately leading to more efficient and reliable clinical trials. This approach allows for more efficient screening of compounds, potentially reducing the time and cost associated with developing new drugs. Moreover, by offering a more human-relevant platform for early-stage testing, OoC models may help reduce late-stage failures (Esch et al., 2015). The capacity of OoC models to faithfully mimic the physiological processes of organs is one of its key advantages. These models provide a more accurate representation of the cellular composition and functionality of human organs by using primary cells derived directly from human tissues or induced pluripotent stem cells (iPSCs), which can develop into multiple cell types (Palasantzas et al., 2023). These models incorporate specific microfluidic channels that allow the application of mechanical forces and media circulation, simulating the dynamic physiological conditions that organs in the human body experience. Furthermore, OoC models present a chance for the advancement of precision and personalized therapies. These systems can be developed to incorporate patient-specific cells, enabling the investigation of various drug reactions. This strategy has the potential to greatly advance personalized therapies since it enables evaluation of the effectiveness and side effects of drugs in a patient-specific context (Ingber, 2022).

In the context of drug discovery and development, OoC technology has opened up exciting possibilities for



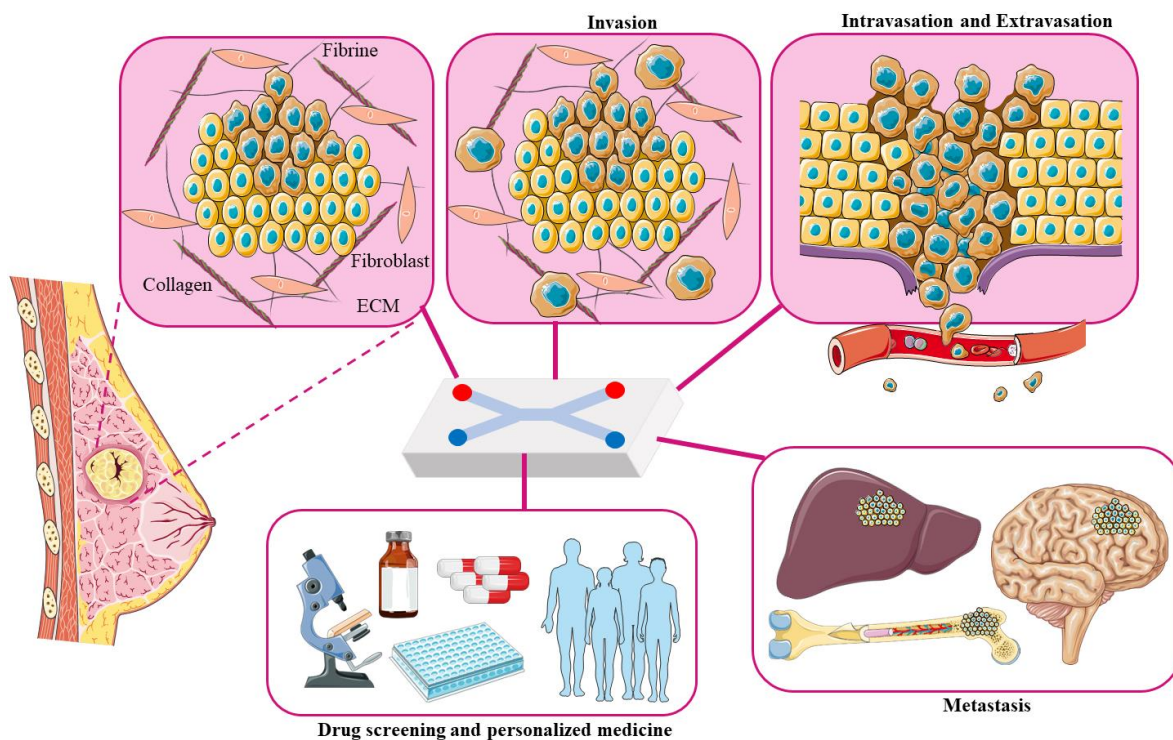
studying disease progression and evaluating the effectiveness of potential treatments. In addition to normal organ anatomy, organ-on-chip models can also capture pathophysiological aspects of diseases (Yesil-Celiktas et al., 2018). Diseased OoC models that can imitate the molecular and cellular alterations seen in patients can be recapitulated by adding disease-specific cells or including genetic abnormalities linked to particular diseases. This strategy makes it possible to investigate disease causes, assess novel therapies, and screen potential drug candidates in a more relevant and predictive manner (Li et al., 2022). As OoC models are highly capable of replicating the complex interactions and dynamics between different cell types and the microenvironment within an organ, disease processes and how various factors influence disease progression can be simulated. These models can also mimic the functionality of specific cell types and their responses to external stimuli, providing valuable insight into disease mechanisms and potential therapeutic interventions. In the field of brain diseases, OoC platforms can mimic the complex structure and function of the blood-brain barrier (BBB), providing significant contribution to common cause of neurological disorders such as Alzheimer's disease, Parkinson's disease, and stroke. These chips enable probing BBB permeability, evaluating drug delivery mechanisms, and studying interactions between neural cells and their microenvironment, paving the way for novel therapeutic strategies (Vatine et al., 2019). Equally promising is the application of OoCs in cardiovascular research, where it enables the simulation of physiological conditions and the study of heart diseases such myocardial infarction, arrhythmia, and heart failure. Heart-on-chips offer the assessment of drug toxicity, the monitoring of disease progression, and the development of tailored treatments suited to specific patients by combining cardiac cells, endothelial cells, and related mechanical signals (Mourad et al., 2023). In the field of lung diseases, OoC technology can simulate alveolar structure and airflow dynamics, studying respiratory conditions such as asthma, chronic obstructive pulmonary disease (COPD), and lung injuries (Saygili et al., 2023). It is possible to study disease mechanisms, evaluate the efficacy of novel drugs, and consider prospective therapies by exposing lung cells to disease-specific triggers and external stimuli like pollution or cigarette smoke. Furthermore, in 2020, investigations of viral infection in lung-on-a-chips became more prominent due to the SARS-CoV-2 outbreak (Saygili et al., 2021; Shrestha et al., 2020). Along with that, liver-on-chips can mimic the hepatic microenvironment and enable the study of liver diseases such as hepatitis, liver fibrosis, and drug-induced liver injury. Assessment of drug metabolism, toxicity, and disease progression utilizing immune, hepatic, and endothelial cells can ultimately produce innovative therapies and enhance drug safety profiles (Kanabekova et al., 2022). OoC technology can also shed light on gastrointestinal diseases, such as inflammatory bowel disease (IBD), colorectal cancer, and celiac disease. With the recapitulation of the microarchitecture of the gut and including gut cells, immune cells, and commensal bacteria, researchers can study the interaction between the gut microbiome and disease development, evaluate drug efficacy, and develop novel therapeutics (Akhtar et al., 2017). Moreover, OoC platforms can be applied to modeling bone diseases, enabling simulation of the dynamic interplay between bone cells, blood vessels, and the surrounding microenvironment. This technology holds promise for studying conditions such as osteoporosis, bone metastasis, and fractures, facilitating the development of new therapeutics and tissue engineering strategies to enhance bone regeneration (Arrigoni et al., 2017). OoC technology can contribute to the field of vascular biology by recreating the complex structure and dynamics of blood vessels. Incorporation of the endothelial cells, smooth muscle cells and associated mechanical signals enable the study of diseases such as atherosclerosis, thrombosis, and angiogenesis, also help

evaluate the effectiveness of vascular-targeted drugs and investigate the underlying mechanisms of vascular diseases (Gold et al., 2019). Significantly, OoC technology has wide applications in modeling diseases in various organs by simulating the microenvironment of these organs, studying disease mechanisms, drug development by providing unparalleled opportunities to evaluate effectiveness and develop personalized therapies. The treatments ultimately revolutionize the field of biomedical research and improve patient outcomes.

## Cancer and Metastasis-on-a-Chip

Many inflammatory, infectious, and viral diseases are modeled on organ-on-a-chip platforms, with cancer being the most studied disease model due to its wide variety of types (Li et al., 2022). Cancer is a complex and heterogeneous disease characterized by uncontrolled cell growth and proliferation, and one of the leading causes of death worldwide. One of the most critical aspects of cancer development is metastasis, where cancer cells spread from the primary tumor to distant sites in the body (Fisher et al., 2013). Metastasis involves a series of complex steps, including invasion of cancer cells into surrounding tissues, entry into the bloodstream or lymphatic system, circulation in the body, extravasation to distant organs, and establishment of secondary tumors in vital organs (**Figure 1**). Understanding the mechanisms underlying metastasis and developing effective strategies to target and prevent it are critical to improving cancer outcomes (Fares et al., 2020). However, studying metastasis in traditional in vitro cell culture systems or animal models often falls short due to their limited ability to recapitulate the complexities of the metastatic process, highlighting the need for more sophisticated platforms. Cancer and metastasis-on-a-chip platforms have emerged as powerful tools to study cancer growth, metastasis, and targeted therapies of various types of cancer (Liu et al., 2021). Metastasis-on-a-chip models offer several advantages over conventional methods as they provide a more accurate representation of the tumor microenvironment, interactions between cancer cells and the surrounding tissue. Metastasis-on-chip models more accurately reflect the complexity and variety of the tumor microenvironment by including several cell types, like fibroblasts or immune cells, allowing for the examination of the functions of diverse cell types in metastasis (Imparato et al., 2022). Also, microfluidic systems offer the ability to recreate the fluid dynamics encountered during metastasis. By introducing fluid flow and shear forces, how physical cues affect the behavior and migration of cancer cells can be studied. For instance, incorporating vasculature-like structures and fluid flow into the chips allows evaluation of the extravasation of cancer cells from the bloodstream into target organs, mimicking the process of metastatic colonization. This allows for more detailed investigation of mechanistic aspects of metastasis, such as cell adhesion, migration and extravasation (Regmi et al., 2022; Sontheimer-Phelps et al., 2019). In addition, metastasis-on-a-chip models can incorporate specific organs or tissue compartments to mimic the metastatic location. These organ-specific microenvironments can be engineered to replicate the unique characteristics of different tissues prone to metastasis, such as lung, liver, or bone. By recreating these organ-specific conditions, researchers can gain insight into how cancer cells interact with and colonize distant sites, contributing to secondary tumor growth (Sharifi et al., 2020). The capacity of metastasis-on-chip models to more accurately and predictably assess the success of pharmacological therapy is

one of its key advantages. The response of cancer cells to various treatment options can be evaluated by incorporating cancer cells with various metastatic potential or drug resistance characteristics. Microfluidic systems allow precise control of drug delivery and exposure, enabling investigation of drug responses and identification of potential therapeutic strategies to target metastatic cancer cells. In addition, OoC models can be used to investigate organ-specific metastasis. Each organ has unique cellular compositions, extracellular matrix compositions, and physical properties that may influence cancer cell behavior. Organ-specific factors that encourage or inhibit metastasis can be thoroughly examined by developing organ-specific chips, thereby assisting in the development of targeted therapies for particular organs impacted by metastatic disease (Zhang et al., 2022).



**Figure 1.** Breast cancer metastasis and breast cancer-on-chip platforms. The image was created by using the visuals in the SMART Servier Medical Art (<https://smart.servier.com/>) program licensed under a Creative Commons Attribution 3.0 Unported License.

Many different cancer types, such as brain, skin, bone, lung, liver, pancreas, intestine, prostate, ovarian, and breast cancer, have been studied on OoC platforms (Liu et al., 2021). Breast cancer, which ranks first, surpassing lung cancer with an incidence of 11.6%, has also become the focus of cancer-on-chip studies in recent years. The increase in deaths from breast cancer as a result of metastasis or from cancers that metastasize to the breast supports the development of breast cancer-on-chip platforms to develop new and effective treatments by focusing on metastatic processes (Moccia and Haase, 2021). Breast cancer-on-chip models that can recreate the dynamic interactions between breast cancer cells and the extracellular matrix can recapitulate the migration and invasion behavior of breast cancer cells and the structure of the mammary gland. Such models

include biomimetic 3D hydrogels such as collagen, fibrin, hyaluronic acid, Matrigel, GelMA with different invasive properties and different cell types for the tumor microenvironment (Keller et al., 2021). In addition, these platforms allow investigation of intravasation and extravasation, the processes by which cancer cells enter and exit blood vessels, respectively, which are important for metastasis. In the intravasation and extravasation processes, the motility of cancer cells, their interaction with the tumor microenvironment and immune cells, and the flow conditions in the microfluidic platform along the vasculature exhibits utmost importance (Subia et al., 2021). Breast cancer cells that cross the vasculature move to distant sites, such as the bones (Hao et al., 2018), liver (Kim et al., 2020) or brain (Conceição et al., 2022). This has been replicated in breast cancer-on-chip models with the integration of two or more organs, allowing for multi-OoC studies. This study increases the understanding of how the metastatic cascade occurs and the mechanisms underlying metastasis to distant organs. Breast cancer-on-chips also enables assessment of metabolic and biochemical properties of cancer cells, such as nutrient uptake, oxygen consumption, and waste production. These parameters may shed light on metabolic changes in breast cancer and aid in the development of targeted therapies. Additionally, the platform has potential applications in breast cancer diagnosis, as it can be used to study the migratory behavior of tumor cells and assess their potential for metastasis. In a therapeutic context, breast cancer-on-chips provides a valuable tool to test the efficacy and toxicity of variety of therapies, allowing for personalized treatment approaches (Firatligil-Yildirim et al., 2023). These models can incorporate patient-derived cancer cells or tumor samples, enabling researchers to evaluate the effectiveness of potential treatments on an individual basis. By exposing patient-specific cancer cells to different drugs or treatment regimens within the chip, the tumor's response and sensitivity to different interventions can be assessed. This individualized approach has the potential to optimize treatment strategies and improve patient outcomes. These chips also allow evaluation of the effectiveness of anti-cancer drugs and potential interventions to prevent metastasis (Yildiz-Ozturk et al., 2017). Additionally, these chips can be used to test the effectiveness of chemotherapy drugs and identify potential targets for personalized treatments (Subia et al., 2021). To conclude, breast cancer metastasis-on-chip models offer a valuable approach to evaluate the invasion, intravasation and extravasation processes of metastasis, efficacy of drug therapies in the context of metastatic cancer. Ongoing efforts to engineer advanced microfluidic systems and develop organ-on-chip platforms hold great promise for the predictive translation of preclinical findings into clinical studies. Combining the advantages of these models with interdisciplinary collaborations, researchers are paving the way for more efficient and precise drug development processes, bringing us closer to improved treatments for cancer and other complex diseases.

## Conclusion

OoC technology has emerged as a promising alternative, providing a platform that overcomes interspecies differences and better represents the intricacies of human organ function. By enabling more precise and reliable preclinical studies, OoC models offer the potential to enhance drug development, reduce late-stage failures, and accelerate the translation of research findings into successful clinical trials (Ingber, 2020). Incorporating key parameters related to the molecular, cellular, and physiological characteristics of human disease progression,

these innovative models have the potential to break Eroom's Law and revolutionize the drug discovery and development process (Ringel et al., 2020). Recapitulation of in vivo organ-level physiology and pathophysiology, OoC models provide a powerful platform for studying human biology, disease mechanisms, and drug responses. With their potential for personalized medicine and precision therapies, OoCs offer new avenues to advance healthcare and develop safer and more effective treatments. These platforms can be engineered to include multiple OoC modules interconnected to mimic the interactions between organs, creating a system that more closely matches the complexity of the human body (Danku et al., 2022). As cancer, specifically breast cancer, is one of the most common and deadly diseases, metastasis-on-a-chip models emerged as a valuable tool to study and understand the complexities of cancer metastasis. Emulating critical aspects of the metastatic cascade within a microfluidic platform, these models provide a more physiologically relevant platform for investigating the mechanisms and dynamics of metastasis. They have the potential to expand our understanding of the metastatic process, identify new therapeutic targets, and accelerate the development of more effective anti-metastatic strategies. Ultimately, these advances have the potential to innovate cancer research and contribute to the development of more effective strategies for the diagnosis, treatment, and prevention of metastatic cancers.

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## Economical Environmental and Political Aspects of PV Recycling in The Light of Future Projections

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**Abstract:** Photovoltaic materials or a solar cell, is an electronic device that converts the energy of light directly into electricity by the photovoltaic effect. There are several different types of PV cells which all use semiconductors to interact with incoming photons from the sun in order to generate an electric current. Photovoltaic solar cells or panels are accepted as a reliable and non-polluting alternative energy. The PV market grew catastrophically since the last two decades, which is mainly accompanied by the falling prices of solar cells, in special of silicon. PV modules, which will provide a large part of the energy need in the coming decades, may cause a major environmental disaster if they are not recycled after completing their economic life. However, the economic feasibility of recycling is uncertain. On the other hand, both the lack of a technological solution for PV recycling and an international policy in this area are seen as a major shortcoming. In this study, the economic and environmental impact of PV recycling was investigated by taking into account the projection studies carried out by different institutions.

**Keywords:** PV Recycling, PV Waste, PV Cell

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### Introduction

New technological developments are the primary driving force for growth and rejuvenation in industries such as information technology, energy technologies, and AI, which are expected to improve people's quality of life. Many researchers have made important contributions to renewable energy technology (Alptekin et al., 2023; Çebi et al., 2021; M.S. Celiktas & Kocar, 2012; M.Soner Celiktas & Kocar, 2010; Cerone et al., 2017; Deniz & Çeliktas, 2022; Garip et al., 2022; Gunes et al., 2020; Ozay & Celiktas, 2021; Pilavtepe et al., 2013). The renewable energy sector and especially solar power plants have been among the fastest growing sectors in the world over the last decade. Solar PV continued its unprecedented run, reaching 175 GW of new capacity in 2021, for a cumulative total installed capacity of approximately 942 GW (REN21, 2022). There are two main reasons for the acceleration of investments in the solar energy sector; Cost-effectiveness and climate change. The costs of utility-scale PV projects fell nearly ninety percent between 2010 and 2021, from \$0.40 per

kilowatt-hour (kWh) to \$0.046 per kWh (REN21, 2022; Statista, 2023).

Pressure on resources will increase due to increasing global growth such as sustainable industrialisation, ecologicalisation and digitalisation. Increasing demand from emerging markets and the transition to climate neutrality with rare and critical metals, strategic minerals used in low emission technologies and products (Bobba et al., 2020). So, rapid growth of photovoltaic installations over the past decade requires radical action for establishing a robust and economically viable PV disposal and recycling system. The economic lifetime of photovoltaic modules is considered to be around 25-30 years (Kim & Jeong, 2016). Therefore, at current growth rates, the first peak of PV disposal will be seen around 2030. Steps need to be taken today to avoid the fossil fuel turmoil in the renewable sector.

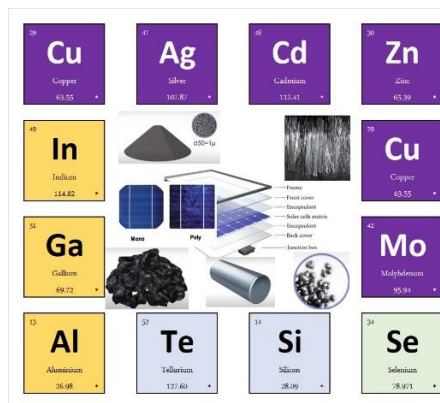


Figure 1. The minerals in solar panel

Photovoltaic panels contain rare minerals and precious metals that are increasingly mined and refined (Figure 1). So, proper recycling of these precious metals and minerals is of great importance for the industry. It is mandatory to establish recycling methodologies, infrastructure and policies to reuse of these materials within the industry. C-Si PV modules, contain aluminum, glass, silicon, copper, silver, and rare minerals (RM). CdTe PV modules contain cadmium, copper, steel, and RMs (Fthenakis et al., 2020). The rare critical metal components used in the PV module are often more expensive than other used materials, and their recycling process is very important for reuse in production. On the other hand, a significant amount of energy is spent to purify these materials for reuse in PV modules. Thin-film modules contain critical and strategic raw materials as Te, In, Ga, and Mo, which are in limited supply (Berger et al., 2010; Meyer & van Dyk, 2003).

### PV Recycling Methods

The biggest challenge in recycling solar panels is that, unlike their complex structure, the materials used in their construction are used together in a single product. PV recycling can be done using a variety of techniques (Table 1). These techniques are based either on physical or thermo chemical recycling (Dias et al., 2017; Gustafsson et al., 2014; Nain & Kumar, 2022). In the physical method, various processes such as size reduction, planetary

grinding and separation are applied (Dassisti et al., 2020; J. Zhang et al., 2013). The recycled products are the aluminum which is part of the frame, glass fragments, silicon powder, copper, ethylene-vinyl-acetate (EVA) and backsheet particles. Although silicon cannot be recycled for use in the PV industry due to low purity, the recycling rate is roughly 90% by mass. In the thermo chemical method, which is primarily based on the degradation of the EVA layer and recovery through pyrolysis, the cell residues undergo a thermal treatment and are then used in chemical processes for the recycling of silicon, silver and aluminum (IRENA and IEA, 2016). Recent research on end-of-life conventional crystalline silicon PV modules has focused on organic solvent methods and alternative conversion methods to recycle silicon cells (Kang et al., 2012; Tammaro et al., 2015).

Table 1. PV Recyclig Methods

Mechanical Recycling		Chemical Recycling		Thermal Recycling	
<i>Traditional</i>	<i>Innovative</i>	<i>Traditional</i>	<i>Innovative</i>	<i>Traditional</i>	<i>Innovative</i>
Crushing	High Voltage Crushing	Strong Chemicals	Mild extracting technology	Incineration	Pyro - metallurgical technology
Shredding	Electro-hydraulic Fragmentation	Leaching	Chemical + Hydrometallurgical treatment	Thermal treatment	Supercritical Technology
Milling	Irradiation by laser	Solvent usage	Biometallurgical Technology	Combined Heat treatment	Vacuum metallurgical technology

### Economical, Enviromental and Political Expectations

It is very difficult to say that disposing of solar panels is environmentally friendly. Heavy metals in solar cells, such as cadmium and lead, can become hazardous and toxic waste if not properly recycled. So, recycling PV systems has both environmental and economic benefits. Although economic concerns are the biggest obstacle in most recycling studies, other precious metals and minerals can be considered worth recycling. Since the average lifespan of a PV system is quite long and varies between various types, the number of end-of-life systems is slowly increasing, but the most important problem here is that the economic benefits of recycling will remain below the company's expectation. The recovery of rare metals and minerals from waste solar cells (or solar panels) is becoming more and more important with the day by day development of the photovoltaic industry. It is gaining importance both economically and environmentally (Z. Zhang et al., 2021).

In addition to its environmental importance, the recycling of solar PV panels will also have an impact on the value chain. Studies on PV module recycling mainly focus on technology and methodology. However, research, especially in the coming decades, should also be geared towards analyzing waste PV cell strategies from an

economic point of view. Some rare elements in PV modules, which are in limited supply in the world, are depleted from the environment over time. If these materials can be recovered, they can be incorporated into the supply chain for reuse in the production of PV and other products. According to a study by the International Renewable Energy Agency, it is estimated that 15 billion dollars could be recovered from the recycling of pv modules by 2050 (IRENA and IEA-PVPS, 2016). However, extracting and recycling these materials is both a complex and expensive process. Based on a study conducted by the National Renewable Energy Laboratory, it was found that recycling costs between \$15 and \$45 per module, while landfilling costs between \$1 and \$5 per module. Due to these costs, most PV panels are not recycled today (Curtis, Buchanan, Smith, et al., 2021).

From this perspective, solar panel recycling is still in its infancy. All players in the game have started discussions on how recycling policies can drive a circular economy for PV system components. The Policies will encourage the development of PV reuse-recycling business models and processes with different approaches to PV module fabrication. In 2012, the EU declared end-of-life PV modules as waste electrical and electronic equipment (Monier & Hestin, 2011; Sander et al., 2007). So in Europe, solar panel manufacturers are required by directives to recycle their panels when they reach the end of their useful life. Likewise, PV system manufacturers also have a legal responsibility to handle end-of-life modules appropriately.

On the other hand, in the US, such a regulation does not yet exist. However, some states have enacted laws regulating the end-of-life management of PV panels. There are no US federal policies addressing PV system equipment recycling or end-of-life management options. Washington, New Jersey, North Carolina and California are the US states with laws or regulations that directly address PV system equipment reuse and/or end-of-life management options [28]. The policy proposal should provide the necessary incentives to enable sustainable materials management practices within the circular economy until recycling costs become competitive with disposal (Curtis, Buchanan, Heath, et al., 2021).

## Conclusion

Circular Economy is a model of manufacturing and consumption that involves sharing, lending, reusing, repairing, reconditioning and recycling existing materials and products for as long as possible (Cebi et al., 2022; Corvellec et al., 2022; Walter R. Stahel, 2016). Of greatest concern are the increasing requirements for metals and minerals due to the development and deployment of renewable energy and storage technology. Demand for these raw materials will exceed current production in the near future, depending on developments. PV module installations are growing rapidly, especially considering the last decade, and will soon dominate energy production, increasing market dominance within the circular economy (Teske, 2019). As a result of this rapid growth, the volume of modules reaching the end of their economic life will similarly grow. As a result, methods for recycling solar modules are being developed worldwide to reduce the environmental impact of PV module waste and recover some of the value from old modules (Lunardi et al., 2018). Further development and implementation of PV recycling and/or end-of-life management requires public funding for research and

development or civil initiative.

Finally, a global policy approach that supports the circular economy and sector of the PV recycle is urgently needed for a successful and cost-efficient transition process. Concrete standards and requirements must be defined at a very detailed level, covering as far as possible all technologies and their areas of application.

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## Wearables and the Practice of Self-Surveillance as Self-Knowledge

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**Abstract:** This paper analyzes how the materiality of knowledge afforded by wearables is present within the practice of self-surveillance. Wearables, such as smartwatches, allow for easy tracing and storage of one's activity history, but they require the wearer to engage in self-surveillance. While giving away one's data to gain access to online services is motivated by efficiency and 'free' accessibility, the practice of self-surveillance in wearables is blurrier. In this paper, I situate the notion of desire as central to the practices of digitalized self-surveillance. This paper follows the following line of inquiry: two case studies of recent self-tracking trends (Quantified Self Movement, Apple Watch) and one historical, media archeology case study of diary writing from the 19th century. The digital self-surveillance is linked to the notion of agency and control exercised by self-disembodiment. Disembodiment is briefly analyzed as establishing a disembodiment view of the self through a distant view of the past and presence. Such a view, 'from outside to inside,' is linked to the self-knowledge inherent in self-tracking across time. The body becomes a data object, at once a stable entity and an object-in-making. Yet there is a threat in perceiving data as an objective mirror of reality (and thus self) rather than a set of opaque algorithm-driven ('cooked') digital objects.

**Keywords:** Wearables, Self-Surveillance, Datafication, Self-Tracking, Media Archeology

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### Introduction

Wearables are becoming an increasingly intrinsic part of many lives across the globe. According to Accenture Research conducted in 2018, the use of wearable technologies tripled in the period from 2014 to 2018, raising from 9% to 33% (Accenture Research 2018). Ranging from 'smart' rings and 'fitness' bands, to watches and apps, technologies of self-tracking allow for an easy way of recording, measuring, analyzing, and storing the history of one's activity. Generally, such devices are "designed to quantify everyday exercise and rest, mood and diet, and then provide feedback to users such that they can better understand and possibly modify their activities and behavior" (Crawford, Lingel, & Karppi, 2015, p. 484). What self-tracking wearable hardware and app software allow for is the recording and collecting of data which is transcribed and analyzed using complex computing operations (Lyon, 2018, p. 101).

In order to self-track one does not even need to physically wear anything. Plenty of smartphone apps that use in-

built phone's accelerometer are able to 'monitor' both outside and inside patterns of the body, from sleep quality to air quality (Salter, 2022, p. 234). While some self-tracking tech can be seen as pure consumer goods no different from gadgets, others are in fact "required" to wear in certain activities or even jobs (Lyon, 2018, p. 101). Whether it is step count, blood pressure, or sleep quality, what self-tracking tech is supposed to help the user achieve is self-optimization (Salter, 2022, p. 234). Thus, self-tracking technologies promise a new, digital way of living a healthier and more conscious (or optimized) life, be it professional or personal life.

Wearables seem to establish self-tracking (or self-surveillance) as a common social practice, offering in exchange access to self-knowledge. It's been already pointed out that the discourse around wearables has often took form of situating wearables within the domain of technology of self-knowledge. In a study devoted to a wearable in form of a ring that is supposed to measure stress levels and alert the user to calm once she is under pressure, Berg points out that user can learn about herself and her bodily senses through the sensors of the wearable (Berg, 2017, p. 7). Berg notes that, on the one hand, wearables "can assist users in learning about themselves and to take command of their lives," yet, on the other hand, wearables imply that "the human body is most often presented as incapable to decipher embodied experiences" (Berg, 2017, p. 7). Partially following that line of inquiry, this article argues that self-tracking that makes wearables work is often taken as a prerequisite for a larger goal, that of new form and ontology of self-knowledge, which would be otherwise impossible. Therefore, this article seeks to answer the following research questions:

RQ1: What are the promises of self-knowledge that self-tracking technologies such as wearables make in exchange for users' self-surveillance practices?

RQ2: In what ways is the self-knowledge offered by digital self-tracking technologies similar/different to self-knowledge of the domain of the analog (e.g. 19th century diary keeping)?

RQ3: What are the logics and new ontologies of self-knowledge that is made accessible to users via datafication and self-surveillance?

## Method

This paper merges materialist media studies as well as radical humanist approaches with interpretative media and communications paradigm. It aims to critically define and evaluate the affordances of a medium (self-tracking technologies) and social relation (users' practices of self-tracking). In this paper, I partially rely on three case studies and the close-reading of the content as a result of a signifying processes. A semiotic analysis of images and their accompanying texts is used in order to pin down the semiotic relations and intended message of the content examined in each case study.

The methodology for this paper is based on three types of analysis: medium/aesthetics analysis, semiotic analysis, and content analysis. First, I conduct a semiotic analysis of the Quantified Self movement and Apple Watch marketing materials. These two case studies consist of captures (screenshots) of the official webpages from the Quantified Self and from Apple, respectively. While the analysis of the Quantified self focuses more

significantly on the written content of the sources, the analysis of Apple Watch included visual analysis and close-reading of marketing materials in a broader context of marketing strategies of Apple, as they were best established in the iconic “1984” Macintosh commercial. Second, I relate my findings to a broader notion of self-knowledge obtained through self-tracking-by-outside-disembodiment. For that purpose, I turn to the third case study, an analysis of which focuses on the practice of diary writing. In the third case study, I follow the principals of media archeology (Parikka, 2012). As Jussi Parikka phrased it, media archeology approach allows one to perform, a “theoretically refined analysis of the historical layers of media in their singularity—a conceptual and practical exercise in carving out the aesthetic, cultural, and political singularities of media” (Parikka, 2011). Lastly, I perform a comparative analysis and discussion of all three case studies. The research sample for performed case studies (website captures) was collected on June 2, 2023.

## Results

### Case Study 1

QUANTIFIED SELF  
SELF KNOWLEDGE THROUGH NUMBERS

THE KEATING MEMORIAL  
SELF RESEARCH GROUP

Would you like to get help with your self-research project from an active, experienced group of peers? You're invited to join the Keating Memorial Self Research group. We meet every Thursday at 10am Pacific time. You can find the agenda, notes & links in the full post.

New Show&Tell Event: Tracking Blood Glucose

Please join us for an hour of short "QS Show&Tell" talks about diet and metabolic discoveries using personal science. This session will focus on minimally invasive blood glucose monitor and meal and activity tracking with Nutrisense.

Figure 1. Capture of the Homepage of Quantified Self. <https://quantifiedself.com>.

“Quantified Self supports every person’s right and ability to learn from their own data. We’re committed to accuracy, independence, inclusiveness, and transparency in all of our work” (Quantified Self, 2023A), announces the quote located at the bottom of each page of the Quantified Self website. The Quantified Self movement took shape in the late 2000s. It was set up by a former WIRED editor Kevin Kelly and Gary Wolf with an aim of pinning down the phenomenon of people who collected and analyzed own data to examine patterns of own behavior. The approach of “data driven-life” (Wolf, 2010), as they called it, has been central in framing empowering self-knowledge as derived from numbers (Salter, 2022, p. 174). Ten years on, the slogan

on the Quantified Self website reads “Self knowledge through numbers” (see fig 1.).

Having started right beside Silicon Valley, the Quantified Self (QS) main office is located in San Francisco, USA, but QS is considered an international “community” of people interested in the use of self-tracking technologies and tools for the sake of “self-knowledge” (Quantified Self, 2023B). On the one hand, QS as a community spawning across the globe speaks of a rather empowering notion of personal ownership over one’s own own data and thus being in charge of using that data for self-knowledge (Quantified Self, 2023B). The scope of QS extends from ‘personal’ self-tracking technologies such as wearables to the depths of datafied society: including the markets for data brokers or “data stores” and online website tracking. Aside from self-knowledge through self-tracking, QS’ emphasis lies in the community-based development and feedback on various self-tracking projects and practices, but also the importance of privacy and broader desire “to better help us answer a broader range of questions about ourselves” (Quantified Self, 2023B) through data.

This premise is reflected in the design of QS’ digital presence as well. The futuristic font omnipresent on their website (fig.1) signifies the digital displays of early-computing days. Somewhat futuristic, it quite literally recalls how ‘the digital’ indeed is made out of digits, historically displayed as single lines or pixels. This visual connection is also referenced in the logo of QS – made out of dots or digits (pixels) which can also be read as data points. The QS’ logo thus directly references the very core of the whole movement: single data points can be put together into a signifying (meaningful and readable) pattern.

The studies of wearables and datafication have often focused on the QS movement (Crawford, Lingel, & Karppi, 2015, p. 484). Yet, as Crawford, Lingel, & Karppi point out, the QS movement is a rather borderline case of a very dedicated group of users of self-tracking technologies who actively identify as such (Crawford, Lingel, & Karppi, 2015, p. 484). Nonetheless, I include the case of the QS movement here precisely because through its borderline magnification of the premise of data-driven self-tracking, we can study the promises of self-knowledge through self-tracking. Such promises, as I argue, also reach a larger group of users, even if they do not actively and directly subscribe to the QS. Self-tracking in the spirit of the QS movement is rather commonplace today (Nafus and Sherman, 2014, p. 1785) as a way of gaining “self-knowledge” that can lead to bettering users’ lives (Lyon, 2018, p. 15). With the widespread of smartphones, self-tacking apps merge with data flows that include personal data accumulated and transferred from users’ devices as well as health institutions (Cheney-Lippold, 2017, p. 118; Lyon, 2018, p. 101). Self-tracking is more than a peculiar movement that outgrown itself, and its basic premise is not as new as it might seem.

## Case Study 2

“Apple ads are about how a product can change your life” (Hollis 2011). In their products, Apple has always promoted very specific values and lifestyle, combined with visually pleasing design, and this strategy remained consistent through the years. While looking at the recent promotional pictures for Apple Watch on Apple’s official website, one can trace the same values and concepts that Apple included in its most iconic campaign. In

its 1984 commercial, Apple played on the reference to George Orwell’s 1984, yet Californian ideology makes Apple commercial appear as an ideological choice based on a belief that technology brings liberation. Steve Jobs and Steve Wozniak, the creators of Apple, embodied the beliefs of the Californian ideology. The idealized vision of internet was based on the hope that it will be the place “where all individuals will be able to express themselves freely within cyberspace” (Barbrook and Cameron, 1996). This illusive cyberoptimism did not include the dark side of the internet, filled with data harvesting, bots’ manipulations, and fake news. Nevertheless, “the Internet remains dominated by American corporations, primarily from California” (Fuchs, 2018), which were born out from this ideology – the QS movement is related to it too. The Californian ideology narrative has been present throughout Apple commercials, and is a part of a persuasion technique they use to promote their products.

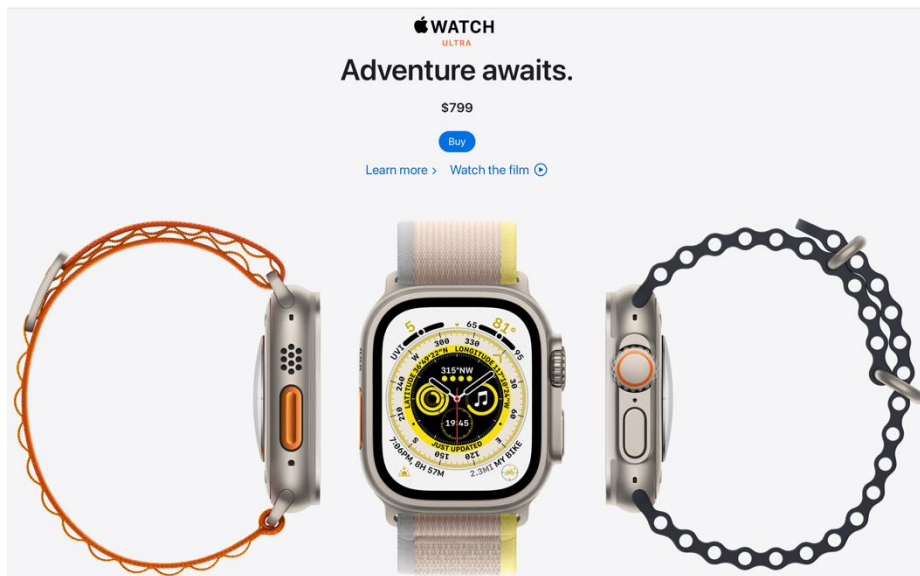


Figure 2. Capture of the Page of Apple Watch. <https://www.apple.com/watch/>

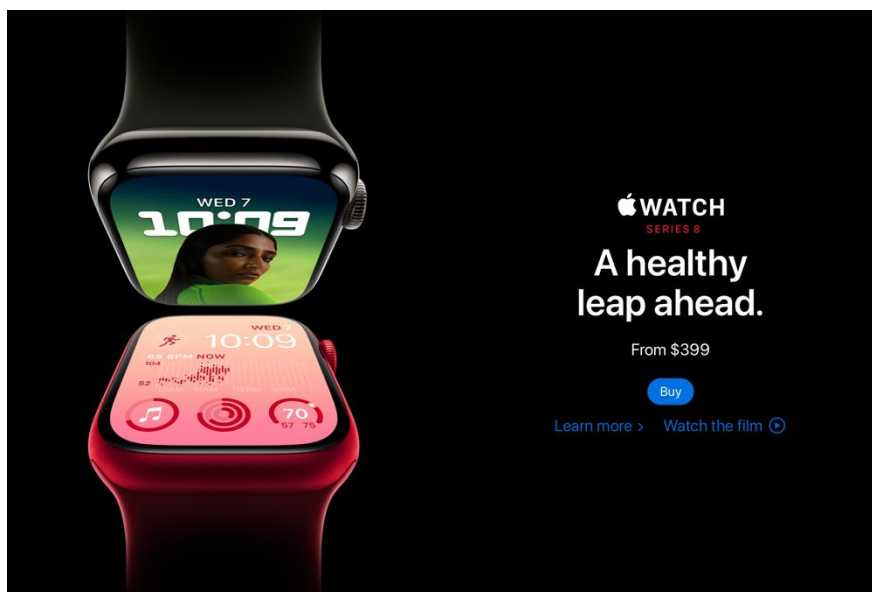


Figure 3. Capture of the Page of Apple Watch. <https://www.apple.com/watch/>

1984 by Apple, shows a dystopian, Orwell-like world, with no individualism and total control. Among a crowd of people blindly staring at a screen of Big Brother’s face, a young woman is running. She is slim, blond, and young. She is wearing red shorts and white top, and she is carrying a hammer in her hands. As she runs from police-like forces, she throws the hammer into the screen, destroying it and subsequently liberating people. The subtitle reads that “On January 24<sup>th</sup>, Apple Computer will introduce Macintosh. And you’ll see why 1984 won’t be like “1984” (Scott, 1984). Each element of this commercial corresponds to the Californian ideology. The digitalization, presented as an attractive and young woman, liberates the masses from control and surveillance. The woman wears bright and saturated colors, red and white, which not only are in contrast with the rest of the shots, but also seem powerful, modern and aesthetically pleasing. The commercial sells the idea of technological liberation by a good-looking and modern solution. Apple Watch offers just that: it is a wearable that is both “extremely insightful” and is the “ultimate device for a healthy life” (fig. 4).

The way in which Apple presents its Appl eWatch (fig. 2 and fig. 3). Apple Watch is hovering in the spaceless void, either emerging from the white background as a liberating portal to a better place – to the “adventure” waiting ahead (fig. 2) or illuminating the black background with its liberating knowledge to empower users to “leap” towards “healthier” selves (fig. 3). Both the signifiers and signified of Apple Watch bear great similarity to Apples’ “1984” ad. In both cases the digital provides a space for a new and liberal ways of communicating, a “digital rhetoric that encourages self-expression, participation, and creative collaboration” (Eyman, 2015). Apple established “the cool design aesthetic, the imagery in the advertising, and the sense of community evoked by seeing people you respect with Apple products” (Hollis 2011), and it works. According to Statista (2018), in 2006 Apple started with a value of 15.98 billion U.S. dollars, while it reached 300.6 billion U.S. dollars by 2018, becoming the second biggest technological brand worldwide, after Google. As Brad Johnson, *Ad Age*’s director of data analytics, observes, “Apple pursued a vision, a dream. It did not pursue a business” (1994).

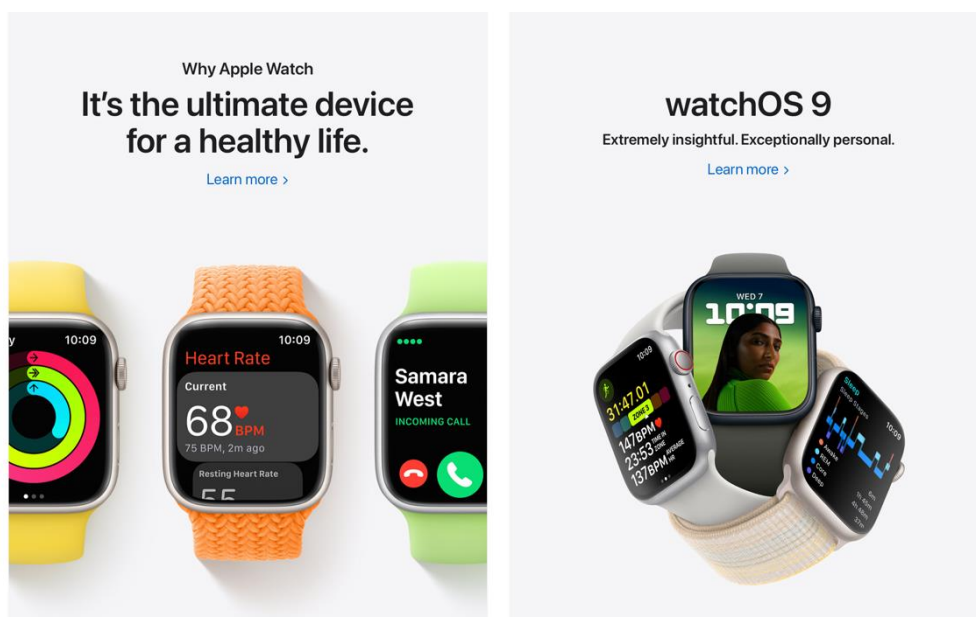


Figure 4. Capture of the Page of Apple Watch. <https://www.apple.com/watch/>

### Case Study 3

The practice of keeping track of the self by putting down data is significantly older than Apple Watch and the QS movement. The practices of record-keeping for professional goals (record books at merchants' such as accounting books) and personal purposes (diaries) and both (calendars and agendas) are centuries long. All these examples are connected by the characteristic of the search for (self) knowledge through a set of data points, recorded through time, that can reveal new, otherwise unattainable, patterns for self-improvement.

Historically speaking, we can locate a certain shift in mentality and growing popularity of self-knowledge practices to the 19<sup>th</sup> century. In the positivist spirit of the industrial revolution, many scientists and industrialists turned to new creating tools and ways of, as we would say today, 'datafying' the visible and invisible of the human behavior. As Salter points out, the unifying aim of such endeavors in both North America and Europe was to establish "a new kind of human being: quantifiable, calculable, and predictable" (Salter, 2022, p. 18). The very idea of turning "messy" human sensations into something "readable" – such as devices to 'measure' heartbeat – was one of the very first attempts at data visualization (Salter, 2022, p. 31). Salter goes as far as to argue that the ideology that spawned in 19<sup>th</sup> century has been directly materialized in the wearables of today:

But to turn our human bodies into continual experimental test subjects that are being monitored 24/7 might just, in fact, be the ultimate apotheosis of the nineteenth-century laboratory, in which the senses could be precisely monitored, qualified, and predicted, all without the intrusion of the experiencing self. (Salter, 2022, p. 214)

Writing and note keeping are a technology in itself older than that of mechanical means of tracking the body. Salter notices that diary keeping as a self-knowledge practices were, nonetheless, "personal, close-up, and subjective accounts of their experience" (Salter, 2022, p. 174). However, the practices as such were in their core similar; as Schüll (2016), following Crawford et al (2015) points out, "people have long used simple, analog devices to record, reflect upon and regulate their bodily states and processes (for example, diaries, scales, wristwatches, thermometers)" (Schüll, 2016, p. 3). Salter discusses an example given by philosopher Michel Foucault, who claimed that "the ancient Roman philosophers called the Stoics sought to obtain 'self-mastery' through self-discipline and would trade detailed lists of banal activities that they involved themselves in, such as exercise routines" (Salter, 2022, p. 174; Foucault, 1997, p. 208; Foucault, 1988). Such "self-mastery" has been reinforced with the notion of the body as needed to be quantified, tamed, and improved.

The connection between control and bodily self-knowledge brings us back to 19<sup>th</sup> century, where the notion of the body as a resource of energy was deeply rooted in both an ideology of industrial revolution and, even earlier, in the pragmatic teachings of Protestantism (Daggett, 2019, p. 75). The development of commercial goods that meant to aid with "self-realization" gained popularity in the US of the early 1900s (Sassatelli, 2012, pp. 640-641). Sassatelli further adds that in the Western culture, healthy body has been repetitively signifying the body that is "expanded" by self-knowledge and fully controlled (Sassatelli, 2012, p. 637; p. 640).

A similar moral obligation towards self-tracking as a duty was made visible by Crawford, Lingel, & Karppi (2015) in their study of weight scales. Locating the premise behind the market for scales to 1890s, they argue that scales were intended as outside self-knowledge tools that offered both quantification and measurement for self-tracking (Crawford, Lingel, & Karppi, 2015, p. 480). The public was supposed to “know one’s metrics” in order to pursue self-knowledge that can then transfer into living a good (or better) life (Crawford, Lingel, & Karppi, 2015, p. 486). As they rightfully point out, “with the emergence of wearable self-tracking devices, remarkably similar claims appear: self-tracking will lead to self-knowledge” (Crawford, Lingel, & Karppi, 2015, p. 483). Such obligation, or a new “moral epistemology,” became popularized stating that “not only *should* one know one’s weight, but it is necessary to know it in order to lead a good life” (Crawford, Lingel, & Karppi, 2015, p. 486). The public – users of the weight scales – were somewhat obliged to engage in self-tracking of measurable aspects of their body to achieve what was otherwise unattainable.

## Discussion

From a historical perspective, there is a certain duty in digital self-tracing, or self-surveillance. We might argue that many users of wearables today do not engage in self-tracking because they necessarily *feel the moral obligation* to. Nonetheless, what connects both the historical and present practices of self-tracking to attain self-knowledge is the idea that through the outside means – tools and devices – one can gain greater agency (and control) over oneself. These ‘outside’ means, or an outside perspective, lead to a state of self-disembodiment.

Self-knowledge is offered by self-tracking technologies through easy and effortless visualizations of the workings of the body; or, at least, it seems so. Berg notices that the prevailing notion of data-driven visualizations is that the knowledge that is offered is indeed pure and direct, and otherwise unachievable (Berg, 2017, p. 8). Berg also points towards the new binary of the self as divided into body-disembodiment; only a view from ‘outside’ can allow one to clearly see the patterns of one’s body which are otherwise either too difficult or too time-consuming to comprehend (Berg, 2017, p. 8). Technologies of self-tracking, particularly wearables such as Apple Watch or apps used by the the QS movement, provide, to borrow the appealing phrase offered by Berg, “a wearable dash-board to the body” (Berg, 2017, p. 2). The metaphor of a “dash-board” to the body is both to-the-point and rich in its signification. The dashboard offers a quick and easy way of comprehending one’s bodily patterns and actions which can then empower one to, e.g., reduce mental distress (Jablonsky, 2022, p. 321). Or, as Salter adds even more profoundly, such a digital dashboard allows one to change one’s mood “or even being” (Salter, 2022, p. 224). Above all, a dashboard offers a way of control.

Following this line of thought, the ‘data-view’ from both outside and above that we see not only illuminates us in some way, but also controls us. While it might be somewhat technodeterministic to claim that “[t]his newly minted index of health, well-being, and general state of living, unintentionally or not, steers the life of the population (Millington, 2009, p. 97), wearables and other self-tracking technologies allow us to become the ones *responsible* through new forms of self-control according to data-driven indexes, for our lives. To go back to



Foucault, such control “at a distance” (Rose, 2000, p. 323) is what Foucault discusses as shifting the notion of governmentality towards the subject who begins to view herself as constituting the self-ruling authority (Foucault, 1997, p. 68). Tiziana Terranova calls the practices of datafication merging with voluntary self-tracking as “soft-control,” a control native to network culture (Terranova, 2004). The device, or the app, are situated as aiding the user to take control of oneself (Schüll, 2016, p. 7).

The notion of control in relation to digital technologies, particularly technologies of self-tracking and datafication, has been discussed in recent literature as a particular extension of the ideology of neoliberalism. Control can be understood as “a set of technical principles having to do with self-regulation, distribution, and statistical forecasting (...) [that] also describes the episteme grounding late capitalism, a worldview that persists beyond any specific device or set of practices,” argues Franklin (Franklin, 2015, pp. xv-xvili). Ruckenstein & Schüll argue that datafication of health (such as the practices of shifting the human patient into a user that is supposed to self-track for one’s own benefit) is an expression of neoliberal selfcare (Ruckenstein & Schüll, 2017, p. 265). “To self-track is to heavily value one’s choices and the need to be responsible for them while, at the same time, relieving oneself of responsibility by delegating it to external technology,” argues Schüll (Schüll, 2016, p. 12). However, intrinsically, the paradox of control of self-tracking wearables is not that much different than the previous acts of delegating the self-observation to a tool or device ‘outside’ ourselves.

The issues of neoliberal selfcare and late capitalism reintroduce us to the notion of marketing and promotion strategies that Apple Watch so perfectly exemplifies. Self-tracking technologies, as most digital technologies, are *affective* object. Affect, in a materialist sense, refers to a myriad of relations and embodied effects that can occur among objects, bodies, and our emotional states. Self-tracking technologies share affective materiality in that people become affectively attached to and affected by the materiality of their devices, app interfaces, and data visualizations (Lupton, 2013, p. 268). Self-tracking technologies can be even perceived to be given ‘agency’ in that they “ask for attention” (Lyon, 2018, p. 97; Borgmann, 1995) both actively (through nudging, reminders, and sounds) and inactively (by just *being* there). This affective modality of self-tracking technologies influences us on a more neurological, subconscious level that it, at the same time, promises to make accessible and visible to us (Niccolini, 2018, p. 80; Sampson, 2016). The means by which self-tracking technologies *speak* to us are affective, from the cognitive play and a promise of “productive learning” of self-knowledge (Niccolini, 2018, p. 78), to a rewarding and satisfaction-inducing visualizations of goals, badges, and rewards (Laurie & Blandford, 2016, p. 282). Lyon also points out “a certain playfulness” in the ways users engage and perceive surveillance today (Lyon, 2018, p. 118).

Going back to the story about the Stoics and their “self-mastery,” Salter offers an argument that Stoics’ intention was indeed something that today’s technology offers: a promise of “an objective and distanced ‘view from above’ in order to stand outside of one’s self (...). [T]he Stoic philosophers used a simple technology, writing, to record actions in order to distance themselves from those actions” (Salter, 2022, p. 175). Such disembodied view of the self is provided by having a view ‘from the outside’ – through technology – which encompasses both the past and present. The view ‘from outside to inside’ – inside being the human body – is linked to an

inherent notion of time that is embedded in self-tracking. Diary keeping, accounting books, and weight scales invite the user to reflect upon the tracked changes through the (past) time. In that sense, self-tracking technologies promise both a physical view from the ‘outside’ as well as the historical view that renders time into space, where body-action becomes materialized into pure self-knowledge.

Such disembodied view of the self creates the user as a (data) subject outside of oneself. As Schüll (2016) argues, however, such knowledge from the “outside” is indeed a new, otherwise inaccessible form of knowledge. Following Swan (2013, p. 95), Schüll states:

big-data epistemologies (...) affor[d] “a sort of fourth-person perspective” on the self and, ultimately, a new kind of truth – one that is “not possible with ordinary senses” in that it does not correspond to a phenomenological self (temporally and spatially located) but to a database self whose truth lies in scattered points, associations and dynamic accretions (Schüll, 2016, p. 9).

A new, forth-person perspective that opens up new knowledge is far from a perspective of an actual person. We could argue that, just as the Stoics desired objective ‘view from above,’ self-tracking technologies that are based upon principles of datafication do offer a new ‘data-view’ from both outside and above. Garzonio points out that the nature of knowledge, as well as its social embeddings, changes once digitalization becomes a new logic of making visible and inviable (Garzonio, 2022, p. 159). In the words of Benjamin Bratton, who, in his text, also briefly refers to the QS movement, a user of a wearable finds himself in a rather contradictory state. Self-tracking technologies promise to users a sense of “individuated coherency and stability as a subject” through data-visualizations of the disembodied self (Bratton, 2015, p. 286). “But as more data is added to the diagram that quantifies the outside world’s impact,” Bratton continues, “the quality of everything that is ‘not him’ comes to overcode and overwhelm any notion of himself as a withdrawn and self-contained agent” (Bratton, 2015, p. 286). The self-knowledge that data offers blurs the notion of the self with the sea of data around it.

In this understanding, the knowledge that we can attain through the ‘data-view’ from both outside and above, is a knowledge deeply rooted in the logics of computing, particular cloud computing. Cloud computing – metaphorically indeed located *above* – relies on processing large quantities of data using algorithms that produce a desired result, such as a new pattern (that we could take for the data-derived ‘knowledge’). Yet the way in which such knowledge is produced is both strikingly similar and dissimilar to the past self-knowledge attained by historical self-tracking. As explained by Amoore, cloud computing “seeks out the ‘unknown unknowns’, the volume of so-called ‘bulk data’ in the lake (...), that promise to yield previously unseen patterns via processes of ‘knowledge discovery’” (Amoore, 2018, p. 15). To put it even more bluntly, and to quote from Amoore again, “what one will ask of the data is a product of the patterns and clusters derived from that data” (Amoore, 2018, p. 15). Yet the knowledge that is being ‘discovered’ in the process is presented as a fact directly derived from one’s body, visualized with satisfying dynamism of Apple Watch.

## Conclusion

What the practice of looking at the self through ‘the outside’ view of a tool – an Apple Watch or a diary – provides, is a disembodiment view of the self through a distant view of the past and presence. Such a view, ‘from outside to inside,’ is linked to the notion of control inherent in self-tracking across time. In diary keeping, time is rendered into space, where it can be viewed and tracked visually back in time. Wearables embrace both of these temporalities of knowledge. Self-tracking technologies promise to be a medium of, management, self-knowledge, and subject-making.

By knowing oneself better, one can learn to act in a more efficient way, take care of one’s health better, be a better version of the self. The way in which wearables display information about the self – through colorful displays and interfaces that track steps and progress, but also compares the sleep quality or the number of calories burnt to the ‘past versions’ of the self – becomes affective. The willingness to self-surveillance that users engage in while learning about themselves in a pursue of self-knowledge is, as I argue, conditioned by the affective value of self-tracking by the outside ‘gaze’ of the device.

The ‘data-view’ from both outside and above indeed provide users with a new, otherwise unattainable (and thus affective) self-knowledge. However, as pointed out before, computing logics behind such view are not as “self” centered as one would imagine. As Bratton phrases it, “the User is confronted with the existential lesson that at any point he is only the intersection of many streams” (Bratton, 2015, p. 286). What Bratton speaks of is the fact that data points are never meaningful in themselves; data points are made meaningful by being collected and contrasted with a myriad of other data points that turn into datafied patterns – from data’s point of view, “what looks like one is really many, and what looks like many may only be one” (Bratton, 2015, p. 289). The data, as Salter argues while speaking of the “dials on the dashboard displays of Fitbits and iPhones,” does not visualize the inner truth, but rather is the by-product of mathematics” (Salter, 2022, p. 177). To conclude with the statement by Salter (2022, p. 177),

Fitbits and smartphones never display "raw" data. They show us statistically shaped and manipulated features and derived numbers that don't exist before mathematical models are applied to them. This data that we think represents us as fact is indeed the result of specific ways of measuring and quantifying the world through engineering, mathematics, and statistics.

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## **Control Strategies at Mrican Landfill, Ponorogo Regency, Indonesia: Identification of Pollutant Impacts, SWOT Analysis, and Pollution Control Strategies**

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**Abstract:** Mrican landfill is owned by the Government and the only landfill for all waste in Ponorogo Regency. The Mrican landfill experienced an increase in the volume of waste that was difficult to control, which caused environmental pollution and harmed the surrounding community. The problem of leachate liquid seeping into groundwater and rivers, thus having an impact on the environment. This study aims to analyze the impact of pollution and formulate a pollution control strategy at Mrican landfill based on SWOT analysis. The research method used is descriptive qualitative consisting of secondary data and primary data to formulate pollution control strategies based on SWOT analysis. SWOT analysis was carried out using the Internal Factor Analysis Summary (IFAS) and External Factor Analysis Summary (EFAS) matrices to show the pollution factors at Mrican landfill. From the results of the data analysis, the role of the Ponorogo Regency government and Ponorogo DLH is currently in a position between the Strength and Opportunity axes, namely Quadrant I (S-O Strategy) where the Regency Government and the Ponorogo Environmental Service have internal strengths and external opportunities. based on the results of the SWOT matrix analysis there were 12 strategic issues which then obtained 7 strategic issues that could be used as pollution control strategies in the area around the Mrican landfill.

**Keywords:** Pollutant Impact Identification, SWOT Analysis, Pollution Control Strategies

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## Introduction

The increase in population as well as the economic activity and lifestyle of the people in Ponorogo Regency will affect the production of the waste produced. Due to the effects of increasing human population, consumerism and goods are difficult to decompose, namely pollution which is a major environmental problem (Singh et al., 2010; Singh et al., 2018; Kumar et al., 2009). Based on the report from the Head of the Ponorogo Regency Environmental Service in early 2022, it stated that "around 70 tons of waste every day goes to the Mrican landfill". The Mrican landfill began operating in 1995 which was built on the property of the Ponorogo Regency government covering an area of  $\pm 2.5$  hectares, each year the volume of waste has increased. Until 2022, the Ponorogo Environmental Service (DLH) stated that the Mrican landfill was overloaded with a height of around  $\pm 50$  meters, so it had to expand the rotation area. Based on preliminary observations, it appears that the Mrican landfill has not been fully managed properly. This is shown, among other things, from the condition of the infrastructure at the landfill site and the method of final disposal of waste that is used does not meet the requirements as stated in the laws and regulations.

Based on DLH data, the Mrican landfill waste processing method is Controll Landfill, but the waste management applied in the field is the Open Dumping system, which is a waste management system that is disposed of in a final disposal site without management. This makes the waste capacity at the Mrican landfill is full and overflows to the outside of the landfill area causing an unpleasant odor. The poor processing system by Mrican landfill causes waste processing to not be optimal, so that the volume of landfill waste is difficult to control. This problem can pose a major threat to human health if the waste contaminates groundwater consumed by residents (Lee et al., 2006; Longe & Balogun, 2010). Based on data covering the whole world, it is reported that there are many cases of groundwater contamination that occur due to landfills that are not managed properly (Abu-Rukah & Al-Kofahi, 2001; Rapti-Caputo & Vaccaro, 2006; Saarela, 2003). Garbage that piles up in the landfill can produce leachate waste when it rains, then seeps through the waste dump can create a significant source of groundwater contamination, although the slow flow of groundwater (meters per day or even centimeters per year) can have a major impact on quality risks groundwater (Sepa et al., 2006; Christensen et al., 2001; Niininen et al., 1994; Barrett and Lawlor, 1995).

According to the Ponorogo newspaper, on Tuesday, March 22, 2022 dozens of members of the farmer group (poktan) of Mrican Village, Jenangan District, which consisted of 20 farmers from 3 poktans, held a demonstration in the landfill area. The farmers demanded the Ponorogo Environmental Service (DLH) to take responsibility for the death of rice plants ready for harvest in a number of rice fields in Mrican Village which resulted from leachate waste entering the rice fields. Based on the Republic of Indonesia government regulation number 82 of 2001 concerning management of water quality and control of water pollution, it is explained that "water is one of the natural resources which has a very important function for human life and livelihood, as well as for advancing general welfare, so that it is the basic capital and factor major development"(Baudouin et al., 2002). This regulation further emphasizes that the existence of clean water is very vital for the survival of

humans and other living things. Therefore, the government and citizens have rights and obligations to preserve the function of water (Sanim, 2011).

This implementation is carried out by controlling pollution and managing water wisely by taking into account the interests of present and future generations as well as ecological balance. In accordance with the background of the problem described by the author that the waste management of Mrican landfill is not optimal which causes pollution to the surrounding environment, the authors conducted research on the identification of pollution impacts and pollution control strategies at Mrican landfill using SWOT analysis.

### Method

This research was conducted in the vicinity of the Mrican Landfill in Mrican Village, Kec. Jenang, Ponorogo Regency with an area of 2.5 hectares and the status of the land is owned by the Regional Government of Ponorogo Regency. Public facilities owned are access roads to the landfill location and field offices for recording the volume of waste entering the landfill. The method used in this study is descriptive qualitative, which aims to objectively explore or photograph conditions that will be thoroughly, broadly, and in-depth examined (Sugiyanto, 2005). The following are the steps in this research process:

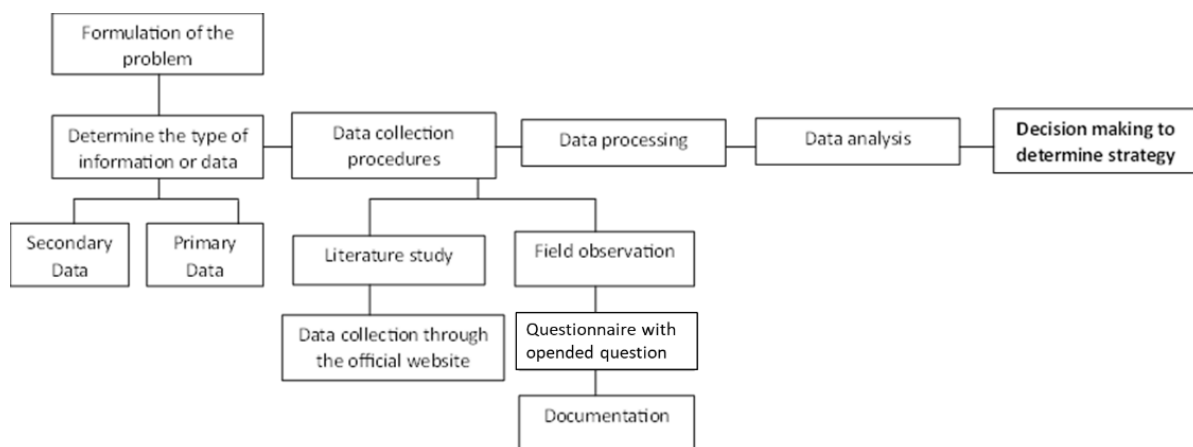


Figure 1: Research flowchart

The descriptive method is used to obtain the results of secondary data validity to determine the urgency of the research problem. The data supports the process of analysis in research. Qualitative methods were used to collect primary data in the form of field conditions, interviews, compile SWOT (strength, weakness, opportunity, treat) data, and determine the analysis of pollution control strategies at Mrican landfill. Collecting qualitative data using a questionnaire given to 30 research subjects and scores using a Likert scale. To develop a SWOT strategy, use the following SWOT matrix combination formula:



Table 1: SWOT matrix combination formula

	Strenght	Weakness
<b>Opportunities</b>	S – O = SO Strategy (Use all the power you have to take advantage of the oppourtunities that exist).	W – O = WO Strategy (Overcome all weaknesses by taking advantage of existing oppourtunities)
<b>Threats</b>	S – T = ST Strategy (Use all power to avoid threats)	W – T = WT Strategy (Press all weaknesses and prevent all threats)

## Results

### 1. Problem mapping at the Mrican TPA

Based on observations, the Mrican landfill is adjacent to residential areas and also agriculture. Which can cause negative impacts on the environment, social and economy of the people who live around the Mrican landfill area. It is sustainable and creates problems in both simple and complex forms. The results of the problem mapping at the Mrican landfill are as follows:

- Pollution of groundwater and rivers

The problems experienced by residents around the Mrican TPA are garbage that emits odor and leachate flowing into the residents' irrigation system. Because leachate disposal is connected to the surrounding river. As a result, leachate contamination during the rainy season is difficult to control its spread. Waste management with an open dumping system like this is very dangerous for the surrounding environment. Based on the information obtained, there has been no special handling regarding leachate management from the district government and the Ponorogo environmental service in the near future. Based on the statement of the Head of Mrican Village and the student demonstration in Ponorogo, namely demanding the construction of a wastewater treatment plant (IPAL) channel before channeling it to the surrounding river, to reduce the level of environmental pollution, especially water (Kompas.tv, March 28 2022). To find out the quality of water and contaminants contained in residents' well water based on the results of previous studies, as follows:

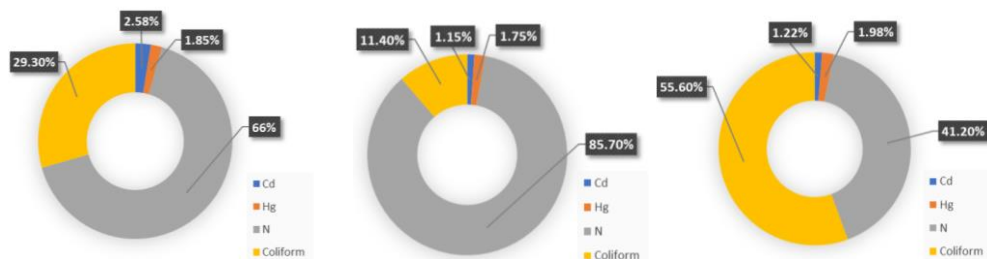


Figure 2: a). 200 m from TPA

b). 500 m from TPA

c). 650 m from landfill

The research data at the end of 2021 above shows that groundwater pollution in Mrican Village is dominated by Nitrogen and Coliform, followed by Hg and Cd. Based on the above groundwater data, the distance of 650 m from the Mrican landfill is not suitable for drinking and for use by the local community, because it will have a negative impact on health.

- Decreased productivity of agricultural land.

The decline in the productivity of agricultural products from Mrican Village farmers has occurred in the last few years. Farmers suspect that the cause comes from the irrigation canals of the rice fields which are contaminated with Leachate from the Mrican landfill. Leachate enters the residents' rice fields because the leachate drainage pipe system at the Mrican landfill is connected to the residents' rice field irrigation canals. This has the potential to disrupt soil fertility, so that the productivity of agricultural land decreases. The following is documentation of irrigation canals polluted by Mrican landfill leachate:



Figure 3: Paddy field irrigation channels polluted by Mrican TPA leachate

Based on the statement of Mr. Suyitno Farmer Mrican (Thursday, March 24 2022) said that "waste pollution does not only damage rice plants, but this overcapacity of waste causes irrigation canals to become clogged with garbage. This has resulted in a reduced supply of water to the paddy fields, and the only water that enters irrigation is water mixed with waste. The following is the documentation of agricultural products in the Mrican landfill area:



Figure 4: Crop failure in the rice fields near the Mrican landfill

Pollution with Mrican landfill waste has caused approximately 67 hectares of rice fields around the landfill to experience crop failure. The rice planted with color withers and dries up, besides that many rice seeds are not filled so that farmers lose. Based on the statement of Mr. Suyanto "Before being affected by pollution, my two rice fields produced 18 quintals. Now it

can only produce 9 quintals.” Based on this information, rice production in paddy fields decreased by 50%.

- Problems with residents' health

Disruption of the Mrican landfill waste emits an unpleasant odor which causes air pollution. The smell emitted by the landfill waste can be smelled up to a radius of 2 – 3 km. This waste problem causes health problems for local residents, especially experienced by scavengers at the Mrican landfill. The main complaints experienced by scavengers are respiratory system disorders such as coughing, shortness of breath and chest pain. Based on research results (AR Andhika, 2016). The effect of exposure to Methane gas (CH<sub>4</sub>) of the Mrican landfill community with a percentage of 9.2% and the influence of hydrogen sulfide gas (H<sub>2</sub>S) is as much as 12% of complaints. In addition to respiratory problems, other residents' health complaints are skin diseases and itching. Based on the narrative of Mr. Suyitno (31/3/2022), a resident around the Mrican landfill, said that he had experienced itching for 3 years and had tried various kinds of medicine but had not recovered. Finally, every time he went to the fields, he smeared his whole body with diesel fuel to relieve itching.

## 2. SWOT analysis calculation

To determine alternative actions and policies for the management of the Mrican Final Processing Site (TPA), a logical framework is needed. SWOT analysis is one way that can help analyze an organization in determining a strategy based on the environmental conditions of the organization, which in this case is the Mrican Final Processing Site (TPA). The strategy used in the management of the Mrican Final Processing Site (TPA) is carried out using a SWOT analysis approach (Strength, Weakness, Opportunity, and Threat). From the results of observations and interviews with respondents in the field, several strategic factors were obtained that greatly influenced the management of Mrican's final landfill. These strategic factors consist of 1) internal factors which include strengths and weaknesses, 2) external factors which include opportunities and threats. These factors are arranged in the form of a questionnaire used to calculate IFAS and EFAS scores in the SWOT analysis:

Table 2. Calculation of IFAS values on the Strength and Weakness variables

Num	Dominant Internal Factors	Weight	Ratings	Score
<b>Strength</b>				
1	There are regional regulations that regulate waste fees and domestic wastewater management	0.15	2.7	0.41
2	Availability of APBD funds (regional revenue and expenditure budget) allocated for waste	0.14	2.6	0.38
3	There is an SKPD (regional work unit) that regulates waste management	0.11	1.9	0.20
4	The Government of Ponorogo Regency provides funding	0.12	2.2	0.27

	for waste processing machines			
5	Availability of Ponorogo Regency Wastewater Master Plan 5 for the next year	0.08	1.5	0.13
6	There is a sanitation working group (LWG) and sanitation KSM (self-help group) that coordinate sanitation programs at the community level.	0.06	1.1	0.07
	Total number			<b>1.44</b>
	Difference (x-axis)			<b>0.92</b>

Num	Dominant Internal Factors	Weight	Ratings	Score
	<b>Weakness</b>			
1	Waste management in the Mrican landfill area has not become a regional priority, so the waste management system is still minimal	0.08	1.4	0.11
2	Special technology for waste management is available with adequate quantity and capacity	0.08	1.4	0.11
3	The operation of the waste processing machine by Mrican landfill officers can run well	0.07	1.2	0.08
4	HR capacity in managing waste at Mrican landfill is still limited	0.08	1.4	0.11
5	The volume of waste that is over capacity	0.06	1	0.06
6	The aspect of landfill sanitation is still low and is not given enough attention	0.06	1	0.06
	Total number			<b>0.52</b>

Based on the internal table above, the internal strategic factors analysis summary (IFAS) value is determined which is used to determine the position of the X axis in the SWOT matrix obtained from the difference in the values of the strengths and weaknesses variables. This IFAS analysis needs to be carried out to determine the level of strengths and weaknesses in the Mrican TPA. Based on the table of internal factors above, it can be seen that the position of the X axis is using the following formula:  
 $X = \text{Total Strength} - \text{Total Weakness} = 1.44 - 0.52 = 0.92.$

Internal factors can be controlled by landfill through collaboration with DLH and Ponorogo Regency Government. This factor is something that is owned by the Ponorogo district government which is a strength of positive value for the management of Mrican landfill. Conversely, the lack or absence of something that should exist becomes a weakness that has a negative value and will reduce the success of Mrican TPA management.

Table 3. Calculation of the EFAS value on the Opportunity and Threats variables

Num	Dominant External Factors	Weight	Ratings	Score
<b>Opportunities</b>				
1	Receive support from community informal institutions (community starting from the RT level, Karang Taruna, etc.) to socialize household waste management and environmental issues	0.10	2	0.21
2	There are district/city institutions in Ponorogo that handle waste management	0.14	2.8	0.40
3	There is an opportunity for financial assistance from the APBD (regional revenue and expenditure budget) from the Ponorogo district/city	0.11	2.1	0.23
4	Collaboration between DLH (Department of the Environment) Ponorogo and private parties and other agencies such as universities, other landfills etc	0.08	1.6	0.13
5	Initiatives from several communities to recycle waste and make it into handicrafts/products that have economic value	0.09	1.7	0.15
6	The existence of print/online mass media to socialize to the public about waste management	0.09	1.8	0.17
Total number				<b>1.29</b>
Difference (y-axis)				<b>0.74</b>

Num	Dominant External Factors	Weight	Ratings	Score
<b>Threats</b>				
1	Public awareness of waste management is still low and waste management at Mrican landfill is inadequate	0.08	1.5	0.12
2	Limited waste disposal and collection facilities (garbage trucks, TPS, and transfer depots)	0.09	1.8	0.17
3	The threat of contamination of groundwater and rivers due to leachate from waste and drainage of the Mrican landfill that is not managed properly	0.06	1.2	0.07
4	The threat to public health is due to the minimal sanitation of the Mrican landfill, which has the potential to contract respiratory diseases	0.06	1.1	0.06
5	The overloaded Mrican landfill will expand the new landfill area around it	0.06	1.1	0.06
6	The quality of the environment, such as land, water, air, and the comfort of the people living around the Mrican	0.06	1.1	0.06

landfill, has declined

Total number

**0.54**

Based on the external table above, the External Strategic Factors Analysis Summary (EFAS) is determined which is used to determine the position of the Y axis in the SWOT matrix which is obtained from the difference in the values of the opportunities and threats variables. This EFAS analysis needs to be carried out to determine the level of opportunities and threats in the Mrican TPA. Based on the table of external factors above, the position of the Y axis can be identified using the following formula  $Y = \text{Total Opportunities} - \text{Total Threats} = 1.29 - 0.54 = 0.74$ .

External factors are factors that are beyond the control of Mrican TPA management. This factor will have a direct effect on the performance of Mrican TPA in the management of waste that goes to the landfill, thus making a positive contribution which can provide an opportunity for the acceleration of the successful management of Mrican TPA. However, there are also factors that pose a threat in the implementation of activities, which have a negative value and can hinder the successful management of Mrican TPA.

From the SWOT weighting matrix it can be seen that the internal and external positions of the research study at the Mrican Final Processing Site (TPA) in determining strategic steps in TPA management are located in quadrant I, namely the X:Y coordinates (0.74 ; 0.92) on the SO strategy, can be seen in Figure 5 below:

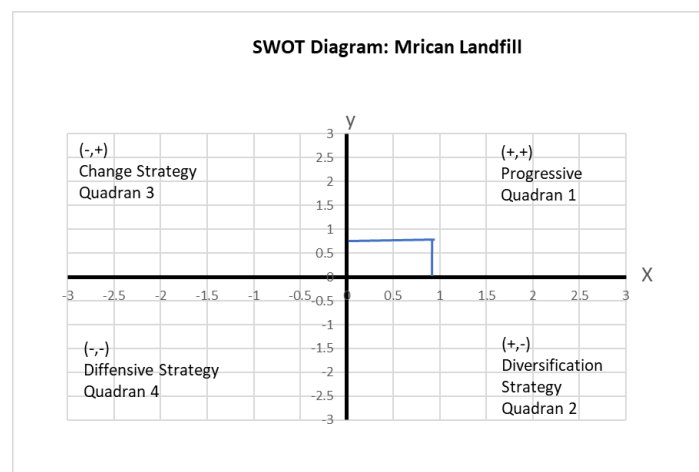


Figure 5: SWOT Diagram of Mrican landfill

From the analysis of internal and external strategic factors (IFAS/EFAS) through SWOT analysis, it is known that Mrican's most strategic pollution control is located between the Strength and Opportunity

axes, namely in Quadrant I (S-O Strategy). Where the Mrican landfill together with the local government and DLH Ponorogo Regency are in a very strong position and in an advantageous position. The two agencies are advised to carry out an aggressive strategy that is very likely to continue to develop, make policies with the community, carry out development and proper waste management at the Mrican landfill.

## Discussion

The results of the SWOT matrix above are used to form a Pollution control strategy around the Mrican Landfill. The strategy for controlling Mrican landfill pollution was designed through a matching stage using the Strengths-Weaknesses-Opportunities-Threats (SWOT) matrix technique. This SWOT analysis is based on information derived from the input stage to match external opportunities and threats with internal strengths and weaknesses. This is intended to determine feasible and effective alternative strategies for the management of Mrican landfill. From the results of the SWOT analysis, 20 alternative strategies were obtained in the management of the Mrican landfill, but based on the SWOT matrix the most effective strategy was implemented to solve pollution problems around the Mrican landfill, namely the SO strategy. This strategy is in quadrant 1 which consists of 7 strategies, obtained from combining or matching internal factors (strengths) with external factors (opportunities) by using strengths to take advantage of opportunities with alternative strategies. So it is hoped that the strategy that will be developed can overcome the strategic issues that arise. The objective is to achieve the solid waste sub-sector target which is part of the defensive strategy. This strategy is also called minimizing weaknesses to survive threats. The following is an arrangement of strategies obtained from the results of the SWOT analysis in this study:

Table 4: SWOT Matrix of Mrican Landfill Pollution Control Management Strategy

		Strength	Weakness
		Internal	Eksternal
Eksternal	Internal	1. Ponorogo Regency Regional Regulation	1. Minimum management system
		2. Availability of APBD funds	2. number and capacity of waste processing machines
		3. SKPD waste management	3. Machine operation routines
		4. Machine assistance fund	4. HR capacity at Mrican landfill
		5. Waste master plan for the next 5 years	5. Overcapacity of Mrican landfill
		6. POJKA & KSM sanitation	6. Landfill sanitation conditions

Opportunities		
<ol style="list-style-type: none"> <li>1. Support from informal community institutions</li> <li>2. Availability of district-level government institutions for waste management</li> <li>3. Financial assistance from the district budget</li> <li>4. Cooperation between DLH Ponorogo and the private sector</li> <li>5. Community initiatives for waste recycling</li> <li>6. Online mass media for socialization of waste management</li> </ol>	<ol style="list-style-type: none"> <li>1. Carry out the functions of the Ponorogo district regional regulation and involve the role of informal community institutions to handle waste</li> <li>2. Preparation of the SKPD regarding the waste management system in detail starting from the household level to the district level so that the volume of Mrican landfill waste can be controlled.</li> <li>3. There are APBD funds allocated for waste that can be utilized, among others; purchase a large-capacity waste processing machine, build adequate landfill sanitation, socialize and train waste management to the community.</li> <li>4. Prepare a landfill waste master plan for the next 5 years, involving private partners, city-level PUPR ministries, DLH, environmental NGOs, and practitioners/universities.</li> <li>5. Establish community informal institutions, namely POJKA or KSM sanitation, which aims to coordinate community-level sanitation programs.</li> <li>6. Utilizing print/online mass media to socialize the community about waste management before disposal to TPS</li> <li>7. Collaboration between DLH and environmental agencies in other cities, universities and private partners to innovate waste management at the Mrican landfill.</li> </ol>	<ol style="list-style-type: none"> <li>1. The waste management system at Mrican landfill is still minimal, because it has not become a top priority for the region. So there must be special attention from the local government through the Regency APBD funds, Ponorogo DLH collaboration with private partners to improve the waste management system.</li> <li>2. The Mrican landfill has a small number of waste processing machines and is inadequate, and the machines do not operate properly. So it needs attention from the local government and DLH Ponorogo Regency to increase the number and capacity of more modern waste processing machines.</li> <li>3. The capacity of human resources at Mrican landfill is still limited, it is better for DLH Ponorogo Regency to provide training and increase the number of waste management personnel at Mrican landfill</li> </ol>



		<p>4. Sanitation conditions at the Mrican landfill are low and paid little attention to. This problem can be fixed through policies on waste management and building sanitation using APBD funds.</p> <p>5. Mrican's overcapacity landfill allows the expansion of landfill, for control it requires coordination between government agencies and the community, through support from formal and informal institutions, utilizing print/online social media to socialize household waste management.</p>
<p><b>Threats</b></p> <ol style="list-style-type: none"> <li>1. Low public awareness of waste management and inadequate waste management at landfill</li> <li>2. Limited waste disposal and collection facilities</li> <li>3. Pollution of groundwater and rivers</li> <li>4. Public health</li> <li>5. Expansion of new landfill land</li> <li>6. Declining environmental quality</li> </ol>	<ol style="list-style-type: none"> <li>1. Implement regional regulations governing waste fees and domestic wastewater management, in order to reduce the level of threat of environmental pollution. This regional regulation is strengthened by legalizing the creation and preparation of SKPDs.</li> <li>2. Utilizing Ponorogo district APBD funds and preparing a waste water management master plan for the next 5 years to build limited waste disposal and collection facilities, as well as increase the number and productivity of machines every day, so as to reduce the waste capacity at</li> </ol>	<ol style="list-style-type: none"> <li>1. Pollution of the Mrican landfill can be resolved by making it a regional development priority, equipping waste management facilities and waste machines that can be operated properly and regularly.</li> <li>2. The low knowledge of the community in waste management can be improved through outreach and training. It is necessary to increase the quality and capacity</li> </ol>

	<p>Mrican TPA.</p> <p>3. Establish a sanitation POJKA (working group) and a sanitation KSM (self-help group) that coordinate sanitation programs at the community level, to increase awareness of household-level waste management.</p>	<p>of human resources for Mrican landfill employees so that they are able to handle landfill sanitation problems.</p>
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Based on the SWOT analysis matching stage, the Mrican TPA pollution control strategy that can be applied in this condition is explained as follows, including:

1. Carry out the functions of the Ponorogo district regional regulations properly which regulate waste fees and domestic wastewater management, and involve the role of informal community institutions to handle waste from the smallest scope, namely household waste. Enforcement of regional regulations on user fees and waste management has the ultimate goal, namely that the government is more concerned about the regional waste sector that is produced every day and the community has awareness and knowledge in managing waste before it is disposed of at TPS.
2. Ponorogo district government agencies should prepare a detailed waste management SKPD on the waste management system starting from the household level to the district level so that the volume of waste that goes to Mrican landfill can be controlled. SKPD is a regional work unit that has main tasks and functions in the field of waste management. SKPD is responsible for the implementation of waste management in the region.
3. The availability of APBD funds allocated for waste is an opportunity for the government to utilize aid funds, including; purchased a large-capacity waste processing machine, built adequate landfill sanitation, the district government together with DLH Ponorogo conducted outreach and training on waste management to the community. The function of the regional budget is very important, including:
  - a. The authorization function, in the implementation of receipts and expenditures, the Regional Revenue and Expenditure Budget (APBD) becomes the basis for a certain period (year) so that activities have the power to carry out
  - b. The function of planning, planning and preparing activities in the year concerned requires the APBD to become the basis and reference for activities.
  - c. Oversight function, APBD is a reference in assessing and reviewing the smooth running of local government
  - d. Allocation Function, it is necessary to direct regional budgets for allocations to support regional development in the framework of creating community welfare in all aspects.

4. The regional government of Ponorogo district should prepare a landfill waste master plan for the next 5 years. The preparation of the master plan should involve city-level PUPR ministries, DLH, environmental NGOs, practitioners/universities, and private partners. So that all parties can help and participate in overseeing the regulations when they are implemented. The purpose of forming the Mrican landfill waste master plan is to regulate the location of the facilities to be built and the spatial layout based on the function of the land. The master plan is the master plan for the development of the Mrican landfill area which departs from the potentials and problems currently owned by the area.
5. The district government, through the village government, should form an informal community institution, namely POJKA or KSM sanitation, which aims to coordinate community-level sanitation programs. The function of POJKA PKP is to form on the basis of a joint commitment of stakeholders to synergize policies, institutions for the implementation of prevention and quality improvement for urban slum settlements, exchange ideas, and coordination. POJKA PKP consists of policy makers and technical staff from various institutions/sectors, who oversee various units related to slums, housing, land, clean water, sanitation, and data management. While the function of Sanitation KSM is to develop an innovative service model for communal scale wastewater treatment with a joint management scheme between KSMs for communal WWTP sanitation facilities with the government from the village level to the district level.
6. Utilizing print/online mass media to socialize the community about waste management, so that the community has the initiative to process waste into something useful and of economic value, so that they are able to utilize waste before it is disposed of at TPS. The influence of the mass media in this digital era is very strong, in connection with this the government can optimize the role of the mass media in disseminating household waste management methods before being disposed of in TPS (Temporary Disposal Sites).
7. The Ponorogo Regency Environmental Service can collaborate with environmental agencies, landfill in other cities, universities and private parties to conduct research, comparative studies, collaboration, and develop/grant waste processing technology that can help improve management at Mrican landfill. The involvement of the private sector and the community is an important part of the national solid waste policy in 2006-2010. Improving a conducive climate for public-private partnerships, such as granting permits and authorities as well as ensuring the supply of waste, is a strategy that the government must implement. The participation of the private sector in waste management is urgently needed, considering the high costs that must be spent by the government to deal with this waste problem.

## Conclusion

Based on the analysis and discussion conducted regarding the environmental pollution control strategy around the Mrican landfill area using a SWOT analysis, several conclusions can be drawn as follows:

1. The Mrican Final Disposal Site (TPA) is the only TPA that is used to dispose of waste from all over the

Ponorogo Regency until now it has not implemented a waste management system that has been established at the beginning of its construction, namely landfill control and even in practice, namely open dumping (Without processing)

2. Based on research studies at the Final Processing Site (TPA) Mrican is in Quadrant I with axis  $(X, Y) = 0.74 ; 0.92$ . This shows that the management of TPA Mrican is in a situation between the Opportunity and Strength axes with the S-O (Strength – Opportunity) strategy. There are 7 aggressive strategies formulated in the SWOT matrix analysis, which can be used for pollution control and waste management at Mrican TPA, including:
  - a. Carrying out the functions of the Ponorogo district regional regulation and involving the role of informal community institutions to handle waste
  - b. Preparation of an SKPD regarding a detailed waste management system starting from the household level to the district level so that the volume of Mrican landfill waste can be controlled.
  - c. There are APBD funds allocated for waste that can be utilized, among others; purchase a large-capacity waste processing machine, build adequate landfill sanitation, socialize and train waste management to the community.
  - d. Develop a landfill waste master plan for the next 5 years, involving private partners, city-level PUPR ministries, DLH, environmental NGOs, and practitioners/universities.
  - e. Establish community informal institutions, namely POJKA or KSM sanitation, which aims to coordinate community-level sanitation programs.
  - f. Utilizing print/online mass media to socialize the community about waste management before disposal to TPS
  - g. Collaboration between DLH and environmental agencies in other cities, universities and private partners to innovate waste management at the Mrican landfill.

## Recommendations

The results of this study are expected to be utilized by the Ponorogo district government and the environmental service. To realize people's expectations of controlling environmental pollution in their settlements. The strategy for controlling environmental pollution around the landfill was prepared by considering four main factors in the SWOT analysis, namely strengths, weaknesses, opportunities and threats. The strengths and opportunities are used as capital in suppressing the weaknesses and threats in the short term and the long term. Meanwhile, the weaknesses and threats are used as reference material for the government and DLH Ponorogo Regency for improvement and planning activities.

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## Comparative Study of SSC-Pcms Through Different Activated Carbons and Production Methods

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**Abstract:** Increasing environmental problems and the rapid depletion of energy resources is a major concern that has led researchers to improve energy storage techniques. Latent heat thermal energy storage methods that use phase change materials (PCMs) have gained importance in overcoming certain drawbacks. Although PCMs have emerged as a promising solution to store thermal energy, leakage problem in PCMs are still a serious issue limiting their application in energy storage. Incorporating activated carbon as a support material has been investigated to eliminate this restriction. In this study, activated carbons with different porous structures were employed as support material to prepare shape-stabilized composite PCMs (SSC-PCMs), using two different methods; direct impregnation and vacuum impregnation. A binary eutectic mixture of stearic acid (SA) and palmitic acid (PA) was used as a PCM. The effect of the porous structure of activated carbon and the preparation method was evaluated to determine the most suitable carbon material and production method for the specific purpose of thermal energy storage

**Keywords:** Pcms, Activated Carbon, Porous Structure, Direct Impregnation, Vacuum Impregnation

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### Introduction

Energy depletion is one of the major problems facing the world. Renewable energy (Akay et al., 2015; Garip et al., 2022; Gunes et al., 2020; Kazan et al., 2015; Ozay & Celiktas, 2016; Pilavtepe et al., 2012) and energy storage systems have gained significance due to their ability to prevent increasing global warming problems and energy shortages (Abdeali et al., 2020; Alptekin et al., 2023; Cebi et al., 2022; M.S. Celiktas & Kocar, 2012, 2013; Melih Soner Celiktas & Kocar, 2010; Cerone et al., 2017; Ozay & Celiktas, 2021; Uyan et al., 2020). Thermal energy systems are energy storage systems that have a wide range of application areas, including building (Zhu et al., 2018), PV (Tahan Latibari & Sadrameli, 2018), cold storage, batteries, medical applications

(Dai et al., 2021; ŞEN & ÇELİKTAŞ, 2022).

Thermal energy storage technology is categorized into thermochemical heat storage, sensible heat storage, and latent heat storage based on how it stores heat energy. The aim of phase change (latent heat) heat storage technology is to store and release heat by taking advantage of the change in latent heat of phase change materials (PCMs) during phase change (Liu et al., 2023). In Figure 1, the advantages and disadvantages of thermal energy storage technologies are shown.

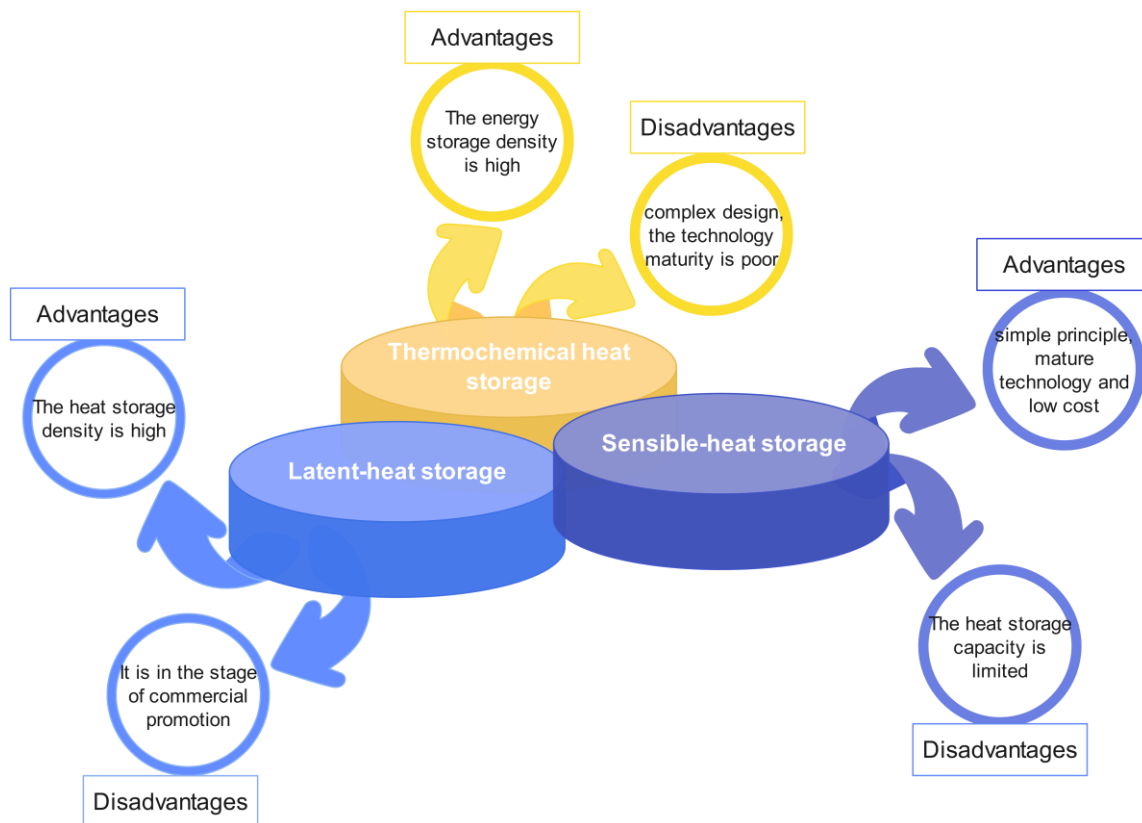


Figure 1. Advantages and disadvantages of thermal energy storage technologies

Among the energy storage techniques, latent heat energy storage techniques based on phase change materials have gained attention due to their higher energy storage properties compared to sensible energy storage techniques (Rathore & Shukla, 2021). Possessing large latent heats, non-corrosiveness, less subcooling, good chemical structure, etc. are superior properties of organic-based solid-liquid PCMs (Hekimoğlu et al., 2022). Even with their advantages, leakage during phase change, high phase change temperatures, and lower thermal conductivity are some of the disadvantages of organic PCMs (Atinafu et al., 2018). Porous carbons are one of the support materials to use for solving these drawbacks (X. Zhang et al., 2020). Different dimensional carbon materials such as activated carbon (one-dimension) (Alptekin et al., 2023; Alptekin & Celiktaş, 2022; Melih Soner Celiktaş & Alptekin, 2019; Gultekin et al., 2018), graphene (two-dimension), carbon nanotube (CNT) (three dimension) and etc., have been utilized for this purpose.



In this study, organic PCM and eutectic mixture of stearic and palmitic acid was evaluated. Production method of shape stabilized PCM (SS-PCM) and employed carbon support material was examined to determine the most suitable carbon material and production method for the specific purpose of thermal energy storage. In the next section, organic PCM, binary eutectic mixture of stearic acid (SA) and palmitic acid (PA) as PCMs and their shape/form stable composite PCMs that contain porous structure are evaluated.

## Organic PCMs and shape stabilized composite PCMs

Organic PCMs (paraffin compounds and non-paraffin compounds), inorganic PCMs (salt hydrates and metallic compounds), and eutectic PCMs (organic-organic, inorganic-inorganic, and inorganic-organic) are the three types of phase change materials. Eutectic PCMs combined with two or more organic and inorganic PCMs, or both of them (Al-Ahmed et al., 2021). The major advantage of EO-PCMs is their adjustable properties. They can be produced such that they exhibit the desired qualities. Many times, eutectic mixtures of fatty acids show lower melting point than individual PCMs but feature outstanding qualities like individual O-PCM, hence for TES applications, the EO-PCM might be chosen as innovative PCMs (Singh et al., 2021). Therefore, studies have focused on the use of eutectic PCMs with desired properties for use in desired applications.

Zhang et al. prepared composite PCMs by using PA-SA (palmitic acid-stearic acid) eutectic mixture as PCM and expanded graphite (EG), whose optimum adsorption ratio is PA-SA/EG:13:1 (wt). Prepared composite PCMs have shown great thermal stability after 720 cycles and enhanced thermal conductivity compared to pure PA-SA (N. Zhang et al., 2014).

Mehrali et al. prepared shape-stabilized PCMs (SS-PCMs) employing SA as PCM material and carbon nanospheres (CNS) as support material. In order to examine the effect of carbon nanospheres in SS-PCM, varying weights of carbon nanospheres, including 0,25 g, 0,50 g, 1 g, and 2 g, were mixed with 2 g of SA in the presence of 50 ml of toluene at 80 °C on a stirring hot plate at 1000 rpm. Used CNS that has 212 m<sup>2</sup>/g of specific surface area enable the SA held in SS-PCMS via surface tension. 89% of SA loading in the SS-PCMs gave the best latent heat of 152.5 J/g at a melting temperature of 56.5 °C. However, SS-PCMs with 50% wt of SA resulted in the highest thermal conductivity of 0.431 W/mK, which is higher than pure SA (0.21 W/mK) (Mehrali et al., 2014).

Zhou et al. have prepared form-stable phase-change materials using a binary eutectic mixture of stearic and palmitic acids as PCMs and expanded graphite as porous support material. PA-SA/EG composite was prepared through direct impregnation at 80 °C for 48 hours and was shaken every 2 hours for complete mixing. PA-SA/EG showed 176.2 J/g of phase-change latent, which is close to pure PA-SA (187.0 J/g). It is stated in the study that the large specific surface area and wormlike porous structure of EG aid in the adhesion of molten PA-SA (Zhou et al., 2020).

Wu et al. have produced copper microsphere (CMS)-doped porous carbon from wheat bran via one-step pyrolysis. SA/CMS-WBB is produced with wheat bran biochar (WBB) and a different weight ratio of stearic

acid as PCMs through the vacuum impregnation method. Among the composite PCMs produced, SA/CMS-WBB-2, which contains 40% (wt) of SA, showed the highest thermal conductivity. Compared to pure SA, its thermal conductivity was raised by 87.2% (Wu et al., 2021).

Li et al. used acid-treated CNT (a-CNT) as support material and stearic acid as PCMs to fabricate composite PCMs. Composite SA/a-CNT PCM is produced through an impregnation method in the presence of ethanol with different mass ratios of 1:1, 2:1, and 3:1. Ethanol was used to uniformly distribute SA into the a-CNT powder. Among the produced composite materials, Composite-2 and Composite-3, which contain 2:1 and 3:1 SA/a-CNTs, exhibited 98.8 J/g and 118.8 J/g at melting temperatures of 33 and 29 °C, respectively. Compared to pure SA, melting temperatures decreased from 74 °C to 33 and 29 °C for Composite -2 and Composite-3, respectively (Li et al., 2015).

## Conclusion

In recent years, the storage of the produced energy is one of the important issues as much as the production of energy. Thermal energy storage technologies are one of the important technologies in storing large thermal energy, increasing the performance and energy efficiency of the application used. Latent heat storage, which is based on phase change material, has become a subject that has been studied extensively in recent years, as it has various organic and inorganic phase change materials to be used in different applications. However, due to the disadvantages of PCMs, it is necessary to increase their performance by producing composite products with support material. Porous carbon materials attract attention as they can be obtained from renewable sources such as biomass. Activated carbons, which have porous structures in different nano-sizes, increase the thermal conductivity of PCMs as well as eliminate leakage problems. In addition, the production methods of shape-stable PCMs also affect the incorporation of PCMs into the support material. For this reason, the production method, the PCM used and the support material must be compatible with each other.

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## Tissue Decellularization- A Novel Modality in Recapitulation of Extracellular Matrix

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**Abstract:** The Extracellular matrix (ECM) is a highly organized three-dimensional (3D) network of proteins and biomolecules essential for all tissue types. Many biomimetic matrices have been developed using protein compositions of the ECM to emulate the native ECM of the tissue. Biomaterials composed of ECM can be prepared by processes that involve the decellularization of tissues and organs. Physical, chemical, and biological approaches are applied in combination to lyse the cells, followed by extensive washing procedures to remove cellular components. Decellularization and sterilization of the decellularized ECM (dECM) are highly effective in obtaining a biomaterial with the desired properties for the targeted clinical application. dECM-based biomaterials encompass mixtures of various biomolecules that regulate cell adhesion, proliferation, migration, and differentiation, such as glycosaminoglycans (GAGs), proteoglycans (PGs), glycoproteins, and structural proteins (i.e., collagens). Therefore, the selected decellularization and sterilization methods should have a minimal negative impact on the biochemical and morphological composition and mechanical properties of the dECM. This study presents an overview of decellularization methods and their effects on ECM structure and composition along with a PEST (political, economic, social, and technological factors) analysis that reveals the status of the dECM-based biomaterials in the market.

**Keywords:** Tissue Decellularization, Extracellular Matrix, Proteins, Biomaterials, Tissue Engineering

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### Introduction

The evolution of eukaryotes from single-cell organisms has an important role in understanding our existence on earth. With the evolution of eukaryotes, complex multicellular organisms capable of possessing specialized

tissues and enhanced biological capabilities have emerged (Ozbek et al., 2010). As such, tissue evolution is involved and affected by several factors such as heredity and natural selection. Thus, tissue evolution brings changes in the ECM, which is uniquely designed for each tissue by completing its optimization throughout evolution. The primary mediator of multicellularity, the ECM is a well-structured highly organized 3D network that bridges cells, binds adhesion receptors of cells to assist their spatial arrangements, and supports cell fate and tissue organization (Hynes, 2009). Although every ECM is composed of proteins, biomolecules, and polysaccharides, each tissue has a unique ECM composition in physicochemical, mechanical, and biochemical properties generated in early embryonic development (Frantz et al., 2010). Thus, understanding the dynamic relationship between tissue evolution and ECM is crucial for considering the impact of matrix remodeling on developmental biology with respect to both health and disease states. Indeed, the increasing number of research papers published in the field in recent years demonstrates the importance of the extracellular matrix (Figure 1A).

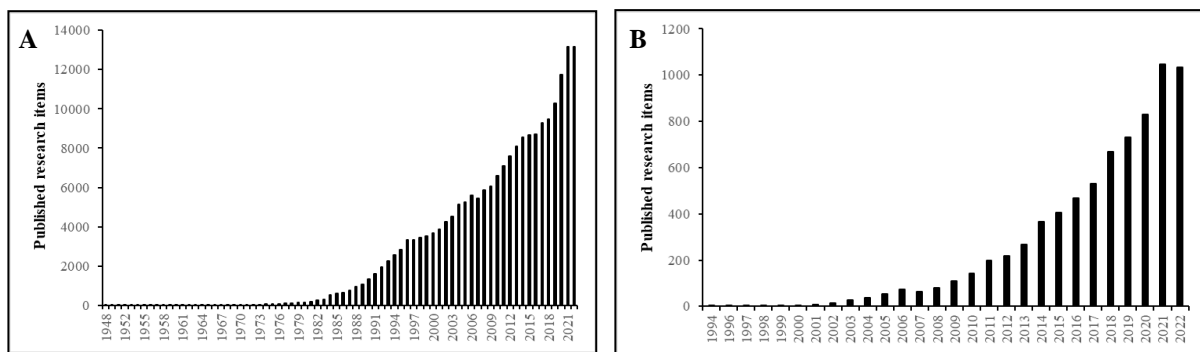


Figure 1. The current state of the ECM and decellularization process. (A) Publications of the ECM per year with the keywords “Extracellular matrix” or “ECM” in the title, abstract, and keywords. (B) Publications of the decellularization per year with the keywords “Decellularization” or decellularized” in the title, abstract, and keywords. (Source: <https://www.scopus.com>, date of search: 12 June 2023)

The ECM is composed of two-layer macromolecular structures that differ based on their location and protein composition. While the basement membrane separates the epithelium from the surrounding stroma of any tissue, the interstitial matrix surrounds cells and provides structural scaffolding for tissues (Morrissey & Sherwood, 2015). Even though the basement membrane typically lines the basal side of the epithelial tissues, additionally it is found in the endothelium, peripheral nerve axons, fat cells, and muscle cells (Kalluri, 2003). The basal membrane is essential for providing structural support and biochemical cues to sculpt the tissue and its unique shape (Khalilgharibi & Mao, 2021). It comprises large insoluble molecules, including type IV collagen, laminin, heparan sulfate proteoglycans (HSPGs), and nidogen/entactin, which assemble to form sheet-like structures (Bonnans et al., 2014). The interstitial matrix comprises fibrous proteins such as type I and type III collagens, fibronectin, and elastin, which provide the structural and functional integrity of the tissues (Frantz et al., 2010). That multi-component complex structure provides not only scaffolding for the cellular components but also provokes crucial biochemical and physical cues that are instructed for tissue homeostasis. These ECM dynamics configure each tissue and organ to meet the requirements for optimum tissue functionality.

To date, numerous biomimetic matrices have been developed using protein compositions of the ECM to emulate

the native ECM of the tissue. The fact that the composition of the ECM changes with gender, aging, and disease states, all developed biomaterials constitute a simplified form of the native ECM. Despite many advanced biomimetic matrices encompassing individual ECM constituents (e.g., collagens, fibronectin, hyaluronic acid, and laminin), protein-based biopolymers (e.g., gelatin, GelMA, and alginate) (Sharifi et al., 2020) or combinations (Cakmak et al., 2022), their success to mimicking of native microenvironment remains incomplete owing to the highly rich, specified composition of the ECM. Apart from single-component matrices, tumor-derived basement membrane extracts (BME) (i.e., Matrigel) have thus far been the gold standard for emulating the ECM. However, BME is purified from the Engelbreth-Holm-Swarm mouse sarcoma and comprises only the key components of the basement membrane proteins such as collagen type IV, nidogen, laminin, perlecan, entactin (Moura et al., 2022). Due to their tumor-derived origin, BMEs encompass various undefined growth factors, thereby rendering it challenging to discern the specific factors responsible for driving and affecting cellular function (i.e., stem cell differentiation and maturation). Moreover, undesirable characteristics such as batch-to-batch variability of their biochemical and mechanical properties, high cost, and inability to recapitulate unique tissue microenvironments limit their usability (Kaur et al., 2021). Therefore, it is crucial to develop alternative biomimetic matrices that mimic the native ECM while offering suitable tissue-specific cues in both homeostatic and pathophysiological conditions. Biomaterials composed of ECM can be prepared by processes that involve the decellularization of tissues, which effectively recapitulate the intricate architecture and composition of native tissues. As seen in Figure 1B, due to an urgent need for a biomaterial that closely mimics the native ECM, research on the decellularization of tissues or organs is gaining interest over time. Decellularization is a process that removes all the cellular components and immunogenic molecules from donor tissue while preserving proteins and macromolecules of the native tissue. dECM-based biomaterials can be applied in a demanded clinical application as a scaffold, powder, hydrogel, and particle form and is an excellent substrate for cell repopulation which offers a unique opportunity to recreate a biomimetic microenvironment, promoting cell attachment, proliferation, differentiation, and tissue regeneration (Yaldiz et al., 2022). This study focuses on the overview of the decellularization of the tissues and organs, decellularization methods, and their effects on the ECM structures and compositions. Then, current market trends in dECM-based biomaterials and PEST (political, economic, social, and technological factors) analysis that reveals the status of dECM-based biomaterials in the market is presented.

## **Decellularization of Tissues and Organs**

Decellularization of tissues consists of two main steps, including the decellularization of a tissue or organ and terminal sterilization of the dECM. Both steps are highly effective in obtaining a biomaterial with the desired properties for the targeted clinical application. Since the decellularization process evolved with the critical balance of eliminating cellular components and preserving the protein composition and mechanical properties of the native ECM, each decellularization methodology should be tailored to the tissue source. In fact, many developed biomaterials fail due to immunologic rejections mainly attributed to the histocompatibility complex molecules (MHCs), which trigger a cellular immune response (Massaro et al., 2021; Ground et al., 2021;



Dhatchinamoorthy et al., 2021). In an unsuccessful developed decellularized scaffold, damage-associated molecular patterns (DAMPs) which are released from the damaged cellular components and ECM enhance the inflammation process resulting in the secretion of pro-inflammatory cytokines such as interleukin (IL) 1, IL6, and tumor necrosis factor (TNF) (Yaldiz et al., 2021). Although trace amounts of MHC molecules remain in the decellularized scaffold, inter- and intra-species conservation of ECM elicit a positive host response during early degradation, enabling recognition by the host immune system (Kasravi et al., 2023). Thus, successfully produced dECM-based biomaterials exhibit more biocompatibility and lower rejection rate compared to synthetic biomaterials. Therefore, to develop a successful decellularization process, three decellularization criteria have been proposed; (i) the amount of DNA should be <50 ng/mg dry weight of ECM, (ii) the length of DNA fragments should be lower than 200 bp on gel electrophoresis, and (iii) visible nuclear material, should not be observed in histological staining (Crapo et al., 2011).

dECM-based biomaterials encompass mixtures of various biomolecules that regulate cell adhesion, proliferation, migration, and differentiation, such as glycosaminoglycans (GAGs), proteoglycans (PGs), glycoproteins (i.e., laminin, fibronectin, and integrin), and structural proteins (i.e., collagen). Therefore, the selected decellularization and sterilization methods should pose minimal negative impacts on the biochemical and morphological compositions as well as mechanical properties of the decellularized matrix. Although each ECM component has a unique function within the tissue, they act as a whole to provide tissue organization and function. Collagens, the main structural ECM component, are fundamental for tissue's structural organization (e.g., shape, stability, and elasticity) and provide mechanical properties. Interestingly, collagens with triple helix structures are known as one of the ancient proteins that enable animal tissue evolution (Fidler et al., 2018). Thus far, 28 types of collagens classified into 3 main categories including fibrillar collagen (e.g., type I, II, III, and V), fibril-associated collagens (e.g., type IX and XII), and network-forming collagens (e.g., type IV, VIII), where each of them has unique functionality differing based on tissue location. Type I collagen is the major component of the organs and connective tissues such as mammary glands and skin (Sun, 2021). Moreover, collagens have crucial functions in hydrogel formation, involving the self-assembly process of the fibrillar structures in dECM under physiological conditions (Krishtul et al., 2020). Proteoglycans are glycosylated molecules where glycosaminoglycans (GAG) are conjugated to the core protein. The GAGs are specified as six types including chondroitin sulfate (CS), dermatan sulfate (DS), keratan sulfate (KS), heparan sulfate (HS), heparin (Hep), and hyaluronic acid (HA), whereas proteoglycans are identified on the basis of the type of core proteins, as well as the number and location of the GAG chains attached to the core (Walimbe & Panitch, 2020). Proteoglycans and sGAGs play pivotal roles in tissue hydration, and homeostasis and regulate many signaling pathways whether in healthy or pathophysiological conditions through interaction with different ECM proteins. Glycoproteins comprise ECM proteins such as laminin, fibronectin, and elastin, which are important in cell recognition, adhesion, and migration and function as a cohesive network in ECM. Laminin is an adhesion molecule found within the basement membrane and generates a structurally functional basement membrane with self-polymerization resulting in layered sheets (McKee et al., 2021). Fibronectin is another fibrillar protein found in the interstitial matrix, which plays a critical role in cell adhesion, migration, proliferation, and differentiation and provides mechanical support to tissue. Fibronectin is involved in many important biological

processes, including tissue repair, wound healing, bone repair, embryogenesis, and pathological processes such as fibrosis and cancer (Bierbaum et al., 2021). This provides strong proof that altering the correct ECM protein ratios in tissue may alter healthy tissue into a diseased state. While collagen fibers provide stiffness to the tissues and further show limited responses when stretching, conversely elastin fibers have excellent abilities to stretch specific tissues such as lungs, arteries, and skin, where compression and relaxation are needed for their function (Trębacz & Barzycka, 2023). Consequently, ECM is a dynamic microenvironment organized uniquely for each tissue and organ that provides the essential biochemical, physical, and mechanical properties for proper tissue functionality. Hence, it is crucial to understand the effect of agents and techniques on ECM in order to develop an effective decellularization methodology to preserve ECM proteins and macromolecules during the decellularization process.

## Decellularization Strategies

To date, various physical, chemical, biological or a combination of approaches are applied to the donor tissue to lyse the cells, remove nuclear components and lipidic membrane contents while exerting minimum damage to the native ECM. Although most tissue types contain the main ECM components, different ratios of ECM proteins, tissue thickness, lipid contents, and cellular density of each tissue require optimization of the decellularization protocol. Even the donor variations (human, porcine, sheep, and bovine, etc.) of the same tissue or organ require an adapted decellularization methodology with a minimum loss of ECM content. Successful decellularization requires careful optimization of parameters such as treatment duration, the concentration of chemicals, and mechanical forces applied to effective cell removal while preserving the structural integrity of the native ECM. Following decellularization, extensive washing is required to remove residual cellular debris, and detergents to minimize potential adverse effects on subsequent cell seeding and tissue regeneration.

## Chemical Methods

Chemical methods encompass the utilization of various acids, bases, detergents, and organic solvents to effectively dissolve the cell membrane and disrupt the intercellular bonds. Detergents enhance the effective removal of cellular components by solubilizing the cell membrane, and the effect on the decellularization varies depending on the types of detergents (e.g., ionic, nonionic, and zwitterionic detergents). The commonly used ionic detergent, sodium dodecyl sulfate (SDS), dissolves both outer and nuclear membranes and is effective in removing nuclear and cytoplasmic residuals of particularly dense tissues. However, it tends to cause lower GAG concentrations, collagen integrity loss, and denaturation of proteins and could impact the structure of the native matrix (Fu et al., 2014). However, due to the non-ionic nature, Triton X-100 provides less drastic action to dissolve cell membranes with preservation of protein-protein interactions, thus causing less damage to ECM proteins than SDS (Mendibil et al., 2020). Therefore, SDS and Triton X-100 are typically applied together in the decellularization process to maximize the effect of the decellularization with optimized detergent concentration,

treatment time, and treatment order. Zwitterionic detergent such as 3-((3-cholamidopropyl) dimethylammonio (CHAPS) has both properties of the non-ionic and ionic detergents and removes the lipid–lipid, and lipid–protein interactions while solubilizing membrane. CHAPS is more effective in the decellularization of thin tissue due to its limited permeation ability (Gilpin & Yang, 2017). When acid and base treatments are used for the decellularization process, the combination might exert a destructive effect mainly on collagens, and GAG while removing nucleic acids. Therefore, peracetic acid is often used in shorter treatment times for sterilization of the decellularized scaffold (Tao et al., 2021). Among others, alcohols support the decellularization of the tissues rich in lipids content with dehydration and degradation of the cells. Although alcohols including glycerol, isopropyl alcohol, and ethanol are used to effectively to decellularize the adipose tissue as part of the delipidation process, their fixation effects cause remaining DNA in the tissue (Chun et al., 2021). Therefore, an extensive washing process should be applied to prevent fixation before detergent applications.

### **Physical Methods**

Physical methods such as agitation, sonication, pressure, freeze-thaw, and electroporation are used to further dissolve the cell membrane and release cellular components. However, employing these methods alone will not result in decellularization. Hence, combining with other chemical and biological techniques is required to achieve successful dECM-based biomaterials. Freeze-thaw treatments applied in the first step of the decellularization process involve freezing at  $-80\text{ }^{\circ}\text{C}$  and thawing at room temperature or  $37\text{ }^{\circ}\text{C}$ . The process induces intracellular ice crystallization formation, thereby disrupting the cell membrane (Burk et al., 2014). Typically, more than one freeze-thaw cycle is applied as a single cycle is insufficient. The high hydrostatic pressure approach is used to disrupt the cell membrane by applying direct pressure to the tissue for a short duration. However, this method is effective for non-dense tissues (Hashimoto et al., 2011). Other approaches include sonication and electroporation, disrupting the cell membrane and releasing the cell contents to external solutions such as detergents.

### **Biological Methods**

Enzymatic methods employ protease or nuclease enzymes to cleave nucleotide bonds in the tissues or organs. However, utilizing enzymes alone is challenging to remove the cellular components during the decellularization, and the application time must be tuned to each tissue, as enzyme residues can result in an adverse immune response (Crapo et al., 2011). Among these enzymes, trypsin is the most common, combined with ethylenediaminetetraacetic acid (EDTA) to break cell-matrix interactions. However, optimization of the trypsin application is crucial as prolonged treatment can alter matrix integrity, destroy laminin, and remove GAGs (Mendibil et al., 2020). Nucleases such as DNases and RNases effectively break down the nucleic acid sequences and therefore assist in the removal of nucleotides after cell lysis (Moffat et al., 2022). Nucleases are administered specifically after detergent applications to eliminate the remaining DNA in the tissue for more effective decellularization.

## Application Techniques of the Decellularization Agents

The above-mentioned decellularization agents can be applied via immersion and agitation, whole organ perfusion, or the supercritical CO<sub>2</sub> (SC-CO<sub>2</sub>) process, depending on the tissue or organ source and the subsequent application of the ECM. The immersion and agitation process is applied to tissue parts where the tissue or organ is cut into small pieces or minced and soaked into the decellularization agent with mechanical stirring. This process is utilized to decellularize mainly the non-vascularized tissue such as the brain, adipose, cartilage, bone, cornea, or skin, where perfusion-based decellularization cannot be applied. With the agitation process, decellularization agents diffuse throughout the tissue via the pores and then removed with the cellular components (Gupta et al., 2017). Such a process continues until the tissue is completely decellularized, thus for minimal ECM damage during the agitation, tissue thickness, agitation speed and time should be carefully optimized. To increase decellularization efficiency, the agents should be changed after particular times, and also washing step should not be forgotten to remove the detergent residues and cellular debris. Besides non-vascular tissues or organs, organs with the vascular system can be decellularized with the immersion and agitation process based on the final product. Typically, dECM-based biomaterials with hydrogel or microparticle forms are produced via this process, whereas the perfusion-based process is chosen to achieve whole organ decellularization. Indeed, perfusion technique is used to decellularize vascularized organs (e.g., liver, lung, heart, and kidney, etc.) as whole by perfusing decellularization agents throughout the organ's native vascular system (arteries, arterioles, and capillaries) while removing all cellular components and residues through the vasculature (Gupta et al., 2017). The peristaltic pump provides transport of the decellularization agents homogenously throughout the organ, resulting in the preservation of the 3D structure of the ECM. Thus, perfusion-based decellularization represents a promising approach to increase organ transportation in the near future, as the recellularization of the acellular whole organ presents the generation of a functionalized candidate organ introduced with patient-derived cells or stem cells resulting in reduced risk of organ rejection.

As an alternative approach, decellularization with SC-CO<sub>2</sub> has gained attention to effectively remove cellular residues while ensuring minimal deterioration of the mechanical and structural properties of the ECM. The supercritical phase is reached when the pressure and temperature of the fluid are above the critical point, hence showing both liquid-like (e.g., density) and gas-like (e.g., diffusivity and viscosity) properties (Filiz et al., 2022). Due to its low critical temperature (31.1 °C) and pressure (7.4 MPa), SC-CO<sub>2</sub>-based decellularization is suitable for decellularizing tissues where higher temperatures destroy ECM proteins (Senyay-Oncel & Yesil-Celiktas, 2011). Furthermore, since SC-CO<sub>2</sub> is non-polar, the inclusion of ethanol or methanol as a co-solvent allows the removal of the polar components of the membrane (Kim et al., 2021). However, such solutions are a common fixative agent, thus the concentration and introduction time should be well-adjusted to avoid tissue and DNA fixation (Yaldiz et al. 2021). Other advantages of the SC-CO<sub>2</sub>-based decellularization process are that there is no need for a separate sterilization step of the decellularized scaffold and obtained decellularized scaffold is in dry form with the ability for long-term storage, eliminating the lyophilization step.

## PEST Analysis of the dECM-based Biomaterials for Commercialization Possibilities

Today, dECM-based biomaterials are gaining attention for their ability to address the needs of tissue engineering, regenerative medicine, and biomedical engineering applications by preserving the biochemical, physical, and mechanical properties of the native ECM. Comprehensive research into the current market's prospects and obstacles in bringing these biomaterials to market to fulfill consumer expectations can provide insight into the market position of dECM-based biomaterials. Herein, the PEST analysis is utilized as a technique to evaluate the political, economic, social, and technological aspects that may affect the market status of dECM-based biomaterials as the market is influenced by a variety of factors (**Table 1**).

**Table 1.** PEST analysis of the dECM-based biomaterials

Political Factors	Economic Factors	Social Factors	Technological Factors
The government's regulations and policies can affect the development, production, and growth of decellularized biomaterials in the market	The affordability of decellularized biomaterials compared to alternatives will positively impact sustainability in the market	Since decellularized biomaterials are a new treatment product in the market, patients may exhibit biased behaviors	The progress in biomaterials, tissue engineering, and 3D bioprinting technologies positively affects the availability of decellularized biomaterials in the market
Opinions on decellularized biomaterials of animal origin can be controversial due to cultural differences	Decellularization allows the various discarded organs in slaughterhouses to be recycled and used in tissue engineering and regenerative medicine applications	Since decellularized biomaterials are mainly of animal origin, they may not be accepted by animal activists	Progress in technologies positively affects the quality of decellularized biomaterials and their ability to mimic relevant organs
Such arguments may affect the public acceptance of these biomaterials	The low production cost of dECM-based biomaterials provides a benefit in the current market	Cultural beliefs and ethical considerations can greatly influence the acceptance of decellularized biomaterials in society and their progress in the	Providing support and funding for university research groups and collaboration with R&D departments of companies will leverage the associated technology

market

The willingness of patients to accept functionalized decellularized organs plays a vital role in the market demand

Giving education and seminars about concerns to raise awareness about their benefits can increase the acceptance of decellularized biomaterials by society

Raising awareness through education may assist in to adopt of dECM-based biomaterials by society

Politically, government regulations critically affect the commercialization of dECM-based biomaterials in the market. Such regulations also have an impact on the public acceptability of these biomaterials. On the other hand, the low production cost of dECM-based biomaterials compared to alternative biomaterials contributes positively to their sustainability in the market. However, ethical considerations and cultural differences might have serious impacts on the acceptance of decellularized biomaterials in public. Moreover, advancements in 3D bioprinting technologies are anticipated to positively affect the fabrication of functional tissues and organs. Although dECM-based biomaterials have a promising approach for creating functional tissue by mimicking native ECM, the issues of batch-to-batch variability, standardization, and ethical considerations of these biomaterials require further research.

## Conclusion

The inability of existing ECM-mimetic biomaterials to adequately mimic the highly complex ECM has enabled the decellularization of numerous tissues or organs. Optimization of decellularization protocols, comprising a combination of physical, chemical, and biological methods, is critical for developing functional tissue architectures. When dECM-based biomaterials are utilized with tissue engineering and 3D bioprinting technologies, clinical products incorporating fully functional tissues or organs with patient-derived cells or stem cells can be developed in the near future to be employed in disease modeling, regenerative medicine, and organ transplantation. More work on standardization and a focus on batch-to-batch variations are required prior to market entry of these products for medical purposes.

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## Changing The Success Probability in Computerized Adaptive Testing: A Monte-Carlo Simulation on The Open Matrices Item Bank

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**Abstract:** For efficiency, Computerized Adaptive Test (CAT) algorithm selects items with the maximum information, typically with a 50% probability of being answered correctly. However, examinees may not be satisfied if they only correctly answer 50% of the items. Researchers discovered that changing the item selection algorithms to choose easier items (i.e., success probability  $> 50\%$ ), albeit not optimum from a measurement efficiency standpoint, would provide a better experience. The current study aims to investigate the impact of changing the success probability on measurement efficiency. A Monte-Carlo simulation was performed on the Open Matrices Item Bank and simulated item bank. A total of 1500 examinees were generated. We modified the item selection algorithm with the expected success probability of 60%, 70%, and 80%. Each examinee was assigned to five item selection methods: maximum-information, random,  $p=0.6$ ,  $p=0.7$ , and  $p=0.8$ . The results indicated that traditional CAT was 60-70% shorter than random item selection. Altering the success probability did not affect the estimation of the examinee's ability. Increasing the probability of success in CAT increased the number of items required to achieve specified levels of precision. Practical considerations on how to maximize the trade-off between examinees' experiences and measurement efficiency are mentioned in the discussion.

**Keywords:** Adaptive Testing, Easier CAT, IRT, Open Matrices Item Bank, Test-Taking Experience

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### Introduction

Computerized Adaptive Testing (CAT) is a type of assessment that utilizes computer technology to adjust the difficulty level of the test items according to the examinee's proficiency level. This type of testing is getting more popular due to its advantages. One of the most substantial advantages of the CAT over linear tests is that it provides more precise estimates with a shorter test than traditional fixed-item testing (FIT) (Wainer, 2000; Weiss, 2011). The administration of CAT relies on the accuracy of the examinee's answers to the previously administered items to determine the selection of the subsequent item or set of items. If the examinee answers the item correctly, the next item will be more difficult. On the contrary, if the examinee answers the item incorrectly, the next item will be easier. After responding to a test item, the person's ability estimate,  $\theta$ , is

updated. This cycle will continue until the stopping rule (e.g., level of precision or number of items) has been reached.

The most widely used criterion for item selection in CAT is the Maximum Information (MI) criterion (van der Linden, 2005). This particular criterion is designed to minimize the standard error of measurement (SE) by identifying the item with the highest information function value during the last estimate. Modern CATs mostly use item response theory (IRT) to calibrate items and estimate the examinee's ability. In IRT, too easy or too difficult items provide little information about that examinee's ability. The CAT algorithm chooses the difficulty of the item to match the currently estimated ability. Consequently, high-ability examinees face more difficult items, whereas low-ability examinees face easier items. Within the Rasch or 2PL-IRT framework, the examinees will have a 50% probability of being answered correctly, regardless of their ability. This optimum CAT algorithm can reduce the test length to reach the prespecified measurement precision.

Several researchers believed that utilizing the CAT item selection algorithm would result in a challenging and optimally motivating assessment scenario for the examinees (Linacre, 2000; Wise, 2014). This is due to the fact that the algorithm ensures that the examinees are not compelled to work on items that are either too difficult or too simple, thereby preventing feelings of being over- or under- challenged. However, empirical evidence supporting this claim is unclear. A recent meta-analysis study found no overall effect of test type on motivation when comparing CAT with FIT (Akhtar et al., 2022). According to Andrich (1995), a success probability of 50% may not be sufficient for maintaining test-takers motivation in a CAT. This is because they will only be able to achieve success in roughly half of the items presented to them. This success probability is typically lower than people used to in fixed-item tests.

Several researchers modified the CAT setting in order to maximize examinees' motivation. For example, Ling et al. (2017) found that participants who completed easier CAT (i.e., CAT with success probability > 50%) showed higher engagement and lower anxiety than participants who completed traditional CAT or FIT. In their study, they modified the success probability to 70%. A similar study also found that participants in the easier CAT group showed slightly lower anxiety than in traditional CAT or FIT groups, even though the difference was not significant due to low statistical power (Revuelta et al., 2003). Häusler & Sommer (2008) discovered that alterations made by utilizing base success probabilities above 70% decreased measurement precision and, more importantly, a bias in estimating person parameters for respondents with higher abilities. However, a few easier motivator items could enhance test-taking motivation throughout the test without sacrificing testing time.

Evidence indicated that modifying the CAT algorithm to present easier items (i.e., success probability > 50%) would provide a better experience for examinees. However, modifying CAT to select easier items is not without consequences. When the difficulty level of a test is lower, additional items are necessary to achieve the designated SE. In their simulation, Bergstrom et al. (1992) found that if the specified SE is 0.5, the length of the test would be 16 items for the difficult test ( $p = 0.5$ ), 17 items for the moderate test ( $p = 0.7$ ), and 19 items for the facile test ( $p = 0.7$ ). In their study, the item bank was calibrated using the Rasch model. In the Rasch model,

an item with  $p = 0.5$  will always provide maximum information. However, in the 2PL model,  $p = 0.5$  is necessary but not sufficient to provide maximum information. Therefore, practical considerations should be made to maximize the trade-off between test-taking experience and measurement efficiency.

### Study objectives

This study aimed to investigate the impact of changing the success probability on measurement efficiency. I manipulated the success probability of administered items to 60%, 70%, and 80%. As a baseline, I also simulated traditional CAT using MI item selection and non-CAT using random item selection. A real and simulated item bank was used for this study. Specifically, our research questions were as follows:

1. Does changing the success probability detrimental to measurement efficiency (i.e., longer test length)? Specifically, at what point does measurement efficiency decrease drastically?
2. Does the estimates ability differ when different item selection methods are applied?

This study was divided into two stages. The first stage was a simulation on a simulated item bank. The same procedure was then replicated to a real item bank to examine whether item bank characteristics influenced the results. I used the Open Matrices Item Bank (OMIB, Koch et al., 2022) for the real item bank since it provides many benefits. The OMIB provides free and unlimited access to a large set of empirically validated figural matrices items. Therefore, researchers who are interested in applying easier CAT in a real testing context would not face any access barrier.

## Methods

### Item bank

This study used two item banks: simulated item bank and real item bank. All item banks used the 2PL model for item calibration. A simulated item bank was generated through R software (R Core Team, 2012) to generate an item bank as realistically as possible. A simulated item bank consisted of 1000 items with varied item difficulty ( $b$ ) and item discrimination ( $a$ ). Item difficulty for the simulated item bank was normally distributed. The mean and standard deviation of the distribution on the log scale for item discrimination were set as 0.2 and 0.3, respectively. It resulted in the final simulated item bank with  $b$  parameter ( $M = 0$ ,  $SD = 1$ ,  $Min = -3.39$ ,  $Max = 3.66$ ) and  $a$  parameter ( $M = 1.26$ ,  $SD = 0.38$ ,  $Min = 0.49$ ,  $Max = 3.14$ ). The distribution of  $a$  parameter and  $b$  parameter of simulated item bank is shown in Figure 1.

The second item bank used for the simulation is the real item bank from Open Matrices Item Bank (OMIB, Koch et al., 2022), freely available at <https://osf.io/fqtzp>. The bank consisted of 220 items. The final distribution of the OMIB had  $b$  parameter ( $M = -0.17$ ,  $SD = 0.99$ ,  $Min = -8.98$ ,  $Max = 2.41$ ) and  $a$  parameter ( $M = 2.09$ ,  $SD = 0.84$ ,  $Min = 0.11$ ,  $Max = 5.16$ ). Figure 1 depicts the distribution of  $a$  parameter and  $b$  parameter of OMIB.

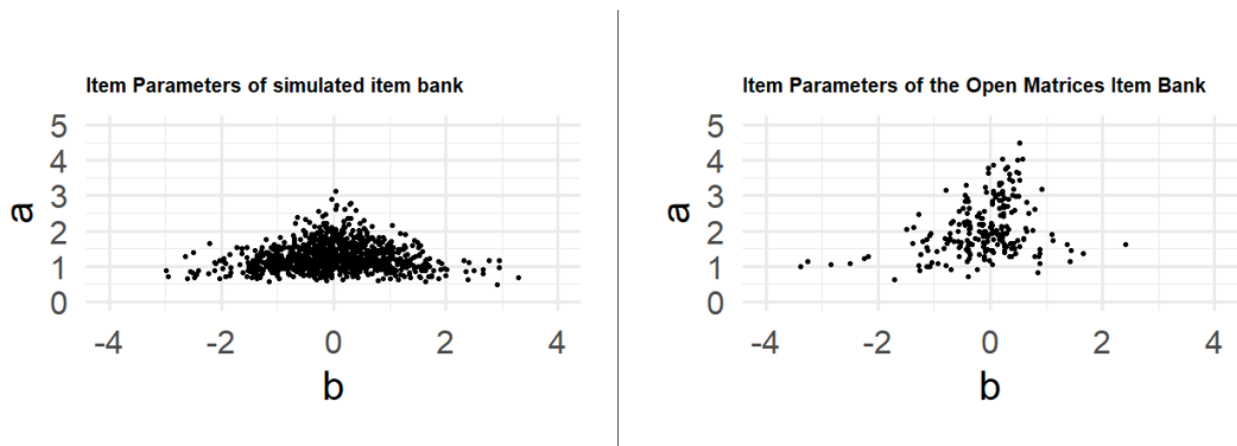


Figure 1. Distribution of item parameters of the item banks

### Design of the CAT Simulation

CAT simulation was performed in two stages. In stage 1, simulation was performed in the simulated item bank. Examinee response and theta were generated using the mirtCAT package (Chalmers, 2016). The theta parameters were drawn from a standard normal distribution ( $M=0$ ,  $SD=1$ ), and the sample size was fixed to 1500 for each condition. The simulation design differed in terms of item selection and stopping rule. Five different item selection methods were used: Maximum-information (MI), success probability 60% ( $p = 0.6$ ), success probability 70% ( $p = 0.7$ ), success probability 80% ( $p = 0.8$ ), and random items selection methods (Non-CAT). As a stopping rule, the precision-based termination rules were utilized with two conditions:  $SE < 0.30$  (analogous to high-stakes testing) and  $SE < 0.40$  (analogous to low-stakes testing). For ability estimation, Bayesian Maximum A Posteriori (MAP) was used. In stage 2, the same procedures were replicated in the OMIB.

Three criteria were used to evaluate the simulation for all conditions: test length, root means square error (RMSE), and correlation between estimated and true theta ( $r_{xt}$ ). The test length was simply the number of items required to terminate. Test length was the main interest of this study as it was the indicator of measurement efficiency. RMSE was the absolute difference between the estimated and true theta. The  $r_{xt}$  is the Pearson correlation between the estimated and true theta. In addition, I also compared the real proportion of correct answers for each condition to check whether the item selection algorithm worked as expected.

## Results

### Measurement efficiency of each item selection

To answer the first research question (*Does changing the success probability detrimental to measurement efficiency?*), I compared all conditions in the simulation. The complete findings of the simulation study are summarized in Table 1. First, simulation was performed on the simulated dataset. As predicted, the modification from MI item selection to success-probabilities-based item selection increased the test length. For  $p = 0.8$ , the

test length was even worse than using random item selection. However, RMSE and  $r_{xt}$  in all item selection methods did not differ much. Traditional CAT (MI item selection) generally was 70% shorter than non-CAT, while moving to success-probabilities-based item selection decreased the efficiency to 13%-20%. The proportion of correct answers indicated that the real success probabilities were near to what was expected from the algorithm.

Table 1. Results of the simulation study

Item selection	SE < 0.30				SE < 0.40			
	Mean k	Prop	$r_{xt}$	RMSE	Mean k	Prop	$r_{xt}$	RMSE
<b>Simulated item bank</b>								
MI	11.72	0.52	0.95	0.31	6.36	0.54	0.91	0.42
p = 0.6	31.92	0.59	0.95	0.3	17.52	0.6	0.91	0.41
p = 0.7	34.86	0.68	0.95	0.3	17.96	0.68	0.91	0.41
p = 0.8	42.03	0.76	0.95	0.32	22.69	0.76	0.91	0.42
Random	40.18	0.5	0.95	0.3	20.97	0.5	0.91	0.4
<b>Open Matrices Item Bank</b>								
MI	11.06	0.56	0.95	0.3	5.34	0.57	0.92	0.38
p = 0.6	18.93	0.61	0.95	0.3	8.86	0.62	0.92	0.39
p = 0.7	21.08	0.67	0.95	0.3	10.42	0.68	0.91	0.4
p = 0.8	24.07	0.73	0.96	0.29	11.42	0.75	0.92	0.38
Random	26.92	0.53	0.95	0.3	13.63	0.55	0.92	0.39

Note: mean k = average test length, prop = proportion of correct,  $r_{xt}$  = correlation between the estimated and true theta, RMSE = root means square error, MI = maximum information, p = success probability.

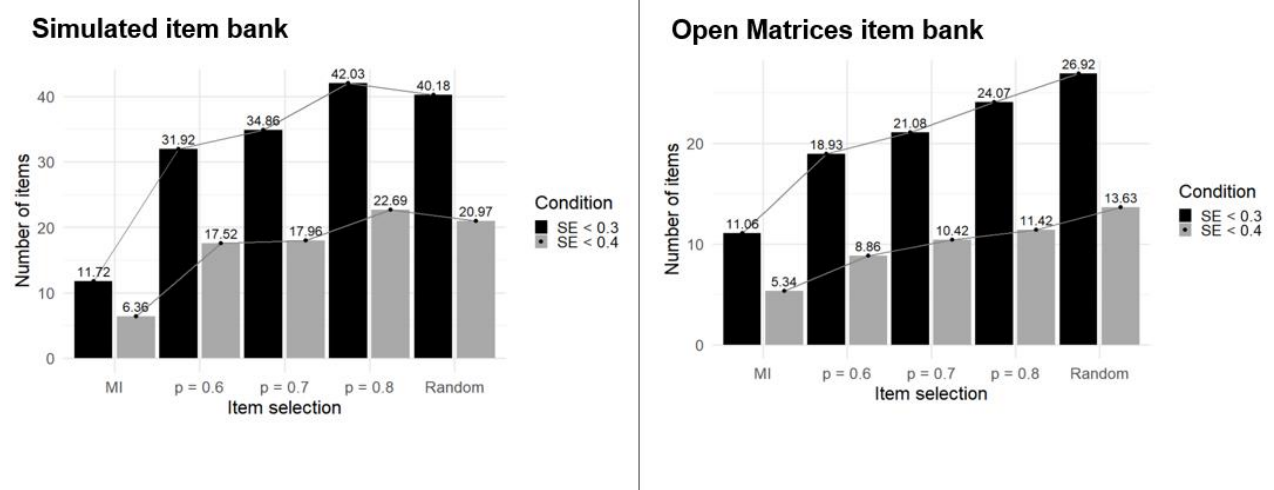


Figure 2. Number of items in each item selection method

The simulation study on OMIB showed similar results. However, modifying the algorithm using success-

probabilities-based item selection did not increase test length drastically, as in the simulated dataset. Using success-probabilities-based item selection was still better than using random item selection. Traditional CAT was generally 60% shorter than non-CAT, and its efficiency decreased to 21%-34% when success-probabilities-based item selection was used. The trend of the increasing number of items in each item selection method is displayed in Figure 2. As shown in Figure 2, when the algorithm switched from MI to  $p = 0.6$ , the test length increased drastically, but then the switching from  $p = 0.6$  to  $p = 0.7$  did not increase too much.

**Estimate’s ability in each item selection**

To answer the second research question (*Does the estimates ability differ when different item selection methods are applied?*), I compared the estimated theta from each item selection method. The comparison was performed using one-way ANOVA. In any comparison, the estimated theta did not differ significantly. For the simulated item bank, in condition  $SE < 0.30$ , there was no effect of item selection on estimated theta ( $F(4, 2495) = 0.17, p = 0.95$ ), and  $F(4, 2495) = 0.80, p = 0.52$ , for  $SE < 0.40$  condition. For the OMIB, in condition  $SE < 0.30$ , there was no effect of item selection on estimated theta ( $F(4, 2495) = 0.32, p = 0.86$ ), and  $F(4, 2495) = 0.40, p = 0.81$ , for  $SE < 0.40$  condition. Figure 3 shows the box plot of thetas in each condition.

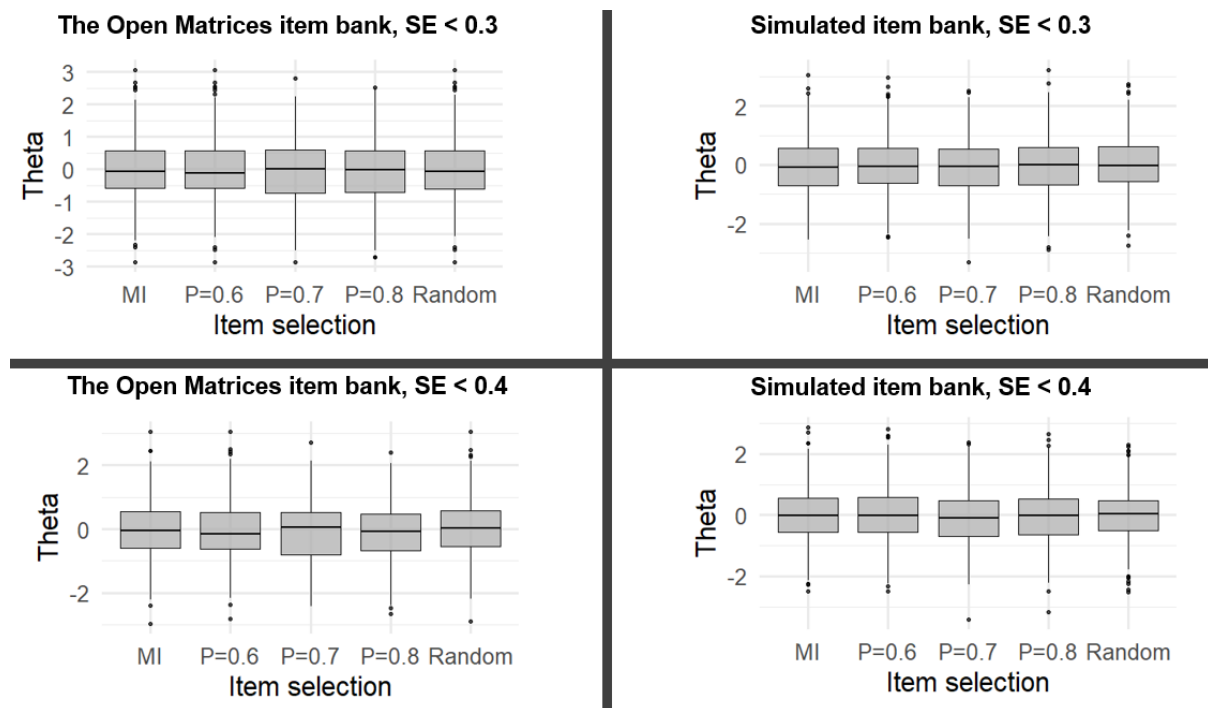


Figure 3. Comparison of estimated ability in all conditions

**Discussion**

This study aimed to examine the impact of changing the success probability on measurement efficiency and estimated ability. This study's main findings indicate that modifying the CAT algorithm to choose easier items

(i.e., success probability  $> 0.5$ ) decreases the measurement efficiency. The test length drastically increased when  $p = 0.6$  was applied but then was relatively stable when  $p = 0.7$  was used. These results were similar for the simulated item bank and OMIB. However, a modifying algorithm to choose easier items did not affect  $r_{xt}$ , RMSEA, and estimated ability. Therefore, even though examinees answered more items correctly than in traditional CAT, their final theta was similar to when tested using traditional CAT.

The simulation study results have been predictable since previous studies found the same (Bergstrom et al., 1992; Häusler & Sommer, 2008). However, this study provides additional insight since two different item banks were used. First, although the OMIB consists of fewer items than the simulated item bank, it provides more efficient testing. It is particularly true when a modification algorithm is used for item selection. For example, to reach  $SE < 0.3$ , when  $p = 0.7$  was applied, the simulated item bank needed 34.86 items, while the OMIB only needed 21.08 items. It is plausible since OMIB has more easy items (i.e.,  $b < 0$ ) with high  $a$  parameter than the simulated item bank (see Figure 1). In the IRT framework, items with higher  $a$  parameter provide maximum information, which in turn reduces SE significantly. Thus, measurement efficiency is not solely determined by the number of items in the bank, but rather by the quality of the item bank itself. However, since the simulated item bank has more items, the gap between the targeted and actual proportion of correct answers is closer than in the OMIB.

Second, modifying the algorithm to select easier items has no impact on  $r_{xt}$  and RMSEA. It indicates that, although not optimal from measurement efficiency, selecting easier items does not decrease measurement accuracy. This idea is also supported by the finding that the estimated ability (theta) did not differ in all item selections. This is true for the two different item banks. Therefore, researchers and practitioners who intend to apply easier CAT should not fear the loss of accuracy.

One notable finding of this study that contradicts previous research was the test-length cost when MI algorithm was replaced by selecting easier items. A previous study (Bergstrom et al., 1992) suggested that easier CAT targeted at a success probability of  $p = 0.7$  only slightly increases the number of items required to reach a certain level of measurement precision. However, this study indicated that CAT targeted a success probability of  $p = 0.7$  increases the number of items twice as CAT with MI item selection. It should be noted that Bergstrom et al. (1992) used the Rasch model. In the Rasch model, all items have similar item discrimination. Therefore, all item has the same weight to provide information as long as they match the examinees' estimated theta. In our study, the 2PL model was employed. Although theoretically, MI will result in  $p = 0.5$ , selecting items based solely on targeted  $p = 0.5$  does not always result in maximum information. When item difficulty matches the estimated theta, item discrimination will highly determine information. Since the item bank has many items with high item discrimination (i.e.,  $a$  parameter  $> 1$ ), it results in more efficient testing. Thus, switching to item selection with a higher success probability will reduce efficiency even more severely.

Several scholars suggested that practitioners need to consider easier CAT because it provides better experiences for examinees (Häusler & Sommer, 2008; Ling et al., 2017; Revuelta et al., 2003). However, what is the cost if



we modify the CAT algorithm to select easier items? This study shows that the test length cost is more severe than in previous studies. Practical considerations should be made to maximize the trade-off between test-taking experience and measurement efficiency. If measurement efficiency is the priority, then no need to move from traditional CAT using MI item selection. In fact, the actual proportion of correct answers using MI was higher than 50%. But, if test-taking experiences are the priority, I would suggest item selection with targeted  $p = 0.70$ . The simulation indicated that CAT targeted at a success probability of  $p = 0.7$  only slightly increases the number of items required to reach a certain level of measurement precision compared to  $p = 0.6$ . This suggestion is also supported by Asseburg and Frey (2013), who suggested that a success probability of 70% is optimal because examinees invested more effort and reported less boredom.

### Limitations

Notably, although the central issue of this study is to address the trade-off between measurement efficiency and test-taking experience, I did not examine the effect of item selection on test-taking experiences using real-time testing. It is imperative to address whether examinees prefer shorter but harder tests or easier but longer tests. Second, I only used the 2PL model for the simulation. Other models, such as Rasch, might provide different results. For instance, in 2PL, MI item selection prefers to choose items with high  $a$  parameter. But in Rasch,  $a$  is constrained to be 1 for all items. Thus, efficiency mainly depends on the distribution of item difficulty. Third, I only used MI for traditional item selection in CAT. However, many other item selection methods exist, such as the Kullback-Leibler criteria. Future research is suggested to compare other methods too. Finally, measurement efficiency in this study was defined as the test length. However, the longer test does not always result in a longer testing time. Hornke (1997, 2000) indicated that incorrect items require longer than correct ones. Thus, easier CAT, although it needs more items, does not necessarily require more testing time. Future studies should investigate further on this issue.

### Conclusion

In summary, changing the CAT algorithm to select easier items (i.e., success probability  $> 0.5$ ) reduces measurement efficiency. These findings were comparable for the simulated item bank and OMIB. However, a modifying algorithm to choose easier items did not impact  $r_{xt}$ , RMSEA, and estimated ability. As a result, even though examinees accurately answered more questions than in a traditional CAT test, their final theta is comparable.

### Recommendations

Practical considerations should be made to optimize the trade-off between the test-taking experience and measurement efficacy. There is no need to switch from the traditional CAT using MI item selection if measurement efficiency is the top priority. In reality, more than 50% of the questions were answered correctly

using MI. However, if the quality of the test-taking experience is more important, I would advise choosing items with an intended  $p = 0.70$ .

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## **Bottleneck Analysis for Soil Bed Production using Zero Waste Simulator**

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**Abstract:** The European Union defines waste as an extraneous object that is being discarded, intends to be discarded, or needs to be discarded, attributed to the fact it has the potential to be used. The world has become extremely alarmed as the number of wastes tends to increase. The sole option is to sustain waste through reusing and recycling, as there is no innovative way to effectively mitigate or avoid this from occurring. Numerous attempts by using green technology have been taken in recent years to recycle waste into various products, such as fertilizer in the form of a soil bed. Waste has been proven to be appropriate for usage in soil bed manufacture. Chemical waste known as sludge from one Oleochemical industry in Malaysia has been found significantly proven to be recycled as soil bed. Thus, the goal of this paper is to present the first section of the research study which is the development of a simulation model for soil beds known as the Zero Waste Simulator (Z-Waste). The Z-Waste simulator has been developed using the simulation technique called Discrete Event Simulation as it is suitable to model process-oriented modelling. The existing process flow of the soil bed production has been modelled and analyzed to check for bottlenecks and constraints. Various test scenarios were used to identify the strengths and weaknesses of the existing process flow. As a result, we found that daily consumed sludge per daily production of sludge has contributed to the significant impact on the soil bed production. The amount of sludge per unit product (soil bed) that is used is relatively small compared to the amount of sludge that was produced daily by the industry. This finding is crucial to prepare the industry for possible upscaling strategies that will help to achieve the zero-waste target by 2030.

**Keywords:** Green Technology, Sustainability, Simulation, Discrete Event Simulation, Waste Management

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## Introduction

Sludge is a semi-solid slurry generated as a byproduct from a variety of industrial processes such as water treatment, wastewater treatment or on-site sanitation systems (Edzwald, 2011). The term encompasses all solid and semi-solid materials that a community discards (da Silva, 2012). There are numerous types of solid waste, but the most common three are industrial waste, agricultural waste, and municipal waste. Solid waste encompasses various types, with three of the most common being industrial waste, agricultural waste, and municipal waste. Industrial waste can take various forms, such as settled suspensions derived from conventional water treatment processes, manure sludge resulting from sewage treatment, or fecal sludge obtained from pit latrines and septic tanks. Industrial waste includes a wide range of substances, such as chemical solvents, dyes, sludge, metals, ash, paints, sandpaper, paper products, and even radioactive materials. To sum up, any chemical byproduct, whether toxic or benign, that arises from an industrial process is classified as industrial chemical waste. These waste items can be hazardous to both human health and the environment if not managed appropriately (Edzwald, 2011). The majority of chemical waste consists of organic and inorganic compounds that may be toxic, flammable, corrosive, or reactive (Daniel & Vallero, 2019). Production, mining, agriculture, healthcare, and research are just few of the industries that can produce chemical waste. There is a risk that improper disposal of this waste, which may contain heavy metals, solvents, acids, and other toxic compounds, will have an adverse impact on the environment in which humans and other forms of life thrive (Karri et al., 2021). In other words, soil, air, and water can all be tainted by these waste products causing a number of major health consequences, including cancer, respiratory problems, and neurological abnormalities, that have been linked to exposure to these toxins (Daniel & Vallero, 2019).

Prior to 1950, most communities around the world disposed their industrial waste by simply dumping it into neighboring rivers or landfills. This practice has caused extensive environmental harm and health problems in affected populations (Limami et al., 2021). Today, many countries have enacted legislation to ensure that industrial chemical waste is processed and disposed safely and sustainably. Different countries are deploying variety of measures to deal with industrial waste. Malaysia for instance, is grappling with the hurdle of handling industrial waste responsibly due to their expanding cities, industrial activities and soaring populations (Mohamed, 2009). According to statistics of 2021 from Malaysian Investment Development Authority (MIDA), Malaysia produced 19,000 tons of waste per day in 2005 at a recycling rate of 5%, in 2018, the amount grew to 38,000 tons per day despite an enhanced recycling rate of 17.5%. This call for concern as it exceeds the

estimated 2020 Japan International Cooperation Agency (JICA) of 30,000 tons per day. Waste management is becoming increasingly pressing as landfill space becomes increasingly scarce and disposal costs continue to rise, threatening the environment and the public's health.

A closer look at the statistics of 2021 from MIDA for Sustainable Waste Management, it is shown that the oil and gas sectors in Malaysia were responsible for around 41% of all fugitive emissions of methane (CH<sub>4</sub>), followed by industrial waste water treatment and discharge emissions at 28% and solid waste disposal sites at 18%. Palm Oil Mill Effluent (POME) accounted for more than 99% of the emissions from industrial waste water treatment and discharge. In tandem with the rapid development of economic growth, environmental degradation in developing nations has increased (Apergis et al., 2021). Despite legislation encouraging consumer waste management through recycling activities (Ghobadi et al., 2021), it should be recognized that industrial processes are the primary source of waste. However, most developing nations that are becoming industrialized lack adequate resources and technology to dispose their industrial waste with minimal environmental impact as the world search for more eco friendly environment. To improve and preserve environmental quality, there is a greater need to adopt and transition to more integrated and sustainable waste management strategies at all levels (Dahale et al., 2012). Processes involved in managing industrial chemical waste include treatment, storage, transportation, and disposal. Treatment may entail neutralizing or removing pollutants from the waste by physical, chemical, or biological methods. Transportation is done by qualified personnel using specialized equipment, and storage facilities are built to prevent leaks and spills.

To prevent harm to the environment and human health, proper disposal of industrial chemical waste is crucial. The inadequate management of production waste raises the number of wastes across nations resulting in increase in global pollution (Dahale et al., 2012). To prevent this pollution, an innovative waste management procedure is required. There are various methods for waste management, such as establishing a landfill or practicing segregation. Consequently, it is still unable to sustainably decrease waste (Mohamed, 2009). Sustaining waste is one method of optimizing its use. Typical means of waste disposal include incineration, disposal in landfills, and deep-well injection. However, these methods can have significant environmental effects (Anderson, 1987). Therefore, attempts are being made to identify more sustainable and eco-friendly alternatives, such as recycling and waste-to-energy technology.

In this paper, we developed a simulation for Oleochemical industry to guide it on optimizing the use of sludge waste generated during the production of soil bed and the rest of the waste generated during the manufacturing process. Findings like these are critical for setting the industry up for success as it considers upscaling options that will bring it closer to the zero-waste goal set for 2030.

The structure of this paper is divided into five sections as follows: Section **Hata! Başvuru kaynağı bulunamadı.** describe the related work. Section **Hata! Başvuru kaynağı bulunamadı.** examines the material and composite preparation. Section **Hata! Başvuru kaynağı bulunamadı.** examines result and discussion for ZWS, Section **Hata! Başvuru kaynağı bulunamadı.** conclude this research.

## Related Work

### Sludge Waste Management

In Malaysia, one of the existing management system for industrial wastes predominantly utilized is an end-of-pipe approach, emphasizing treatment and disposal (Mohamed 2009). The approach involves phases; first, is thickening and dewatering sludge that reduces its volume and facilitates its handling and transportation by removing surplus water. Second, is treating the sludge to reduce its volume and remove dangerous chemicals using typical methods such as anaerobic digestion, aerobic digestion, and composting. Third and the final phase, the sludge is then disposed of in a way that is both safe for humans and the environment. Other approaches in industrial waste management of sludge include landfilling, recycling, incineration and composting (Yasin, 2017). generally, there are varied capabilities offered by these methods. Each has its own advantages, disadvantages, and tradeoffs.

However, all these approaches have been associated with various environmental issues, including illegal dumping and the necessity for additional land to accommodate disposal facilities (Mohammed, 2009). The consequences of illegal dumping of industrial waste poses significant risks to human and environmental well-being. It is essential to transition from the existing management method to a more sustainable regime, considering the availability of technology and the increasing demand for waste recovery and reuse. Japan as an example, prioritizes the recovery of waste and by-products by implementing strategies that replace material resources with technological advancements (Erkman, 2002). Several other studies such as (Ui, 1984; Hirayama et al., 1987; Langenhove 2005) have identified the importance of waste recovery in creating alternatives resources and promoting costs efficiency. Therefore, we can deduce from these authors that waste recovery in industries leads to cost reduction, improved resource utilization, eco-friendly product designs, and effective environmental and health protection.

Recently, a technique have been developed to use industrial waste in the form of sludge for soil bed production. Studies conducted in the use of sludge waste in soil bed production focus on the dosage mixtures with different replacement levels of sludge in their effects on mechanical properties on soil bed. Studies such as (Erdal, 2001; Donald, 2011; Brooks, 2011; Joshi et al., 2012) and many others concluded that cement and lime improve soil volume stability, strength, stress-strain behavior, permeability, and durability. Most of these studies argued that cement or lime stabilize any soil except organic or very plastic clays. Futhermore, Lime and cement were frequently utilized as soil stabilizers to modify soil characteristics until recently, research indicates that solid waste products such as flyash and rice husk ash can be used to produce soil beds, with or without lime or cement (Dahale et al., 2012). Rice Husk Ash (RHA) another form of solid waste was found to improve soil performance. Several researchers including (Muntohar, 2002; Basha et al., 2005; Chun-Yang et al., 2006; Musa, 2008; Roy et al., 2010; Edeh et al., 2012) examined RHA-soil combination geotechnical properties to determine their stabilizer potential.

To conclude this section, various methods such as waste treatment and disposal, recycling and waste recovery were identified. However, these approaches have been associated with health and environmental issues. To address these concerns, there is a need to shift towards a more sustainable management regime that emphasizes waste recovery and reuse. Waste recovery offers benefits such as cost reduction, efficient resource utilization, eco-friendly product designs, and effective protection of the environment and human health as demonstrated from the cited literatures. In addition, recent research has explored the utilization of industrial waste recovered, specifically sludge, in soil bed production, aiming to improve soil properties and stability. Thus, the aim of this paper is to present the first section of the research study which is the development of a simulation model for soil beds known as the Zero Waste Simulator (Z-Waste).

### **Simulation Techniques In Business Process**

A simulation model, according to Pidd (1997), is a computer-based system representation that can imitate the dynamic behavior of that system. The model can then be used to run "what if" experiments without having to develop or damage the real-world system. Models used in simulations are simplifications of the underlying systems or processes that capture their essential properties and behaviors. These models can take either a continuous or a discrete form. The use of a digital computer to solve models with constantly changing states is known as continuous simulation (Bratley and Schrage, 2011). Full wave rectifiers (Durling, 1974) and radioactive decay (Ord-Smith and Stephenson, 1975) or time-dependent models make up the bulk of the work on continuous simulation. These are the typical domains in which continuous simulation is used, however it can also be used in business games.

In contrast to continuous simulations, where state variables change continuously, discrete event simulation only permits state changes at predefined intervals. Simulation models make it possible to figure out a system's throughput, find its weak spots, and answer "what-if" questions about proposed changes to the system. For modelling batch processing systems, discrete event simulation (DES) is the best method (Alexander, 2006). This, has been echoed by Heilala et al. (2010) who demonstrated how DES may be used as a system analysis tool to examine production system principles, system setup, and control logic. Similarly, Dottavio et al. (2016) used FlexSim software to model the flow of nuclear waste during a typical decommissioning process. Many other researchers have employed DES models for a wide range of nuclear waste management purposes and as an overarching project planning tool in decommissioning (Thompson and McCann, 2010). It is obvious that DES is suitably fit for solving a variety of problems in the development process, military, service sectors, and manufacturing. In addition, if a business needs a new assembly line, DES is a good candidate to utilize.

With regards to industrial waste simulation, Zhou et al. (2019) investigated the performance of the reactor and the effects of operating parameters such as coal feeding rate, semi-coke to coal ratio, and particle sizes of coal pressurized pyrolysis process in an industrial-scale spout-fluid bed reactor. Similarly, the same technique was applied by Mokhta et al. (2020) for studies on microwave-assisted pyrolysis of biomass to make bioenergy.



Their focus was on the number and location of waveguides. The usefulness of simulation has grown as it has been used to more and more fields such as in simulation of biomass pyrolysis conducted at the particle size, taking into account intra-particle transport processes and surrounding flow fields (Xiong and Kong, 2016). Furthermore, simulation of microwave-assisted pyrolysis of biomass for bioenergy production with special attention on waveguide number and location was done (Jaroenkhasemmesuk et al., 2018). The study investigated the catalytic cracking process for bio-oil upgrading. In a related study, Ding et al. (2020) simulated the analysis of the catalytic cracking process of biomass pyrolysis oil with mixed catalysts optimization using the simplex lattice design. The author was able to identify the weakness and areas of improvement. In addition, machine learning was deployed in simulation process. For instance, the simulation of combustible solid waste pyrolysis in a fluidized bed reactor Powder Technol and in CFD-based reduced-order modelling of fluidized-bed biomass fast pyrolysis using artificial neural network to recycle energy (Zhong et al., 2020).

Recently, simulation makes it possible to do a dynamic analysis of production systems to find ways to improve the process "as is" and ways to add new technologies often called "to be" states (Skooch and Johansson, 2008). Despite its limited use at the corporate level (Battista et al., 2010), numerous researchers have focused their attention on simulation due to its enormous potential. Simulation, in fact, is a powerful tool for analyzing complex systems (Solding and Gullander, 2009). This is because it provides the opportunity to quantify each variation. In reality, a simulation can be used to evaluate alternate designs or to improve an existing one, allowing cost savings and reducing lead time (Hosseinpour and Hajhosseini, 2009). Moreover, modelling and simulation are developing as critical tools to support production in the twenty-first century (Mor et al., 2021). While several researchers have investigated the possibility of using the simulation techniques from several points of view, little has been made with regards to soil bed production using zero waste simulator. Thus, the Z-waste simulation is intended to drive the strategic sustainability goals towards practical operational implementation.

In this context, the focus of this research is to provide the initial findings of the research study, which is the development of Zero Waste Simulator, a simulation model for soil beds that is appropriate for modelling process-oriented modelling, the Z-Waste simulator was developed using the simulation approach known as Discrete Event Simulation. The existing soil bed production process flow has been modelled and examined to identify bottlenecks and constraints. Several test scenarios were performed to identify the existing process strengths and weaknesses.

## **Material and Composite Preparation**

### **Sludge Preparation**

FPG Oleochemicals (FPGO) is a joint venture between Felda Holdings Bhd Malaysia and Procter & Gamble Company, USA. The former produces refined glycerin, methyl esters, and fatty alcohols while the latter distributes and exports the products to Europe and Asia. The business is headquartered in Kuantan, Malaysia, and was established in 1993. The by-product produced in the form of sludge is refined to be used in soil bed

production. This is to promote the drive towards achieving the zero-waste target by 2030. The process involves converting sludge to soil bed. System Dynamic Simulation (SDS), Agent-Based Modelling & Simulation (ABS), and Discrete Event Simulation (DES) are among the finest techniques for simulating such process. After considering all of the benefits and drawbacks, DES is chosen because of its capacity to imitate the process (Alexander, 2006; Heilala et al., 2010; Dottavio et al., 2016; Thompson and McCann, 2010).

There are several processes require in order to turn the sludge waste into the soil bed. The substance that needed in this process are dried sludge, cement, sand and water. First, sieve all the materials using an aperture scale of 2.0 mm before weighting using ratio of 1:5 for small-medium sized pot as shown in Fig 1. Then, prepare the bottom layer for the plant pot to prevent mixture from escaping during molding process and hole drilling in the polystyrene cup as in Fig 2(a) and Fig 2(b). The mixed substances being place in the mould to form a soil bed as shown in **Hata! Başvuru kaynağı bulunamadı..** The soil bed produced will be let dry directly from the sunlight for 24 hours.



Figure 1: Sieve materials before weighting process



Figure 2 (a) : Bottom layer preparation for plant pot



Figure 2 (b): Hole drilling for polystyrene cup



Figure 3: Mixture of all substance



Figure 4: Moulding substances into soil bed

The mix design for soil bed with different percentage of sludge is used as the three test cases for experiment which include three scenarios (Scenario 1: Simulation according to standard process of soil bed production, Scenario 2: identify bottleneck existence, buffer/stocking concept will be implemented, and Scenario 3: Parallelism with multiple distribution and multiple product development). These three test cases are the sludge with 10%, 50% and 100% used in the soil bed production process as shown in the **Hata! Başvuru kaynağı bulunamadı.**

Table 1. Mix Design for Soil Bed using Sludge

Sludge %	Sludge (kg)	Cement (kg)	Sand (kg)
10	100	1000	1000
50	500	1000	1000
100	1000	1000	1000

## Model Development

In order to aid in the management of sludge waste and decision-making, the Zero Waste Simulator (ZWS) has been designed utilizing the DES method. Based on the three case studies the model output shown in 0, about the three same basic conceptual models are developed for DES, addressing the scope and level of the system under exploration. The concept for a DES model is developed, addressing the basic process flow shown in 0. However, there are few things that must be taken such as simulation attributes and performance measurement to setup the simulation. The number of sludge arrived, and the number of sludge used has been taken as simulation attributes. While number of sludge left, percentage of sludge used and number of soil bed produced, has been taken as the performance measurements in Table 2.

Sludge is the main product from sewage waste. Conventional soil bed is mostly prepared by using soil. Chemical composition of sludge is nearly similar to the soil. Thus, the sludge can be used as a replacement for soil in manufacturing of soil bed. By identifying the requirements needed for soil bed processing using sludge waste as a replacement of cement and sand, a simulation can be modelled.

Table 2. Simulation Attribute and Performance Measurement

Simulation Attributes	Performance Measurement
a. Number of sludges arrives	a. Number of sludges left
b. Number of sludge used	b. Percentage of sludge used
	c. Number of soil bed produced

## Scenario 1

### 1. Sludge arrival rate

Using the arrival process regarding sludge waste inside the real-world method illustrated, the appearance rate in the ruse model is identified. In the ruse model the appearance rate is modelled using an integer distribution with everyday arrival rate shown in Table 3.

Table 3. Sludge Arrival Rate (Scenario 1)

Parameter	Rate
Sludge Arrival	1000 kg per day

2. *Number of sludge used for producing soil bed*

In addition, for soil bed production process in the real-life system, sludge is used as cement or sand replacement and the percentage of sludge used per soil bed varies. In the simulation model the number of sludge used is modelled using an integer value shown in Table 4.

Table 4. Number of Sludge Used (Scenario 1)

Parameter	Value
Number of Sludge used	10% cement replacement (65g sludge)

## Scenario 2

1. *Sludge arrival rate*

Based on the arrival process regarding sludge waste inside the real-world method illustrated, the appearance rate in the ruse model is determined. In the trick model the physical appearance rate is modelled utilizing an integer supply with everyday appearance rate shown in Table 5

Table 5. Sludge Arrival Rate (Scenario 2)

Parameter	Rate
Sludge Arrival	1000 kg per day

2. *Number of sludge used for producing soil bed*

In addition, for soil bed production process in the real-life system, sludge is used as cement or sand replacement and the percentage of sludge used per soil bed varies. In the simulation model the number of sludge used is modelled using an integer value shown in Table 6.

Table 6. Number of Sludge Used (Scenario 2)

Parameter	Value
Number of Sludge used	10% sand replacement (370g sludge)

## Scenario 3

### 1. Sludge arrival rate

In line with the arrival process of sludge waste in the actual life system illustrated, the introduction rate of the simulation model is defined. In the simulation model the arrival rate is modelled utilizing an integer distribution with daily arrival rate shown in Table 7.

Table 7. Sludge Arrival Rate (Scenario 3)

Parameter	Rate
Sludge Arrival	1000 kg per day

### 2. Number of sludge used for producing soil bed

In addition, for soil bed production process in the real-life system, sludge is used as cement or sand replacement and the percentage of sludge used per soil bed varies. In the simulation model the number of sludge used is modelled using an integer value shown in Table 8.

Table 8. Number of Sludge Used (Scenario 3)

Parameter	Value
Number of Sludge used	Both 10% cement replacement (65g sludge) and 10% sand replacement (370g sludge)

## Results

Looking at tables 8 and 9, there are two scenarios related to a soil bed project. The data is organized into columns, each representing a specific aspect of the project. The first column, labeled "Amount of Sludge," indicates the quantity of sludge used in kilograms for the project. In both scenarios 1 and 2, the amount of sludge used is consistently 1000 kg. The second column, labeled "Amount of Sand," represents the quantity of sand used in kilograms for the project. Again, in both scenarios, the amount of sand used is 1000 kg. Similarly, the third column, labeled "Amount of Cement," denotes the amount of cement used in kilograms for the soil bed project. Like the previous columns, the amount of cement used is 1000 kg in both scenarios. The fourth column, labeled "Size of Soil Bed," provides information about the size or scale of the soil bed used in the project. In scenarios 1 and 2, all rows indicate a "Medium" size for the soil bed. Moving on to the next columns, the "No of Workers" column specifies the number of workers involved in the project. The number of workers varies for each row, starting from one worker and increasing up to three workers. Moving forward, the "No of Hours" column indicates the number of hours worked on the project. In both scenarios, all rows show a consistent value of six hours of work.

The "Oven Capacity" column specifies the capacity of the oven used for the drying process in the project. The oven capacity varies across different rows in the scenarios. Unlike the "Total Output" column which displays the overall output or yield of the soil bed project. It is represented by numeric values, indicating the quantity or measurement of the output. The "Sludge Remain" column however, indicates the amount of sludge that remains unused after completing the soil bed project. The values in this column are represented in kilograms and decrease with each row, indicating the reduction in remaining sludge. Furthermore, the "Sludge Used" column represents the amount of sludge that was utilized in the soil bed project. The values in this column increase with each row, indicating the incremental usage of sludge. Finally, the "Percentage Sludge Used" column displays the percentage of sludge used in the project compared to the total available sludge. The values in this column are represented as percentages and increase with each row, indicating the proportion of sludge used relative to the total amount available.

The simulation models results for lab environment production is shown in Table 8 while the simulation models results for production environment is shown in Table 9.

Table 8. Result of Scenario 1

Amount of Sludge (kg)	Amount of Sand (kg)	Amount of Cement (kg)	Size of Soil Bed	No of Workers	No of Hours	Oven Capacity	Total Output	Sludge Remain (kg)	Sludge Used (kg)	Sludge Used (%)
1000	1000	1000	Medium	1	6	10	10	999.44	0.56	0.062
1000	1000	1000	Medium	2	6	10	10	999.06	0.94	0.1
1000	1000	1000	Medium	3	6	10	18	998.75	1.25	0.131

Table 9. Result of Scenario 2

Amount of Sludge (kg)	Amount of Sand (kg)	Amount of Cement (kg)	Size of Soil Bed	No of Workers	No of Hours	Oven Capacity	Total Output	Sludge Remain (kg)	Sludge Used (kg)	Sludge Used (%)
1000	1000	1000	Medium	1	6	10	30	962.8	37.2	3.72
1000	1000	1000	Medium	2	6	20	60	925.6	74.4	7.44
1000	1000	1000	Medium	3	6	30	90	888.4	111.6	11.16

The simulation models result with significant changes in soil bed solution to zero waste is shown in Table 10 :

Table 10. Result of Scenario 3

Amount of Sludge (kg)	Amount of Sand (kg)	Amount of Cement (kg)	Size of Soil Bed	No of Workers	No of Hours	Oven Capacity	Total Output	Sludge Remain (kg)	Sludge Used (kg)	Sludge Used (%)
100	400	600	Medium	20	40	170	1600	0.06	99.94	99.94

Based on the results from scenarios 1, 2 and 3, it can be deduced that the findings demonstrates how Zero Waste Simulator using DES technique helps in sludge waste management and decision making. From the simulation results, we can conclude that the Scenario 3 is suitable to be applied as it has produced more soil bed per day with low cost and maximize the number of sludge used.

*ZWS Animation & Output*

The enhancement for DES model starts by developing the soil bed production process flow of the specific model with multiple product development. Generally, the simulation models make full use of same model suggestions parameter values described as follows:

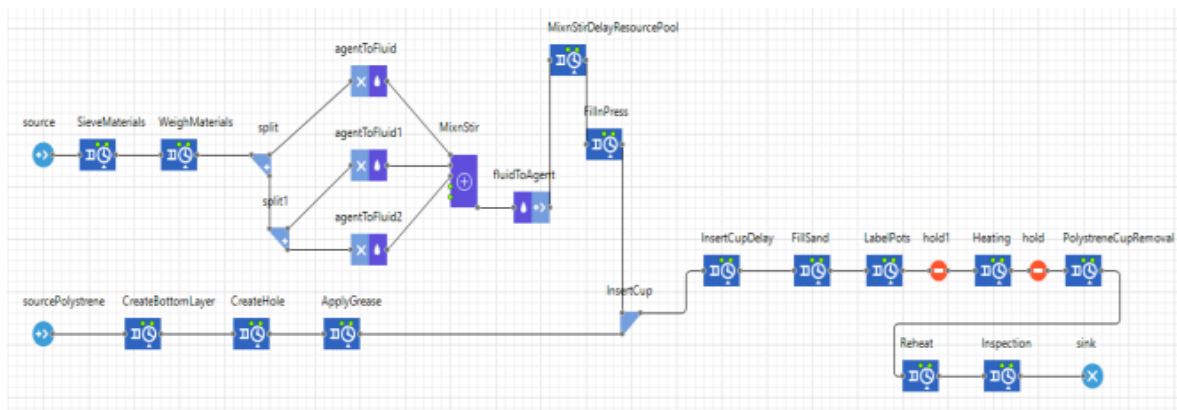


Figure 5: Zero Waste Simulator Process Logic

**Discussion**

The ZWS was developed with the ability to handle the waste management in order to use sludge for soil bed production. It was accomplished by simulating the process of soil bed production from the sludge waste with multiple possible scenarios such as different number of sludge used for production and different number of sludge arrives per day for production to improve and maximize the number of sludge used for soil bed production with less excessive sludge left. The ZWS evaluated according to the evidence found in scenarios 1, 2 and 3. The simulation of sludge waste soil bed process model was achieved using discrete event simulation. From the simulation, several solutions for decision making on sludge waste management were analyzed. Therefore, the outcomes of scenarios 1, 2, and 3 demonstrated how the Zero Waste Simulator using DES

technique can aid in sludge waste management via provisions of multiple possible options for best decision making. Hence, the simulated result demonstrated that the Scenario 3, with 1000kg sludge per day are the most suitable option to be applied. This is obvious as it has produced more soil bed per day with low cost and maximize the number of sludge used in comparison with both scenario 1 and 2. Thus, the results of this research suggest the potential alternative process for bottleneck analysis that can improve the soil bed production process from sludge waste as well as maximizing the usage of the sludge waste.

## Conclusion

It can be deduced, using the results from scenarios 1, 2, and 3, that the findings demonstrate how the Zero Waste Simulator using DES technique helps in sludge waste management and decision making. The hypothesis was written in section 3, and the results were obtained from those three scenarios. Based on the findings of the simulation, we can draw the conclusion that Scenario 3 is an option that should be considered for application because it has produced more soil bed per day at a lower cost and has maximized the number of sludges that have been used.

## Recommendations

The future research investigates the performance of ZWS in real life case studies of manufacturing or business production process. Additionally, further investigation of the performance of ZWS in large attributes and complex system is important area of focus.

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## Powder Properties of Spray Dried *P. pulmonarius* Liquid Culture from Temperature Effect and Protectant Materials

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**Abstract:** In mushroom cultivation, spawn is among the most important factors that ensure a successful production. Considering several drawbacks from both solid and liquid spawn in shelf life and preservation matters, it is suggested that dry powder form of spawn is a good potential to explore. A study of powder culture formation using a spray dryer had involved various inlet temperatures of 80 °C, 90 °C, 100 °C and 110 °C. The properties of the spawn powder (moisture content, water activity, hygroscopicity) were analyzed. Then, the effect of inlet temperature to the powder properties was studied. Also, the powder properties between spawn powder produced from addition of 10% maltodextrin and 10% of Arabic gum were compared. Moisture content and water activity were measured directly with a moisture and a water activity analyzer and the data was used in hygroscopicity calculation. At highest inlet temperature of 110°C, the most suitable powder formation with properties of moisture content (5.13%, 5.53%), water activity (0.3258, 0.3215) and hygroscopicity (39.34%, 37.46%) were obtained for both maltodextrin and Arabic gum. The study proved that the powder culture of *P. pulmonarius* was able to perform and revive and therefore potential to be preserved in longer period, which is beneficial for the mushroom cultivator.

**Keywords:** mushroom spawn, powder properties, spray drying

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## Introduction

In mushroom cultivation, mushroom spawn or mushroom seed is one of the factors that determine the cultivation success rate. Most of the time, mushroom spawn prepared in the form of grains and been marketed in glass bottles or plastic containers. The spawn has a life span of approximately one month only in the room temperature once it has matured or is ready to be used. When stored at 4 °C, the shelf life can be extended up to three months, but there is a risk that the spawn quality will decrease. In fact, the production of solid and liquid spawns may involve a high risk of contamination, a large production area, and a longer incubation time. Additionally, the process required a huge investment of time and money, making cultivation and management are difficult (Kerketta et al., 2017). Another type of spawn that is in liquid form is prepared for immediate use with the goal of achieving faster growth because it can be distributed evenly. According to Kumar et al. (2012), these materials are typically unsuitable for long-term storage as well as transportation, and they are also more prone to contamination (Soko et al., 2019).

It has been suggested that other forms of spawn, such as in the form of dry powder, would be a good choice to explore for solving the problems in mushrooms spawns. The idea of microencapsulation using spray drying would have allowed for an earlier resolution of the issues, in addition to an improvement in both performance and quality through the extension of the product's life span and prevention of other microorganism growth (Burgain et al., 2011; Jin & Custis, 2011b; John et al., 2011; LI et al., 2017; Muñoz-Celaya et al., 2012a). Basically, spray drying is used in converting liquid to powder. Through the process of microencapsulation by spray drying, the core material can be given a physical barrier to shield it from unfavorable environmental conditions and extending the product's shelf life (Desai & Park, 2007; Gharsallaoui et al., 2007; Jamekhorshid et al., 2014). The process can be conducted in wide range of temperature and used in converting liquid life culture into powder forms. Based on previous study, the liquid culture of *Trichoderma chlamydosporum* and conidia among had been successfully spray dried (Braga et al., 2019) ; Maruyama et al., 2020).

The two factors that given focus in using spray drying are protectant material and temperature. The maltodextrin and Arabic gum are popular protectant that produced satisfactory results (Go et al., 2019). The temperature is the most important consideration when applying this method because it requires a very high temperature to transform cultures from their liquid form into powder form. The inlet temperature of the drying air can affect the properties of the powder, such as its moisture content, hygroscopicity, and water activity (Fernández-Sandoval et al., 2012; Jin & Custis, 2011c; Muñoz-Celaya et al., 2012b).

Among edible mushrooms, particularly *Pleurotus spp.*, the conducted studies are very limited, yet this mushroom is the second largest consumption in this world. Therefore, the purpose of this study was to investigate the characteristics of powder culture that had been produced by spray drying at a range of temperatures, from 80°C to 110 °C, and to compare those characteristics to those of powder that had been treated with two different types of protectants, each consisting of 10% of maltodextrin and Arabic gum.

## Materials and Methods

### Preparation of *P. pulmonarius* liquid culture and protectant materials

Liquid culture was prepared from hyphae fragments which harvested from *P. pulmonarius* mycelium cultures grown on Potato Dextrose Media (PDA) using 0.85% saline with 0.01% tween 80 as detergent. The fragments then were washed and centrifuged upon usage. Approximately 0.1 ml of hyphae suspension was transferred into 50 ml of D-glucose soluble starch medium and incubated at 25°C, in the dark with static condition (Chong et al, 2019).

Two protectant materials were used in this study, the 10% of maltodextrin and 10% of Arabic gum. The solution of protectant was prepared by mixing 100ml distilled water with 10 grams of protectant and autoclave for 15 minutes at 121°C. Later, the protectant was added into the liquid media and agitated with stirrer for homogenous solution before continue with the spray drying process.

### Spray drying of liquid culture

A 500ml solution of liquid culture and protectant was fed into a Mini Spray Dryer B-290 (BÜCHI, Switzerland) equipped with zero grade compressed air (Radnor, USA) at various inlet ( $T_i$ ) and outlet ( $T_o$ ) temperature set up (80/48, 90/68, 100/75, and 110/83°C). The setup for spray dryer has been modified from Jin and Custis, (2011). In all experiments, the fed was set at 5ml per minute, nozzle clean at 5 time per minute and the air flow has been set at 30mm. While the aspiration was set at 100%.

### Properties of powder culture

#### *Moisture content, water activity ( $a_w$ ) and hygroscopicity*

The moisture content of the powder culture was measured according to A.O.A.C standard method (Baur & Ensminger, 1977). The water activity ( $a_w$ ) was determined at 25 °C using water activity meter (Aqualab Series 3TE, USA). Hygroscopicity determination was slightly modified whereby a 0.05 g of spray-dried powder were placed in a glass desiccator at 25±1.0°C containing saturated NaCl solution (75.3% RH) and kept for a week. Then the samples were weighed and the percentage of hygroscopicity was calculated using the following formula (Cai & Corke, 2000):

$$\text{Hygroscopicity (\%)} = \frac{(W_i + F_w) \times 100}{100 + W_i}$$

Where,

Fw (%) = free water / moisture (according to GEA Niro method A1c)

$$W_i (\%) = \frac{c - b}{b - a} \times 10$$

a = weight of container

b = weight of container + powder in gram

c = weight of container + powder in gram after 1 week

## Results and discussions

### Properties of powder culture

The production of the powder culture for the *P. pulmonarius* was the primary objective of this work, and investigation on the properties was accomplished successfully. The Table 1 below show the result of properties from powder culture added with maltodextrin protectant. The highest moisture content was 5.8667% from inlet temperature 80°C, while the lowest moisture content was powder culture produced from temperature 110°C with 5.1333%. In the meantime, the results of producing powder culture with Arabic gum are shown in Table 2. The highest moisture content is 5.9333% at 80°C, and the lowest is 5.5333% at 110°C. According to both results for moisture content, as the inlet temperature increases, the moisture content will decrease. In a previous study by Braga et al., (2019), they also found that the moisture of powder from *Trichoderma spp.* was high when the drying air's inlet temperature was between 60°C and 70°C than when it was above 80°C. This show that high inlet temperatures raise the temperature gradient inside the drying chamber, facilitating heat transfer and the dehydration process during the spray drying process.

Table 1. Properties of powder culture with maltodextrin

Inlet Temperature (°C)	Moisture Content (%)	Water Activity ( $a_w$ )	Hygroscopicity (%)
80	5.8667	0.3458	29.8864
90	5.8000	0.3437	30.6262
100	5.7333	0.3365	34.0312
110	5.1333	0.3258	39.3445

Table 2. Properties of powder culture with Arabic gum

Inlet Temperature (°C)	Moisture Content (%)	Water activity ( $a_w$ )	Hygroscopicity (%)
80	5.9333	0.4012	21.0941
90	5.7333	0.3422	30.0602
100	5.6667	0.3275	32.8969
110	5.5333	0.3215	37.4679

Meanwhile, the results for the water activity ( $a_w$ ) in both powder culture with maltodextrin and Arabic gum were shown in Table 1 and 2. The result in both powder culture was between 0.3215 to 0.4012 for inlet temperature

80°C to 110°C. Therefore, the outcome for powder culture water activities was satisfactory. This was supported by Fernández, (2011), who stated that microbial growth does not occur when water activities are less than 0.9 and that this also relates to the control of bacterial growth for determining the shelf life of powders. In other studies, water activity was the most important factor affecting powder stability, modulating microbial response, and determining the types of microorganisms encountered by the powder. Therefore, water activity properties were essential for preventing and restricting microbial growth (Tapía et al., 2020).

From Table 1 and 2, the result of hygroscopicity properties for inlet temperature at 80°C give lowest percentage for both maltodextrin and Arabic gum which is 29.8864% and 21.0941%, respectively. Then the highest hygroscopicity showed at temperature 110°C for both maltodextrin and Arabic gum which is 39.3445% and 37.4679%, respectively. Based on the result from this study, the higher inlet temperature, the lower result for hygroscopicity was achieved. According to Pui & Lejaniya, (2022), the hygroscopicity of powder that was produced from a spray dryer was affected by the inlet temperature. This statement has been supported by Phisut, (2012), who also found that the hygroscopicity percentage goes up when the inlet temperature increases. This is because high air inlet temperature made the powder less moist, which made the powder take in moisture from the air (Carneiro et al., 2013).

**Comparison properties of powder culture with different protectant material**

Figure 1,2 and 3 shows the comparison between properties of powder culture with maltodextrin and Arabic gum, respectively. In Figure 1, the result for Arabic gum gives lower hygroscopicity percentage than the maltodextrin. According to Avaltroni et al., (2004), the molecular weight of maltodextrin (9 kDA) was lower than that of Arabic gum (220-310 kDA), which was related to hygroscopicity. This statement was supported by (Cai & Corke, 2000), who stated in their study that the hygroscopic properties of spray dried powders increased with the decrease of protectant molecular weights.

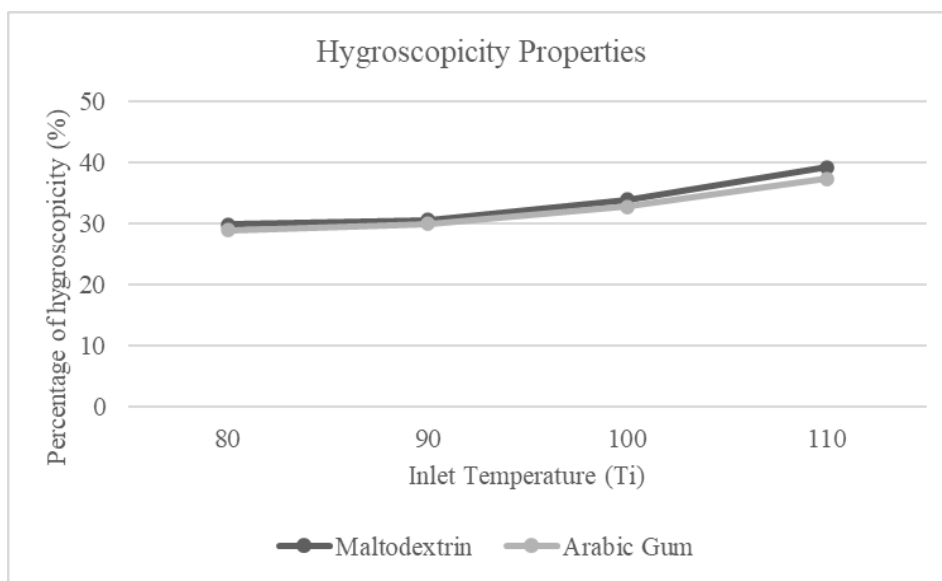


Figure 1. Comparison of hygroscopicity percentage between maltodextrin and Arabic gum



Besides, in industrial field, addition of protectants in spray dryer drying, are used to control hygroscopicity and prevent crystallization (Mohd Nawi et al., 2015). The stability of a powder can be divided into three main categories: physical, chemical, and microbiological. Hygroscopicity is one of those categories. It is essential to investigate hygroscopic behaviour in order to accurately forecast the amount of time a product will remain good for sale and the conditions in which it will be stored (Rodríguez-Restrepo et al., 2017; Soukoulis et al., 2014).

Moreover, in Figure 2 below, both of moisture content of powder from maltodextrin and Arabic gum showed decreasing trend in the graph. The Arabic gum spawn powder gave result slightly higher at 80°C of inlet temperature, compared with maltodextrin powder culture. Then, at 110°C the moisture content for maltodextrin powder culture gave result lower than Arabic gum powder culture. Both result for maltodextrin and Arabic gum were lower than 6% which indicates as satisfied. Research conducted in the past by Neri et al., (2010) found that the percentage of moisture content in powder dried by the spray drying method was typically less than 6%. Additionally, they came to the conclusion that the moisture that was obtained for the microcapsules was able to provide good storage. This is because products with low humidity values can achieve better stability over time. Result in Figure 2, also show maltodextrin had lower moisture content than Arabic gum when inlet temperature 110°C. Some researchers also stated that spray drying blackberry powders with maltodextrin causes a greater loss of moisture content than other additives used (Ferrari et al., 2012). Some studies claim that increasing the amount of Arabic gum and maltodextrin would increase the moisture content. Powder with a low moisture content would make the environment absorb water until the water content was balanced (How & Siow, 2020)

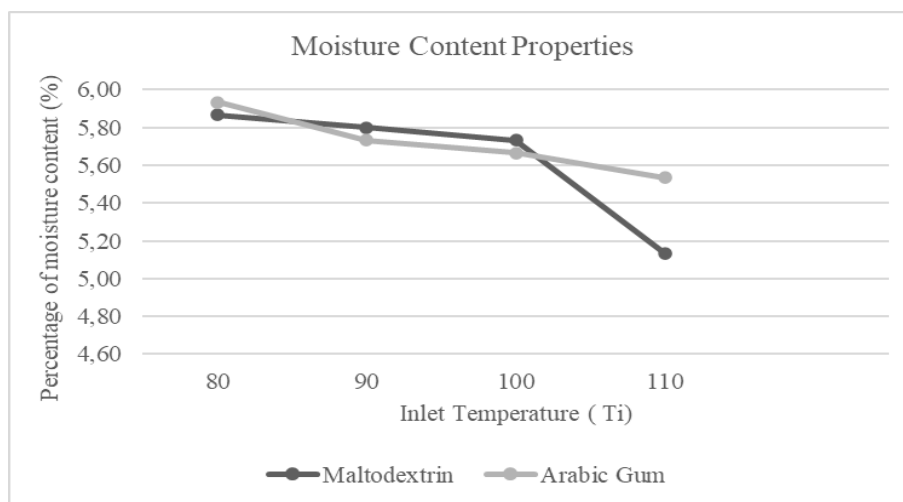


Figure 2. Comparison of moisture content percentage between maltodextrin and Arabic gum

Meanwhile, Figure 3 show the result for water activities from maltodextrin and Arabic gum. Comparing maltodextrin and Arabic gum, the water activity in powder with Arabic gum was higher at 80°C than maltodextrin. However, increased of inlet temperature afterwards, inversely, the water activity in powder with maltodextrin became higher than Arabic gum. But both of maltodextrin and Arabic gum showed water activity lower than 6.0 which classified as low water activity. Water activity in food can be classified into three

categories; low water activity when less than 0.60, intermediate water activity when between 0.60- 0.85 and high-water activity which is more than 0.85. (Erkmen & Bozoglu, 2016). In addition, they also stated that increased in water activity will increase the chances of food spoilage. For growth, bacteria need more water activity than fungi do. Microbial growth does not occur below 0.60.

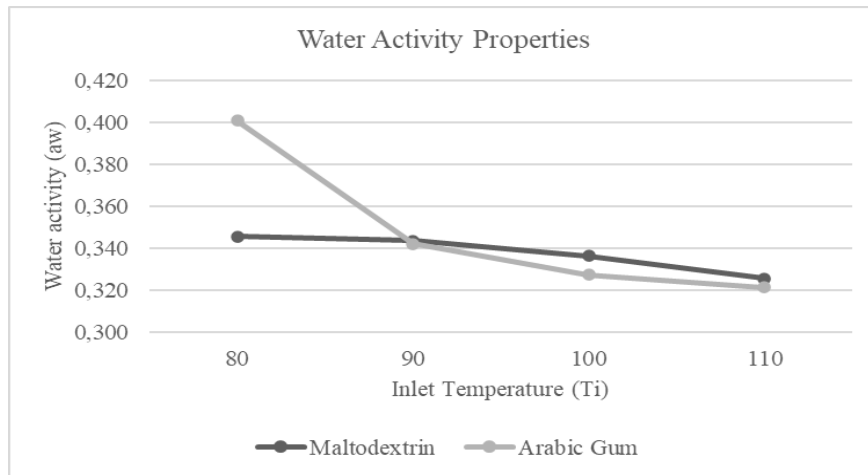


Figure 3. Comparison of water activities between maltodextrin and Arabic gum

## Conclusions

It has been confirmed that the powder culture of *P. pulmonarius* can potentially be produced through spray drying. According to the findings of moisture content, hygroscopicity, and water activity, it is concluded that both maltodextrin and Arabic gum would give good powder culture characteristics, which can prolong the storage time and preserve the spawn's quality.

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## Review of Completely Automated Public Turing Test to Tell Computers and Humans Apart (CAPTCHA)

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**Abstract:** The integration of technology has impacted nearly all industries, resulting in automated processes that utilize the internet to complete various tasks and actions. Web services have become popular for handling routine tasks. However, this advancement has a challenge of verifying the legitimacy and intent of users. Providers of these Web services, whether they are a platform, software, or infrastructure, employ various Human Interaction Proofs (HIPs) to validate the authenticity and intention of their users such as CAPTCHA. CAPTCHA is a program or a system that protects against unauthorized users or robots from having access into ones document. It is in form of a test that humans can pass but computer programs cannot i.e. the program should be simple for human and be robust and difficult for computer to solve. Almost everyone uses CAPTCHA systems to make security and protect services that are internet based from penetrating by computer bots. Different categories of CAPTCHA technologies are discussed in this paper and a detailed analysis on their usability and weaknesses. Subsequently, a new CAPTCHA technique is given as a proposal which is based on hybrid i.e. combining features of two different CAPTCHAs which are image-based and math-based CAPTCHA.

**Keywords:** CAPTCHA, Human Interaction Proofs, System Security, Image-based CAPTCHA, Math-based CAPTCHA

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### Introduction

Almost everyone today is using internet and that has made data transmissions a necessity, compulsory and of great importance. For this, there is apprehension on how to protect the confidentiality and data integrity against

unauthorized access and use. To protect ones document or resources from hackers, robots and/or other unauthorized users, security must be given top priority. Hence, this has resulted in an explosive growth of the field of security or information hiding. Completely Automated Turing Test to Tell Computers and Human Apart (CAPTCHA) is a cryptographic system that humans can easily tackle but always difficult to tackle by computers. Although the program barrier looks easy, it has to do with a complex programming test connected to the security (Darko et al, 2017). Specifically, in this the user is tested in the aspect of intelligence, communication that takes place visually and cognitive psychology. That brought about CAPTCHA which is described as a question test that can differentiate humans from computers. It is the main test of intelligence, which evaluates the similarity between the human and the machine intelligence.

In Turing test, three objects are involved (interrogator, human and computer) where the interrogator is a human whose function is to ask question(s) being in a separate room from the human and the computer who will both be in another room. The interrogator ask both question(s) and the two provide answer(s) in which from the answer(s) the interrogator would be able to differentiate human from computer and the aim is that human should be able to answer the question correctly and computer otherwise, but if the interrogator cannot differentiate the human from computer then it means the interrogator has been fooled, which by implication means that the machine possesses artificial intelligent which is equivalent to the intelligent of human. Though no machine has ever passed the Turing test designed by Alan Turing in 1950.

With this it can be said that CAPTCHA is a reverse of Turing test in the aspect of the interrogator. As the questioner in Turing test is human, the questioner in CAPTCHA is machine itself and both human and computer are examined in both Turing test and CAPTCHA but the expectation is that human should found it easy to solve but difficult if not impossible for computer to solve. The goal of designing CAPTCHA is to prevent one's document from bots so that it will not be able to read or have access to the document on the internet and to prevent unauthorized user from penetrating into saved documents. Many techniques have been used to prevent access to documents using CAPTCHA such as text-based CAPTCHA, audio-based CAPTCHA, video-based CAPTCHA, math-based CAPTCHA, puzzle-based CAPTCHA and image-based CAPTCHA. Figure 1 indicates CAPTCHA and Turing test.

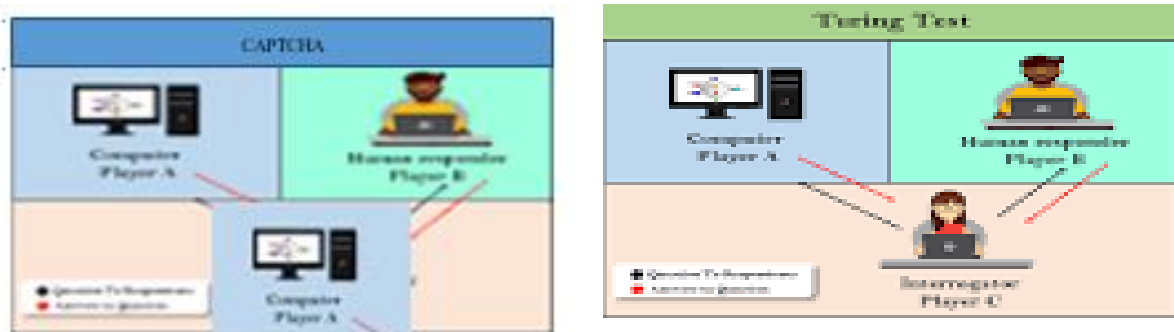


Figure 1. CAPTCHA and Turing test (electricalvoice.com)

## Literature Review

CAPTCHA is known as reverse Turing test. It is valid, because it uses objective of reverse system (Darko et al, 2017). It is called reverse because Turing test uses human as the questioner who neutrally ask question and judge, while CAPTCHA uses computer as the questioner though those to be examined are the same in the two systems (human and computer). If a computer can be able to supply correct answer to the questions then it is said that it has intelligence in similitude as a human, well called Artificial Intelligence (AI). Unlike the Turing test, where the questioner that evaluates the correctness of the answers supplied is replaced in the CAPTCHA to the machine (computer) from the human (Darko et al, 2018).

One of the importance of CAPTCHA is that we use it on the Internet to protect the Web sites from attackers through malicious programs such as password crackers. The important of CAPTCHA in Internet security is not underrated (Qian-qian, 2019).

One vast way to secure web-based application from fraudsters and online spam is CAPTCHA. And its one of the techniques that has gained much popularity to verify a human user (Nitirat and Apichaya, 2019).

In some conditions, open web resources, like social networks including Facebook application, Twitter application etc., and even service providers, such as, Google, Yahoo, Hotmail etc., malicious program and spurious bot programs can be attacked. Therefore, to get rid of such kinds of Bot attacks, a security system called CAPTCHA can be used (Noshina et al, 2018).

## Applications of CAPTCHA

CAPTCHA is popularly used on the Internet to secure Web sites from being attacked by malicious programs like password crackers. CAPTCHA is very important in Internet security. Divyashree and Satish, (2016) highlighted some applications of CAPTCHA which are:

- Preventing Search Engine from Bots
- Preventing against Worms and Spam:
- In password systems, its use to prevent Dictionary Attacks
- In Blogs, it Prevents Comment Spam
- Protecting Registration done on Website
- Securing Email Addresses from Scrapers

Jung et al, (2017) also added that: CAPTCHA can be used to protect Online voting manipulation

## Categories of CAPTCHA

There are several categories of CAPTCHA discussed by various researchers and they can be grouped as follows:



- Text-based CAPTCHA
- Audio-based CAPTCHA
- Maths- CAPTCHA
- Puzzle-based CAPTCHA
- Video-based CAPTCHA
- Image-based CAPTCHA

***Text-Based CAPTCHA***

CAPTCHA was firstly designed by Broder’s team in 1997 for Altavista, to prevent automatic inclusion of URL to a database of a web browser (Divyashree and Satish, 2016). Text-based CAPTCHA is the most popular and known type of CAPTCHA. Where the computer user is asked to solve the text that is usually distorted in some ways. For text-based CAPTCHA to be strong and be difficult for machine to solve the distortion of the text images is given great consideration. CAPTCHA designers like this type of CAPTCHA because it is easily created. Its security depends on the solution quality of different element combinations in text and its background (Darko et al 2017).

Examples of text-based CAPTCHA are Gimpy CAPTCHA (used by Yahoo), Ez Gimpy CAPTCHA, Baffle Text CAPTCHA, re-CAPTCHA, iCAPTCHA, MSN CAPTCHA, Bar CAPTCHA, Thread CAPTCHA, Transparent CAPTCHA, etc. which are depicted in Figure 2.



Figure 2: Text CAPTCHA (Darko et al 2017).

***Weaknesses of Text-Based CAPTCHA***

- In text images, it is difficult for user to shuffle out the correct text or characters because of the combination fonts. Size of font. Blurred Letters Wave Motion like those examples in Figure 2.
- It can easily be detected by Optical Character Recognition (OCR) techniques. Current OCR’s

algorithms can successfully achieve over 90% of detecting text based CAPTCHA (Mir et al, 2016).

- In Jung et al, (2017) paper it was presented that a character segmentation technique can be used to attack many text CAPTCHAs.
- Gabriel Moy, et al., in their work stated two Distortion estimation techniques which cracked EZ-Gimpy and 4-letter Gimpy CAPTCHAs using object recognition and they recorded success (Anvesh and Sandhya, 2016).

### ***Audio Based CAPTCHA***

Audio CAPTCHAs were created to provide alternative to visual text CAPTCHAs. This kind of CAPTCHA allows the user performing some form of speech recognition among many distorted speech. But, still the fact that audio CAPTCHAs are commonly used alongside visual CAPTCHAs, the security is often overlooked (Yang-Wai, 2019).

Audio CAPTCHA picks a word or a sequence of numbers bombardedly, changing the word or the numbers into a sound clip and distort the sound clip. So it will presents the distorted sound clip to the computer user to enter its contents. This CAPTCHA recognises the difference in ability between humans and computers in the aspect of spoken language (Kumary et al, 2019). This category of CAPTCHA is primarily designed for the blinds. Examples of Audio based CAPTCHA are:

*Speech CAPTCHA:* The design of Speech CAPTCHA is based on superior human ability to recognize numbers, letter, or phrases in the midst of the background noises such as acoustic sounds, music, or a chatter. The speech is gotten through speaker (human) or using the speech synthesizer (Sushama and Hanumant, 2018). Some of the speech CAPTCHA designed are: Speech-Based Reverse Turing Test, Voice CAPTCHA for Internet Telephony, Secure Audio CAPTCHA/No Nonsense CAPTCHA, Auditory CAPTCHA, C-instance.

*Acoustic CAPTCHA:* Acoustic CAPTCHA requires human auditory perception to differentiate human and bots apart (Sushama and Hanumant, 2018). Some of the acoustic CAPTCHA designed are Picture/Sound Form of CAPTCHA/HIPU, SoundsRight CAPTCHA, Nonspeech Audio CAPTCHA. There are several other audiobased CAPTCHA such as Google audio CAPTCHA, Digg CAPTCHA, reCAPTCHA's audio CAPTCHA, e-Bay audio CAPTCHA etc.

### ***Weaknesses Of Audio Based CAPTCHA***

- The aim of adding noise to the word recorded is to make the CAPTCHA robust and prevent the CAPTCHA from penetrating into by Bot programs, however, it can confuse the user and he may end up supplying the wrong answer.
- Since Audio CAPTCHA is designed to understand English language, for this, only users with English ability can supply the right answer.
- Some letters that have like sound such as J & G, C & K may confuse the user (Walid, 2019).

- Audio CAPTCHA can be solve by advanced speech algorithm which reduces the level of it security
- Google audio CAPTCHA, Digg CAPTCHA, and an older version of reCAPTCHA’s audio CAPTCHA were all broken using AdaBoost, SVM, and k-NN techniques while Decaptcha was used to break e-Bay audio CAPTCHA, and acoustic CAPTCHA was attacked using ASR system (Sushama and Hanumant, 2018).

**Math-Based CAPTCHA**

This type of CAPTCHAs requires users to solve a mathematical equation so as to pass a test. The hardness of the equation varies across implementations (Nicos et al, 2018).

Math CAPTCHA test uses logic and reason series to display the CAPTCHA challenge to the users to prove the users are human. The main arithmetic operators used are (+, -, \*). And atimes several mathematical equations are displayed for user to solve (Mir et al, 2016).

Math-based CAPTCHA can be either of the two text based CAPTCHA or image based as stated by (Nitirat et al, 2019).

The CAPTCHA, named as “Math CAPTCHA” or “QRBGS CAPTCHA”, displays five types of problem out of which are differentiation, arithmetic calculations, polynomial questions. It asks the user to supply solution to a mathematical question so as to verify that a human is behind the system (Anvesh and Sandhya, 2016)..

Below depicts Math based CAPTCHA, the one in figure 1 is a math CAPTCHA that is based on text while the one in figure 2 is a difficult Math which is mainly for those that studied mathematics.

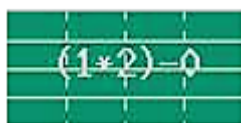


Figure 3a

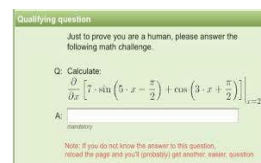


Figure 3b

Figure 3. Maths Based CAPTCHA (Anvesh and Sandhya, 2016).

**Weaknesses Of Maths Based Captcha**

- The Math-CAPTCHA that is based on text has same weaknesses like those of text based CAPTCHA for those in form of text.
- It needs the skill of problem solving and requires much time to solve the question to pass through the CAPTCHA. Like the one in fig 3b above.
- It is much complicated to solve by the users. but is secured, Hence, its usability is low due to the

complicated matter (Darko et al, 2018)

### ***Puzzle-Based CAPTCHA***

In puzzle-based CAPTCHA systems, a picture is shared into clumps though depending on how big is the picture. In the question, the user is required to arrange jumbled picture chunks to form the exact original picture. Example is shown below where the user is expected to pick the samples outside and place it where appropriate, if places well, then the user passed (Mir et al, 2016).



Figure 4. Puzzle based CAPTCHA (Mir et al, 2016).

There are various types of Puzzle-based CAPTCHA examples are Dice CAPTCHA,

*Dice CAPTCHA:* Is one of the puzzle-based CAPTCHA. It needs a puzzle (dice) to be solved where the dice is visualized as the main element of the test. Accordingly, in puzzle-based CAPTCHA, the user is asked to solve and supply the total number (dots) displayed by the dice in order to verify the user if its a human or a bot. when it is correctly solved, the user is considered as a human (Darko et al 2018).



Figure 5. Dice puzzle CAPTCHA (Darko et al 2017).

### ***Weaknesses Of Puzzle Based CAPTCHA***

- It needs the ability to solve image but may be difficult by low vision users.
- It requires much time to arrange puzzle challenge in exact order
- The task is not easy for users because identifying exact image need deep thinking.
- In the dice CAPTCHA above, the black dot may be mistakenly counted by the user because it shows three sides (up, left and front).

### ***Video-Based CAPTCHA***

In Video-based CAPTCHA, the user is asked to provide three or more words describing the content in a video.

This type of CAPTCHA was generated from YouTube videos, and each video does have its labels/tags. If the user correctly provides any of the three words and confirmed that it matched the labels/tags that were supplied by the person that uploaded the video then the user will be considered as human (Yang-Wai, 2019). That is, if the user provides the correct answer then he is said to have passed the test whereby machine is not expected to pass the test. Video CAPTCHA sometimes may display human or other objects not necessarily to be words.

#### *Weaknesses of Video-based CAPTCHA*

- Video-based CAPTCHA uses or displays flowing text during the video projection. And the text will be displayed in different colours. However, advanced Optical Cognitive Recognition can break it.
- The video may be tedious for the user when it is in large size and network may be fluctuating in downloading the video which may lead the user to leave the website.
- Video CAPTCHA is only available in English Language and not all users understand English (Walid and Abdullah, 2016).

#### *Image-based CAPTCHA*

In image-based CAPTCHA sets of images with the same concept or object are displayed. And the user is asked to supply the concept or the object which the images belong to (Divyashree and Satish, 2016).

Image-based authentication, this method asks for answers by displaying pictures or some images. Mostly, it displays an image of a particular object and asks to input the name in text, or rotating image to its original state (Jung et al, 2017)

In this type of CAPTCHA, it requires the performance of an image recognition task. The idea is displaying image that will be difficult to recognize by bot. The difficulty will come in as a result of multiple colours in all pixels and also having huge variety of meaningful images. Therefore the user highly needs the recognition of images (Kumary et al, 2019).

Image recognition is never an easy task for machine to tackle with because there is still variety of unsolved image perception and interpretation problems for machine. However, humans see image recognition as an easy task. Thus, this makes image-based challenges an interesting alternative to text-based CAPTCHAs as they can most of the times be easy for humans, but difficult for computers. However, unlike text-based CAPTCHAs, which are easy to generate, one of the necessary things in image based CAPTCHAs is getting the source of images. Furthermore, a way to arrive at the solution of image recognition is essential, such as the use of pre-labeled images, to enhance automated grading (Yang-Wai, 2019).

Different Image based CAPTCHA schemes are available that make use of different definitions or styles which would easily be recognized by the users but difficult for the robot. Some of the image based CAPTCHA's are Bongo, Pix CAPTCHA, Picatcha, Human emotion based CAPTCHA, Scenario based captcha, ARTiFACIAL

image based captcha, Imagination image based captcha, Game-based CAPTCHA, Fun CAPTCHA etc.

*Bongo CAPTCHA*: This image-based CAPTCHA was named after Mikhail M Bongard who wrote a book on pattern recognition problems. In this CAPTCHA, visual based pattern recognition is displayed so that the user of the system will supply the answer. Fig6 is an example of Bongo CAPTCHA. It has 2 block series which are the left block series and the right block series. The two series (left and right) have differences. So the user is asked to identify the differences and supply the answer for authentication (Divyashree and Satish, 2016).

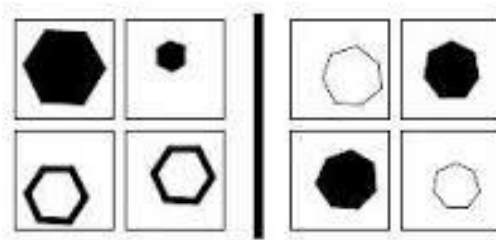


Figure 6. Bongo CAPTCHA (Divyashree and Satish, 2016).

*Pix CAPTCHA*: This is another image-based CAPTCHA that make use of a large volume of database which has the animated pictures and photographs of some objects together with labels (such as: a flower, a horse, a baby, an animal etc.). In Pix CAPTCHA, a set of objects will be displayed, and these sets are picked randomly from the database and the user will be asked some question based on the images (Divyashree and Satish, 2016).



Figure 7. Pix CAPTCHA

*PICATCHA*: In this different images are displayed and the user will be asked elementary question of choosen some parts of the images.

*Human emotion based CAPTCHA*: In this type a graphic or statement is shown to the user and he would be required to type the emotion of what is shown.

*Scenario based CAPTCHA*: in this analytic and understanding capability of humans is used instead merely objects recognition (Kumary et al, 2019).

*ARTiFACIAL image-based CAPTCHA*: This CAPTCHA was based on recognizing the differences in the thinking ability of human and machine human facial recognition. Therefore, it deals with image problems and solutions to be achieved without manual effort.

*Imagination image based CAPTCHA*: This was proposed by Divyashree and Satish, (2016). The important thing about this CAPTCHA system was to discover imagination of human through identifying and interpretation of images in a set of distortion / clutter images. And the problem presented by the scheme connoted two processes; an annotated and a click process (Yang-Wai, 2019).

*Assira CAPTCHA*: Assira means “Animal Species Image Recognition for Restricting Access”. It’s a CAPTCHA that display either dog or cat image recognition. The classifiers will then differentiate between cats and dogs that are used in the Assira. Another version was later developed which contains animal grid, collection of animals and user have to differentiate among all the species by clicking (Mir et al, 2016). Example is Microsoft Assira which displayed 12 distinct images then the user will select by clicking in the animal that is asked to click on.



Figure 8. Assira CAPTCHA (Mir et al, 2016).

From the research studies, it was discovered that the image-based CAPTCHA has many advantages mostly in security aspect and usability elements over other types of CAPTCHA such as the text-based and audio-based CAPTCHAs (Walid and Abdullah, 2016).

#### *Weaknesses of Image Based CAPTCHA*

- Image-based CAPTCHA may be difficult to attempt by human users who have low vision or disabilities in learning.
- As soon as the number of features added decreases then the ability to decrypt the CAPTCHA will increase, therefore more features need to be applied for robustness. However, this system will consume the database.
- This type of CAPTCHA is mostly available in English Language; therefore, those that do not understand English language may find it difficult to answer the challenge.
- There is indirect attack for getting the answer from client side in game-based CAPTCHA.
- Random guessing by unauthorized user may break the CAPTCHA.

## Summary

CAPTCHA is an essential scheme which is used to protect websites against malicious programs. CAPTCHA has been existing for many years and many researchers have gone into designing of different types of CAPTCHAs. variety CAPTCHAs have been reviewed such as Text-based CAPTCHA, Audio-based CAPTCHA, Video-based CAPTCHA, Math-based CAPTCHA, Image-based CAPTCHA etc., and they are considering them in terms of the usability to human, robustness against automated attacks (Machine), semantic information, and so on. As technology advances day by day, different techniques are designed to secure resources, and researchers nowadays have much insight into the area of CAPTCHA design and security, and must consider different strategies for developing CAPTCHAs. Having brought out the weaknesses of various CAPTCHA designs, research gaps are immediately identified for necessary improvement on the design reviewed.

## Recommendations

This paper therefore recommends an hybrid form of CAPTCHA that will combine some features of other CAPTCHAs. A simple mathematical based CAPTCHA combined with a form of image that will display two numbers and operator (addition or subtraction) between them, where the user would be expected to supply the answer in text form.

Researchers will continue to exploring the field of CAPTCHA based on strength and the weaknesses which will definitely lead to having security against automated scripts. Also, in future, enhancement of the recognition procedure which will lead to increase the decode time frame for existing system there by creating robust security by suggesting the new measures to make the field of CAPTCHA stiff to inappropriate access can be explored.

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## Nitrogen Uptake Efficiency on Water Spinach in Controlled Planting Medium Using Spent Mushroom Medium Compost and NPK-16 Fertilizer

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**Abstract:** Ipomoea aquatica (water spinach) is a long and leafy green vegetable with hollow stems that easily grown on the water surface or damp soil. It is a tropical and subtropical perennial herbaceous aquatic or semi-aquatic plant. Water spinach needs more water compared to other vegetable crops, thus suggested to employ slow-release fertilizer for sustain the available nutrients in the soil that being leached off by watering. Nitrogen uptake is the major issue in agriculture to sustain the quality of crops and soil for planting medium. Several studies have been conducted on many types of fertilizer and showed beneficial results on growth of water spinach. This study aimed the research on comparing the nitrogen uptake rate study during the planting period for both organic and inorganic fertilizer. The measurement of plant height, dosage of fertilizer and nitrogen uptake were highlighted in this research activities. Pots has been used and the growth of water spinach was evaluated along 30 days of planting. The spent mushroom medium (SMM) compost and NPK-16 fertilizer were used to evaluate the rate of nitrogen uptake for water spinach based on the Michaelis Menten kinetic study to evaluate the best fertilizer dosage with research design activities. It was showed that a 1 g of NPK16 fertilizer was equivalent to 2 g of SMM in the amount of N. There was a clear correlation between the nitrogen concentration and the water spinach growth. From the result obtained, the application of NPK16 fertilizer provided higher nitrogen value initially. However, SMM compost improved both physical and chemical to help water spinach absorbed sufficient moisture and nitrogen uptake at a steady state rate owing to the higher organic matter in SMM. As a conclusion, SMM compost resulted better nitrogen uptake efficiency by improved the soil fertility and better growth of water spinach.

**Keywords:** Chemical fertilizer, composting, kinetic study, organic compost, soil fertility

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## Introduction

Water spinach (*Ipomoea aquatica*) is a member of the morning glory family and belongs to the same species as sweet potatoes (Rana & Brar, 2017). It is a tropical and subtropical perennial herbaceous aquatic or semi-aquatic plant. Almost every part of the young plant tissue is edible, but the sensitive branch tips and younger leaves are the most preferred. The leaves of water spinach are incredibly nutrient-dense and contain ample amounts of vitamins and minerals. Water spinach is filled with nutrients.

The optimum fertilizer for water spinach is high in nitrogen to stimulate quick growth and leaf development. Water spinach is a heavy feeder that requires a lot of nitrogen to grow and develop properly. On top of that, organic and inorganic fertilizers are two types of fertilizers can be used as one of the planting mediums for the water spinach. Organic fertilizer known as bio-fertilizer is the product from the composting process of the organic raw materials with microbial inoculant to degrade the organic matter (Pan et al., 2011). Inorganic fertilizer, which is often reasonably priced, consists of mineral-based nutrients manufactured for immediate application on crops. Unlike the organic variety, inorganic fertilizer does not need to decompose over time to supply nutrients to plants. To feed plants and promote growth, most inorganic fertilizers have balanced ratios of nitrogen, potassium, and phosphorus (Harmon, 2022).

Nitrogen uptake is the major issue in agriculture to sustain the quality of crops and soil for planting medium. The most important element that used for crops is nitrogen because the total growth and development are depends on the dosage of nitrogen in the medium. Several studies have been conducted that both organic and inorganic fertilizer are greatly produced a positive result on growth of water spinach, however less research on comparing the nitrogen uptake rate study during the planting period. The measurement of plant height, dosage of fertilizer and nitrogen uptake are highlighted in this research activities. For this study, the spent mushroom medium (SMM) compost and NPK16 fertilizer were used to evaluate the rate of nitrogen uptake for water spinach based on the Michaelis Menten kinetic study to obtain the best fertilizer dosage for a better nitrogen uptake with several research design activities. Table 1 show the comparison of SMM compost and NPK-16.

Table 1. SMM Compost and NPK-16

Variables	SMM Compost	NPK-16
Total Kjeldahl Nitrogen (TKN) (%)	9.50	16
pH	7.3	7.2

## Spent Mushroom Medium Compost

SMM compost is a compost made from spent mushroom medium that is used to improve soil organic matter and nutritional content. It can be used as a soil conditioner to improve the stability of soil aggregates. A mixture of

natural ingredients is used to create a mushroom-growing substrate. The common substances in wheat straw bedding are horse manure, hay, maize cobs, cottonseed hulls, chicken manure, brewer's grain, cottonseed meal, cocoa bean hulls, and gypsum. The discarded mushroom contains a lot of nutrients such organic substrate, sulphur, potassium, calcium, magnesium, nitrogen, and phosphorus because that has an organic content that may help with soil fertility (Lou et al., 2017). The use of SMM as fertilizer in agriculture and horticulture has been feasibly approved (Prasad et al., 2021).

SMM compost has a black topsoil-like appearance, a loose crumbly structure, and an "earthy" scent. SMM compost is high in alkalinity, so it can be used to neutralize all the acids in the soil. SMM compost has an average pH of 6.6. (6.0 to 7.0 is an ideal range for most plants). It's a good natural fertilizer for acidic soils with low organic matter levels. A study was conducted to determine the pH level of mushroom compost from several mushroom farms, and the result was 6.6 (below the pH neutral range). SMM compost is a porous media that can improve the structure of soils because of its low bulk density. The optimal C:N ratio for compost made from spent mushrooms is 13:1. The carbon relative to nitrogen indicates the level of nitrogen available to the plant's growth. Suitable composts will have an ideal ratio of anywhere between 10:1 to 15:1 and never above 30:1. The average NPK value of mushroom compost is 1.1-0.7-1.3. Thus, the NPK ratio is like most other compost, with an average ratio value of 1-1-1. Most of the nitrogen in organic form allows it to get released to the plants over time slowly.

### **NPK-16 Fertilizer**

Inorganic fertilizer, which is often reasonably priced, consists of mineral-based nutrients manufactured for immediate application on crops. Unlike the organic variety, inorganic fertilizer does not need to decompose over time to supply nutrients to plants. To feed plants and promote growth, most inorganic fertilizers have balanced ratios of nitrogen, potassium, and phosphorus (Harmon, 2022). Inorganic fertilizer commonly known as chemical (mineral) fertilizer is widely manufactured in a large scale.

Ammonium nitrate contained in NPK-16 has been the predominant N fertilizer source used on pastures in the United States. It typically contains between 33 % and 34 % N, and relatively high solubility in water. When applied at agronomic rates, ammonium nitrate does not produce as much acidity as other N fertilizer sources. The major difference towards the organic fertilizer is the raw materials for the inorganic fertilizer are from chemical sources/based. Both organic and inorganic fertilizers are highly in the macronutrients such as nitrogen (N), phosphate (P), and potassium (K) because these components are beneficial for the overall development of crops and yields. Compared to the organic fertilizer, the total NPK value in inorganic fertilizer is higher because the mixing process of the raw materials are not degraded during the chemical process (Assefa & Tadesse, 2019).

### **Kinetic Study of Michaelis Menten Equation Model**

The enzymatic rate at various substrate concentrations was mostly described using the Michaelis-Menten

equation, commonly known as zero order kinetics. By graphing a function of substrate concentration, [S], one may experimentally establish the substrate concentration that results in a half-maximal velocity of an enzyme reaction, also known as the  $K_m$  value or Michaelis-Menten constant.

The Michaelis-Menten formula is expressed as follows in Equation 1

$$V_i = V_{\max} [S] / K_m + S \quad (1)$$

Where  $V_i$  is an enzyme reaction's observed beginning velocity,  $V_{\max}$  is its maximum velocity, and  $K_m$  is its Michaelis-Menten constant. It should be noted that the starting velocity,  $V_i$ , approaches the maximum velocity,  $V_{\max}$ , when substrate concentration [S] far surpasses the  $K_m$ .

The maximum fertilizer dosage of SMC and NPK16 and the N absorption by the water spinach were determined by comparing two types of plots, Hanes-Woolf, and Eadie-Hofstee, which were represented by Equations 2 and 3 respectively.

$$[S]/v = K_m/V_m + 1/V_m [S] \quad (2)$$

$$V = V_m = K_m V/[S] \quad (3)$$

Where [S] was dosage of fertilizer, V was N uptake,  $K_m$  was the Michaelis Menten Constant, and  $V_m$  is nitrogen uptake rate.

## Method

### Preparation SMM Compost

#### *Compost Raw Materials*

The SMM was received by the local oyster mushroom cultivators nearby UniCITI Alam, Padang Besar, Perlis. The SMM was separated from the medium bag and crashed to allow the medium to be more porous and not to floc and clog. Chicken manure was acquired from the poultry farm near Wang Kelian, Padang Besar, Perlis. The moisture content of chicken manure was relatively low; less than 20 %. Dried sludge was obtained from the wastewater pond for the production of the bio-ethanol industry at Bukit Keteri, Perlis.

#### *Food Waste Fermented Liquid*

Food waste (5 kg vegetable waste) was collected from the nearby wet market without isolating the type of vegetables. The food waste was chopped to about 2 to 3 cm size and added to the closed container (7 days). After 7 days, the fermented liquid (leachate) was collected and removed from the solid food waste. Another new food waste (5 kg vegetable waste) was collected and mixed with the collected leachate and closed the container

for another 7 days. After 7 days, the process was repeated again by removing the solid waste, collecting the leachate, and measuring the volume of the liquid. The dried sludge, molasses, and rice water was prepared with a similar weight to the fermented liquid and mixed into the closed container. The food waste fermented liquid was ready for the inoculation on the composting of SMM after 14 days of completion of liquid fermentation where the pH reduced below 3.5

### *Composting Process*

The composting process took place in a 40 cm × 40 cm × 20 cm (length × width × height) container. To enhance the surface area per volume for microbial access to the composting medium, the SMM, chicken manure and dried sludge were sieved in average size of 20 mm prior to composting. The composting bed was prepared with a fixed amount of each compost raw material; SMM, dried sludge, and chicken manure. Each raw material was weight by trial and error to obtain the C/N ratio of the compost bed (mixture of SMM, dried sludge, and chicken manure) in a range of 20 to 30. For this study, 23.42 C/N was obtained. The composting bed was laid down on the open clean area with a roof and covered with the gunny bed on the top of the compost for 10 days of composting.

### **Preparation Plant Bedding**

Water spinach requires a well-prepared seed bed for good seedling growth. Water spinach was planted by direct seeding in a container where the volume of the container was fixed (40cm length, 30 cm wide, 12 cm height). It does not require a lot of space to grow at home. A rich, loamy soil mixed with compost was used for growing water spinach in containers. Even though the plant may thrive in either partial or full sun, it will produce more leaves when it receives at least four hours of direct sunshine daily. Regular watering was applied to keep the soil moist. To ensure that the deepest roots are reached, the plant received a thorough watering. When the weather is hot and dry, daily watering was necessary.

The dosage different for this experiment was obtained from the ratio of SMM compost: NPK16 fertilizer based on TKN value. The ratio obtained was 1g NPK16 fertilizer:2 g SMM compost. The sample was treated with three different dosages of SMM compost and NPK16 fertilizer; 50, 150, and 250 kg N/ha to obtain a better comparison with the used of different soil conditioner. Table 2 showed the sample treatments were evaluated in this experiment and the amount of soil conditioner applied was measured and tabulated.

Table 2. Dosage of SMM Compost and NPK-16

Dosage (g N/m <sup>2</sup> )	SMM Compost (g)	NPK-16 (g)
50	7.50	3.75
150	22.50	11.25
250	37.50	18.75

## Cultivation of Water Spinach

Water spinach usually grows in fertile, organically rich soil. The pH of the soil should be between 5.5 and 7.0. Water spinach can be grown in two ways: aquatic or in moist soil. Seeds were planted directly in the beds, or nursery-grown seedlings measuring 10-15 cm tall are transplanted. Seeds should not be older than two years and were soaked for 24 hours before planting to promote germination.

The method of cultivation of water spinach was greatly influenced by the quality of seedlings and care. A quality water spinach seedling was obtained through the seeding method. This method was applied very easily. But it is a good idea to sort the seeds well to grow more optimally. After the entire planting medium is well prepared and treated with the soil conditioner, then planting water spinach seedlings were started. The germinated seeds were planted in each pot, equivalent to 20 seedlings per pot. Each seedling was separated by 5 cm wide to prevent overcrowded.

The water spinach plats were cultivated for 30 days, only in the early vegetative phase of the plants. This is because the amount of soil used in the pot was not sufficient to support the water spinach from flowering and ripening. Within these 30 days, the result obtained from water spinach plants of different samples did show a difference on plant height.

## Results

### Ratio Dosage of SMM Compost and NPK-16

Based on the analysis of TKN on both SMM compost and NPK16 fertilizer, 1 g of NPK16 fertilizer contain approximately 0.16 g of N. While 1 g of SMM compost contain approximately about 0.094 g of N. The ratio was calculated and tabulated in Table 3.

Table 3. Comparison Ratio of SMM Compost and NPK-16

Variables	TKN / 1 g
SMM Compost	0.095
NPK-16	0.16
Ratio of SMM Compost (g) : NPK-16 (g)	2 : 1

The ratio of SMM compost: NPK16 shown in the Table 4.3, 1 g of NPK16 fertilizer is equivalent to 2 : 1 of SMM compost for same amount of N. To obtain a better comparison with the used of different soil conditioner, the sample was treated with three different dosages of SMM compost and NPK16 fertilizer.

### Evaluation of Water Spinach Growth

Continuous plant height measurements throughout the season can contribute to identifying different growing stages. Theoretically, plant height is defined as the shortest distance between the upper boundary (the highest point) of the main photosynthesis tissues and the ground level (Wang et al., 2018). For this experiment, the water spinach plant height was measured by once in two days for 30 days planting. Figure 1 shows the plant height at different dosage of SMM compost and NPK-16.

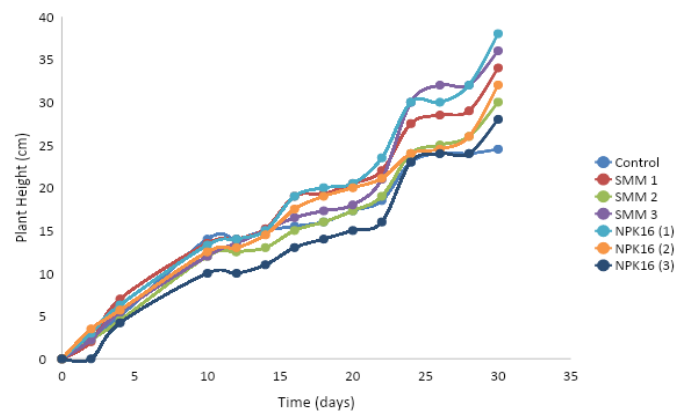


Figure 1. Plant height at different dosage

Based on the graph in Figure 1, the plant height of sample treated with 3.75 g (NPK16 (1)) fertilizer was slightly higher compared to the sample treated with 30.62 g (SMM 3) compost. However, it recorded the highest plant height among all the treated samples. The plant height was strongly correlated to the Nitrogen Use Efficiency (NUE) of the plant. Plant NUE is an important ecological indicator that reflects the capacity of plant to transform into production, which is essential for plant growth and terrestrial ecosystem productivity (Liao et al., 2021). The highest plant may be attributed to greater cell division due to the availability of N nutrient absorption.

### Nitrogen Uptake Rate of Water Spinach

Nitrogen is the most abundant mineral element present in plant tissues, in which it constitutes about 1 to 5 % of total dry matter. Plants acquire N by roots throughout the life cycle, and the availability of this macronutrient, in terms of total amount and forms, deeply affects plant development and interactions with environment (Andrews et al., 2019). In cultivated soils, N availability is a key factor often limiting crop productivity. Hence, N fertilizer is often used to improve the crop productivity. Figure 2 showed the nitrogen uptake of water spinach on the plant medium using SMM compost and NPK16 fertilizer within 30 days.

Based on the graph in Figure 4.7, the result recorded sample with higher NPK16 (3) have the highest TKN value compared to the SMM compost (SMM 3). The presence of high nitrogen content in NPK16 fertilizer affect the



growth of water spinach. The water spinach grows rapidly and produce more yield compared to SMM compost. The comparison of TKN value between NPK16 fertilizer (NPK16 (3)) and SMM compost (SMM 3) shows a very big difference. The TKN value of water spinach in NPK16 (3) was 20.3 while SMM (3) was only 8.4. The result shows a great difference even though the same dosage has been applied to the soil The excessive amount of nitrogen uptake of water spinach may negatively affect the water spinach growth and health. Plant produced excess biomass, or organic matter, such as stalks and leaves, but not enough root structure (Aczel, 2019).

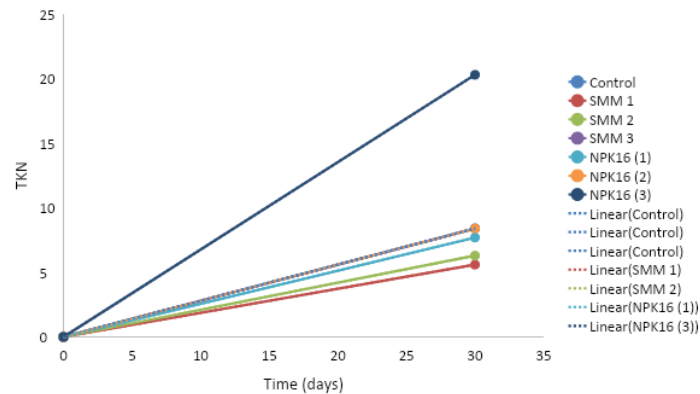


Figure 2. Nitrogen uptake by plant using SMM compost and NPK-16

### Kinetic Study

Nitrogen uptake rate is the slope of the cumulative N uptake curve at any point in time. The maximum N uptake rate gives an indication of how rapidly the crop utilizes N during the period of rapid N uptake (Gastal et al., 2015). For this experiment, the type of kinetic study used to determine nitrogen uptake rate ( $V_m$ ) of water spinach was the Hanes-Woolf plot. Hanes -Woolf was chosen due to its ability to determine  $V_m$  more accurately compared to other kinetic study. Hanes – Woolf plot was given by Equation 2 indicates the information needed to determine  $V_m$ . The Hanes – Woolf plot for nitrogen uptake rate of water spinach treated with SMM compost and NPK-16 fertilizer was showed in Figure 3.

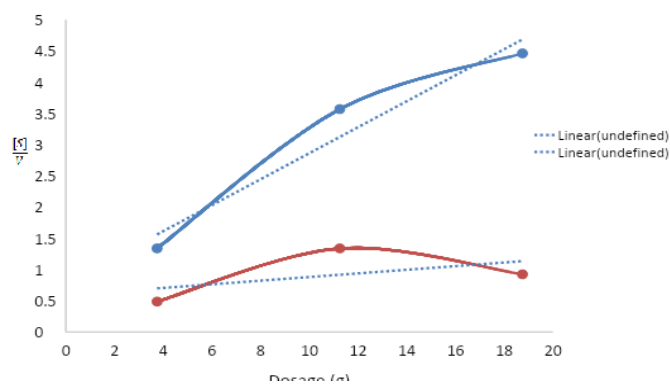


Figure 3: The graph of  $[S]/V$  vs dosage (g)

## Discussion

By using Hanes – Woolf Equation stated in Equation 2, the parameter for each y-axis, y-intercept, slope and x-axis can be arranged in Table 4. After rearrange all the parameters, the nitrogen uptake rate noted as  $V_m$  of water spinach using SMM compost and NPK-16 were stated in Table 5.

Table 4. Arrangement of parameter for straight line plot

y-axis	y-intercept	Slope	x-axis
$[S]/v$	$K_m/V_m$	$1/V_m$	$[S]$

Table 5. Nitrogen Uptake Rate using SMM Compost and NPK-16

Variables	Nitrogen Uptake Rate, $V_m$ (g/Nm <sup>3</sup> )
SMM Compost	4.8008
NPK-16	34.3643

Regarding the effect of SMM compost and NPK16 fertilizer nitrogen uptake rates, obtained data Table 5 clearly indicates that nitrogen uptake rate ( $V_m$ ). of water spinach treated with NPK-16 fertilizer has the highest value compared to SMM compost. This is because, NPK16 is a quick released nitrogen fertilizer that make nitrogen immediately available to plant roots and encouraged a rapid recovery from nutrient deficiency. However, the use of quick released nitrogen fertilizer can cause unsightly burn like damage to leaves and excessive amounts of growth that weaken the overall health of the plant.

In contrast to that, SMM compost have lower  $V_m$  because it is a slow released nitrogen fertilizer that provide nitrogen for water spinach over a period of weeks and best used at planting time to provide nutrients throughout the first half of the growth season. This type of fertilizer provides nitrogen for water spinach at a steady rate that improved the overall health of the plants and ability to withstand damage from insects and diseases. Slow released fertilizers are also less likely to cause leaf burn when come in contact with the foliage of the plants.

## Conclusion

At the end of experiment, the performance of water spinach growth showed that both physical and chemical properties of SMM compost and NPK16 fertilizer was strongly correlated and can affect the plant growth. 1 g of NPK16 fertilizer can be substituted by 2 g of SMM compost to provide equivalent amount of N. SMM compost did contain a sufficient amount of macronutrient and micronutrient like nitrogen and carbon that is important for water spinach growth. The TKN analysis was able to determine the organic and the inorganic forms of nitrogen contained in the compost.

There was a clear correlation between the TKN concentration and the water spinach in SMM compost. When compared to NPK16 fertilizer, the water spinach's TKN value in SMM compost was lower, but it had a completely different effect on the plant's development. Because SMM compost is a slow-release nitrogen fertilizer that aids root growth and promotes plant health, water spinach develops better when SMM compost is applied, developing more healthy and desirable yields.

The nitrogen uptake rate of water spinach in NPK16 fertilizer has the highest value as a result of the chemical fertilizer's quick release of nitrogen, which makes nitrogen instantly available to plant roots but has an unfavorable effect on the growth of the water spinach by weakening the plant's overall health. However, slow-release nitrogen fertilizers, such as SMM compost, have lower  $V_m$  but nonetheless deliver nitrogen for water spinach at a constant rate, improving the plants' general health.

## Recommendations

The result of the water spinach growth was measured until day 30 and the performance of water spinach growth can be improved with some additional step or precaution step. Hence, in order to improve the study on determine the nitrogen uptake efficiency of SMM compost on water spinach, the following recommendations and research should be done:

- Planting experiments and application of soil conditioner should be conducted on-site with an open area to provide more reliable results and findings.
- The loamy soil and SMM compost should be air-dried to such a degree that no further moisture is given up on exposure to air and crushed into small particles. The SMM compost must be mixed thoroughly to obtain a homogeneous soil mixture.
- To ensure the efficiency of the nitrogen on the plant, research on the nitrogen uptake of water spinach should be conducted every week. The Kjeldahl analysis cannot be performed since there is not enough water spinach sample and there is not enough time to grow additional water spinach.

## Acknowledgements

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## Case Based Learning in The Undergraduate Chemistry Laboratory Using Hplc Analyses of Cbd Products

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**Abstract:** In case-based learning, students develop and apply course knowledge to solve tangible and “real life” problems. This practice can enhance student motivation and engagement in the analytical laboratory. In this application of case-based learning students analyze commercially available oils for CBD content. In the state of Texas anyone can sell CBD products. Many of these products are advertised as natural alternatives to prescription medications. The products are advertised as natural alternatives to prescription medications and make unfounded claims to treat conditions like chronic pain, depression, anxiety, insomnia, diabetes and psychosis. However, these claims are not recognized by the U.S. Food and Drug Administration and lax labeling and licensing regulations create situations where consumers may not know what CBD content is present in the product. In this online presentation the CBD content in various products will be discussed along with the necessary chemical analysis tools, analytical method, and chemical standards to perform the analysis.

**Keywords:** Science education, Chemistry, HPLC

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### Introduction

Anyone can sell CBD in Texas. Many of the products are advertised as natural alternatives to prescription medications and make unfounded claims to treat conditions like chronic pain, depression, anxiety, insomnia, diabetes and psychosis. None of these claims are recognized by the U.S. Food and Drug Administration. And because of lax labeling and licensing regulations, unsuspecting consumers may not actually know what they're buying. Products which contain no more than 0.3% THC can be bought throughout Texas. Any products that are within these guidelines can be sold in Texas. People use CBD or THC products as an alternative to using traditional medications for pain or mental illness.

A cartridge (cart) is something that contains an oil or concentrate that can be attached to an e-cigarette pen. Most carts work with an e-cigarette pen (commonly called vape pens or pens) shown in Figure 1. Powered by a battery which are rechargeable or disposable. The battery powers a heating element which heats the oil into a vapor or aerosol. The aerosol or vapor is then inhaled.



Figure 1. A typical cartridge containing CBD oil

## Method

The HPLC instrument parameters were slightly modified from Storm et al. 2020. With a total run time of 11 minutes, and, column oven temperature of 50C. The mobile phase consisted of solvent A and solvent B. Solvent A consisted of 0.1% Aqueous Phase Formic Acid whereas solvent B consisted of 0.05% Organic Phase Formic Acid. The flow rate: 1 mL/min and all injection volumes were 1  $\mu$ L for standards and 5  $\mu$ L for samples.

Table 1. Mobile Phase gradient composition

Time	% Solvent B
1.5	60
2.5	60
8.5	77
9.7	95

The sample preparation consisted of obtaining 100  $\mu$ L of oil weighed in a 10 mL volumetric flask. After being weighed, 8 mL of ethanol was added to the flask and mixed well. After mixing, ethanol was then filled to 10 mL. 100  $\mu$ L of the solution was then diluted in 900  $\mu$ L HPLC grade methanol and filtered into a glass vial for analysis. Standard preparation consisted of obtaining each standard (1 mg/ml) and mixing in equal amounts and diluted to a concentration of 100  $\mu$ g/mL.



Figure 2. Issues with sample preparation

There were several issues with sample preparation as shown in Figure 2. Carts that were analyzed contained either CBD or  $\Delta$ 8-THC in a concentrated oil. The CBD carts were easy to pipette a sample because the mouthpiece twisted off and the consistency was liquid oil. The  $\Delta$ 8-THC carts could not be pipetted out because the consistency was very sticky and thick. Additionally, the mouthpiece did not screw off, so the cart was broken in the space above the oil.

## Results

The results from the CBD cartridges (carts) and  $\Delta$ 8-THC carts are shown below in Figures 3 through 7. A total of 3 commercial CBD containing carts were analyzed. A total of two  $\Delta$ 8-THC commercially available carts were analyzed.

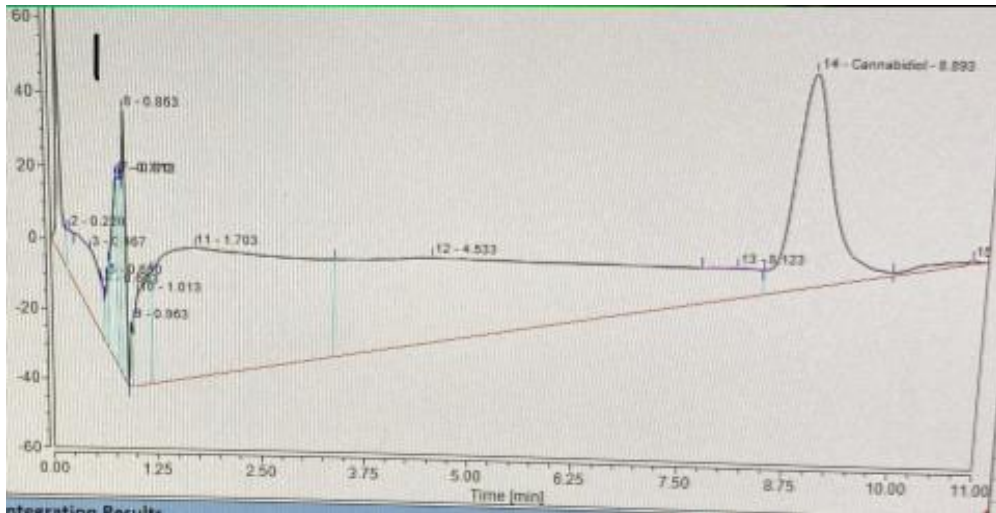


Figure 3. 4.90 mg/mL CBD cart 1

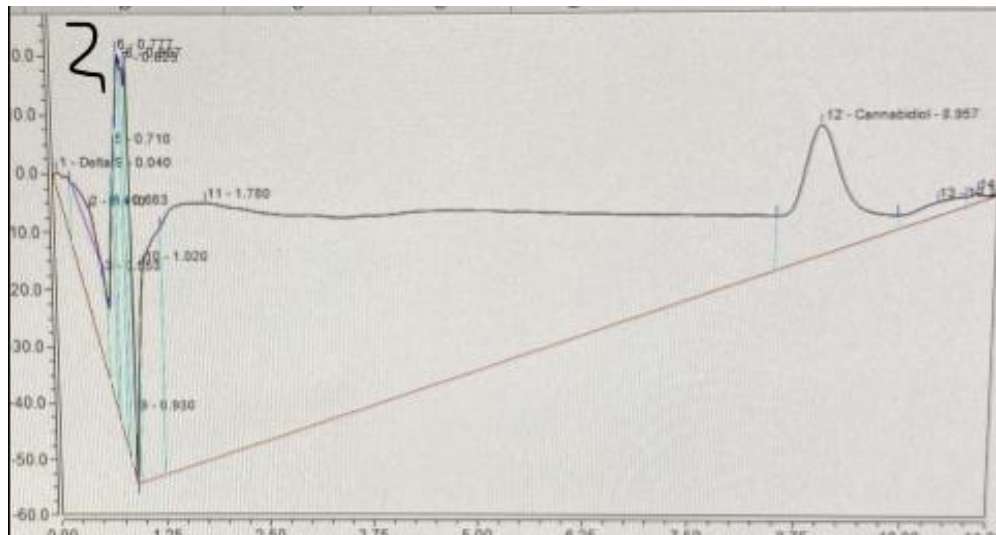


Figure 4. 1.83 mg/mL CBD cart 2

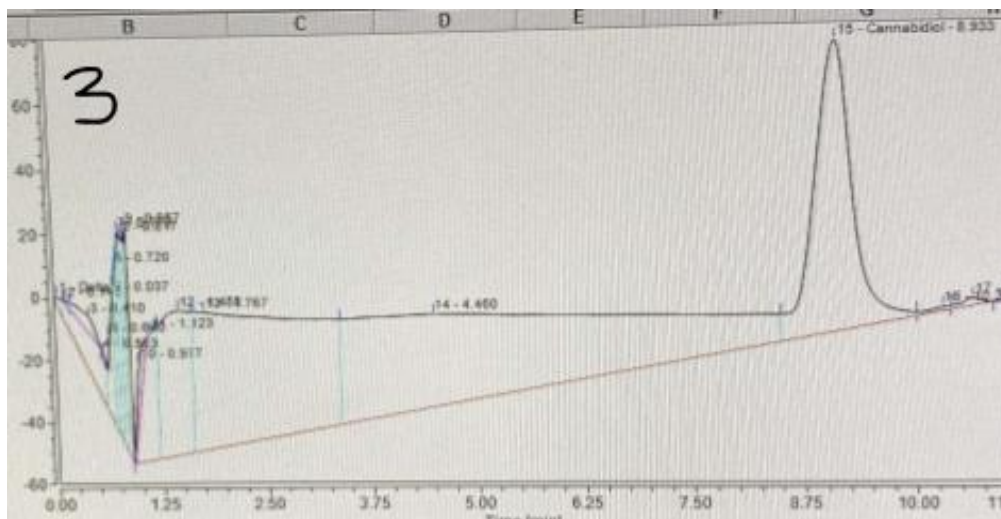


Figure 5. 7.75 mg/mL CBD cart 3



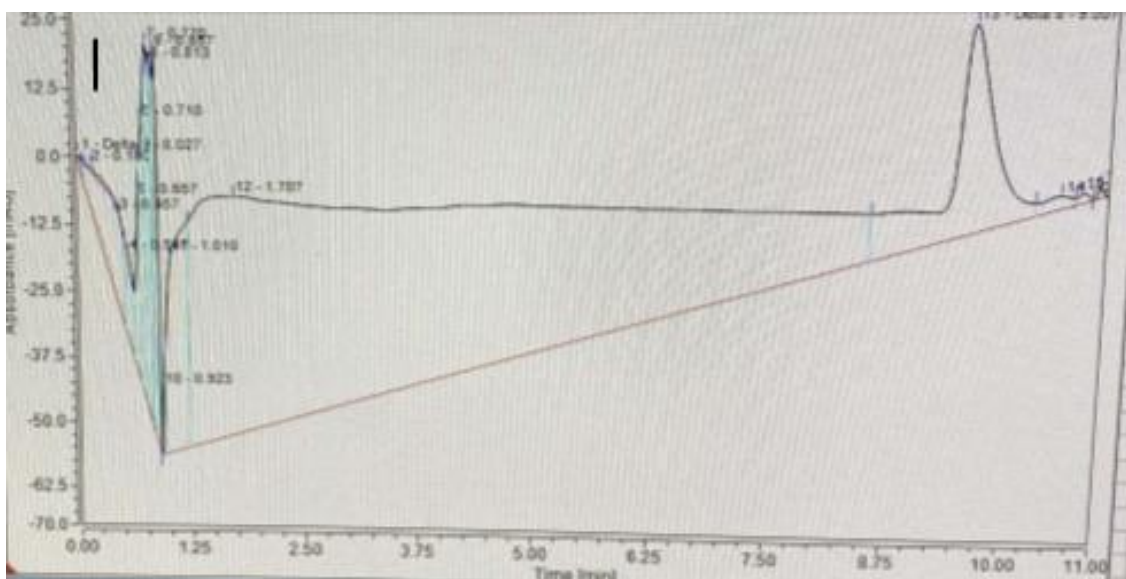


Figure 6. 3.67 mg/mL  $\Delta 8$ -THC cart 1

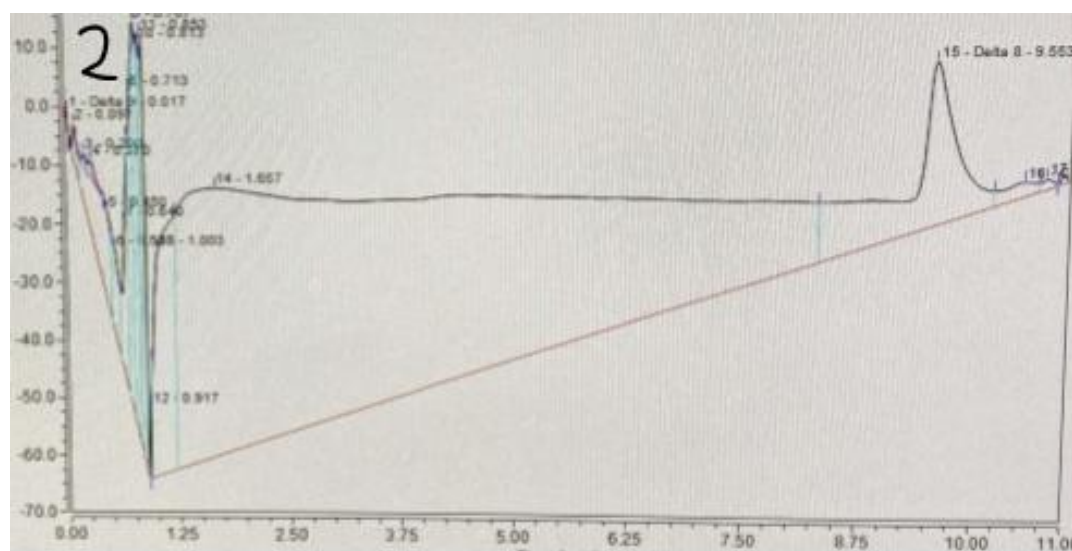


Figure 7. 320 mg/mL  $\Delta 8$ -THC cart 2

## Discussion

It is important to know what is in these CBD/THC products as they become more popular. The results showed that the products tested contained only what they were labelled to contain, so some of these products can be consumed with the knowledge that there are no extra additives. Products must be regulated as they increase in popularity, and future studies should be done to ensure the amounts match the packaging and determine the validity of the claims being made by consumers. Results from this experiment were repeatable and consistent in the undergraduate chemistry laboratory, and the experiment could successfully become a class lab activity. The activity would demonstrate the importance of analytical techniques in monitoring what is in these products and allow students gain experience in the laboratory.

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## Analysis of Increases in Ferronickel Production in An Indonesian Company Due to The Russian – Ukraine War

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**Abstract:** A number of commodity prices, such as oil and coal, strengthened in line with the heating up of geopolitical tensions between Russia and Ukraine which occurred in early 2022. One of the impacts of this event resulted in an increase in ferronickel production costs at a company located in Indonesia. This company runs businesses related to the mining sector, such as nickel, gold, bauxite and coal. In the process of processing raw materials into products or finished goods that are ready for sale, a company needs to carry out several stages. The production process of processing nickel ore into ferronickel raises costs due to several factors. Factors of production such as raw materials, labor, capital and others are important characteristics in determining the category of a company's production costs. The increase in the prices of crude oil and coal commodities due to the events of the war in Russia and Ukraine had an impact on the fuel usage figures in the cost of ferronickel production. The focus of the issues studied in this article is how big the impact of the existence of the ferronickel commodity sector is on national and global economic, political and social conditions, so that it is expected to be a consideration for the steps taken by companies in reducing production costs to anticipate price volatility, both selling prices and the purchase price of ferronickel raw materials in the commodity market.

**Keywords:** Ferronickel Production, Cost Production, Mining Industry, War

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### Introduction

Founded in the late 1960s, a company in Indonesia engaged in the mining sector carries out activities ranging from exploration, excavation, processing, to marketing of mining materials and minerals. There are four operating segments carried out by this company, including nickel, gold, bauxite and coal. One of the company's operating segments, namely nickel, consists of nickel ore and ferronickel commodities. The nickel ore produced

by the company comes from three mining locations located in Southeast Sulawesi and North Maluku.

Laterite nickel ore is one of the mineral resources mined by this company. This type of nickel ore can be categorized as saprolite and limonite nickel ore (Dalvi et al., 2004). Saprolite is a lateritic nickel ore with a high nickel content, which is around 1.5% – 3% nickel (Polyakov, 2013). Saprolite nickel ore is widely processed to produce nickel pig iron (NPI), ferronickel (FeNi) and nickel matte. In addition to producing raw nickel ore, the company also processes nickel ore into ferronickel in the form of pellets. The company will process saprolite laterite nickel ore into ferronickel products at a factory located in Southeast Sulawesi.

In the process of processing raw materials into products or finished goods ready for sale, a company needs to carry out several stages. One of these stages is production. Factors of production become important characteristics in determining the category of costs. Production costs refer to the total costs incurred by the company to produce a certain amount of a product (Pasaribu, 2021). As for the process of making ferronickel, fuel is a factor that contributes a large value to production costs.

In early 2022 commodity prices strengthened in line with the heating up of geopolitical tensions between Russia and Ukraine. The impact of the war on the company was an increase in commodity prices, such as oil and coal, which resulted in an increase in ferronickel production costs. The focus of the problem studied in this article is how big the impact of the existence of the ferronickel commodity sector is on national and global economic, political and social conditions, so that it is expected to be a consideration for the steps taken by companies in maintaining the stability of ferronickel prices in the commodity market.

## Literature Review

### Ferronickel

Ferronickel (FeNi) is an iron alloy containing two main elements, namely iron (Fe) and nickel (Ni) (Eric, 2014). Iron as an element combined with another element, nickel, is melted and converted to form new metal alloys. Ferronickel metal alloys contain 20 – 40 wt% nickel and 60 – 80 wt% iron, as well as impurities such as magnesia (MgO) and (CaO) (Eric, 2014). So nickel ore has good mining value and smelting properties.

The process of producing nickel ore into ferronickel begins with the mining of lateritic nickel ore which undergoes stages including extracting the ore, transporting the ore and unloading the ore shipment. Besides being produced in the form of raw nickel ore, the company also processes nickel ore into ferronickel. The process of making ferronickel uses the pyrometallurgical method, which is the process of separating metal from its ore by heating it at high temperatures. In simple terms, the process of producing ferronickel goes through stages such as rotary dryer, rotary reduction furnace, electric furnace (producing slag pond and slag), raw ferronickel, ferronickel purification and casting.

## Production Cost Control

Cost control is the practice of identifying and reducing business expenses to increase profits, and it starts with the budgeting process. This form of control is in the form of a systematic effort made by the company to achieve goals effectively and efficiently. In addition, control can provide decisions for the company if the resources obtained have been used effectively and efficiently to provide the objectives to be obtained. This activity can be carried out through three stages, such as planning, implementation and measurement.

## Mineral Benchmark Prices

To ensure the availability of supplies and stabilize prices, the Minister of Energy and Mineral Resources issues regulations regarding the procedure for determining the benchmark selling price of metal minerals and coal. The formula for calculating the benchmark price for nickel metal minerals must use the reference mineral price determined based on a Decree of the Minister of Energy and Mineral Resources. So that holders of nickel commodity mining business permits and holders of nickel commodity industrial/processing facilities and/or refining business permits in Indonesia must refer to the benchmark price of nickel metal minerals in the sale and/or purchase of nickel ore.

$$MBP_{\text{feronickel}} = (\%Ni \times RMP_{\text{nickel}}) \times CF \quad (1)$$

## Impact of Geopolitical Wars

Before the war broke out, the World Bank predicted that 2022 would be a stabilization year, with rising energy prices and falling non-energy commodity prices. However, Russia's invasion of Ukraine has threatened pre-existing pressures on global supply chains (Rabbani et al., 2022). Energy and non-energy commodity prices each rose due to the difficulty in recovering the global economy due to Covid-19 (Rabbani et al., 2022).

Energy prices have experienced a very significant increase due to Russia's status as a major oil and gas exporter. Oil and gas prices have soared in recent months on supply worries fueled by companies refusing to buy or ship Russian oil to avoid sanctions. The impact of the Russo-Ukrainian war was very significant on the world economy, as these two countries were major producers and exporters of a number of commodities. The outbreak of war has accelerated price increases for dozens of commodities exported by Russia and Ukraine, such as crude oil, coal, nickel and steel.

## Method

The data in this study uses primary data obtained from the amount of feronickel production and the cost of feronickel production incurred by the company during the Russia-Ukraine war. The data obtained will be

identified in the form of data on production costs, raw material costs, direct labor costs and factory overhead costs. As well as evaluating the allocation of cost categories that provide a high percentage of total production costs. Compilation and calculation of ferronickel production costs were carried out, and forms of efforts were identified to reduce the increase in ferronickel production costs.

**Result and Discussion**

**Feronickel Production Cost**

There was a difference in the cost of ferronickel production before and after the Russia-Ukraine war.

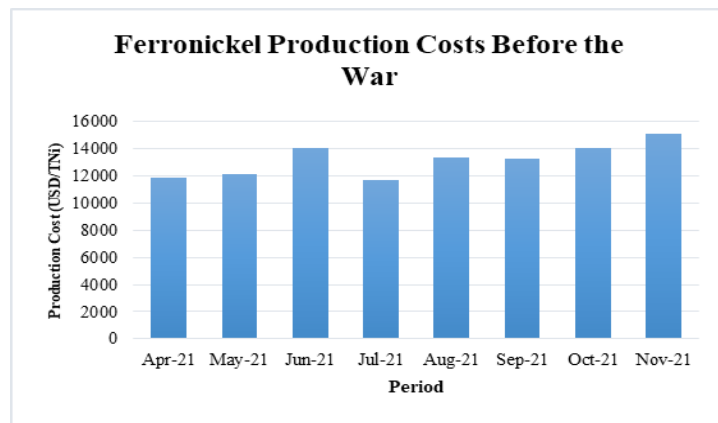


Figure 4. Ferronickel Production Cost Before The War

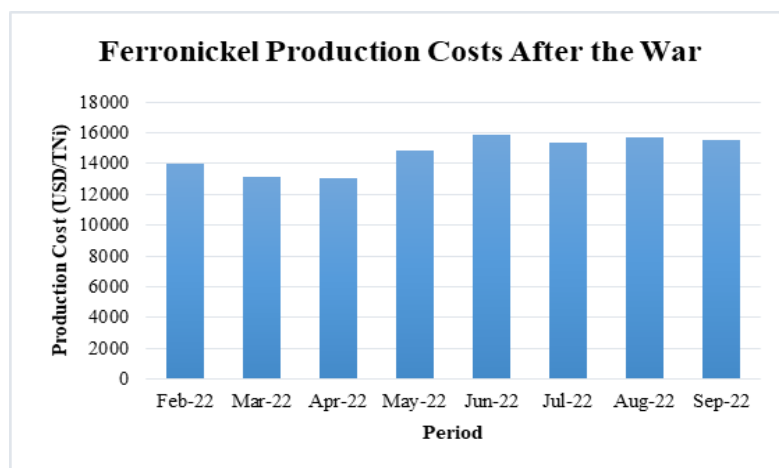


Figure 5. Ferronickel Cost After The War

**Raw Material Cost**

In this study, the indicators for the cost of raw materials needed are the price of raw materials and the quantity of raw materials, both the standard costs or the budgeted costs that have been planned and the actual costs.

Table 21. Price and Consumption Index of Nickel Ore Raw Materials

Period	Usage Ore		Usage Index		
	Ore A (USD/wmt)	Ore B (USD/wmt)	Ore A (%)	Ore B (%)	Total (wmt/Tni)
Jan-22	17.7	62.5	43	57	80.22
Feb-22	16.67	65.36	22	78	76.48
Mar-22	16.14	72.86	26	74	77.44
Apr-22	15.98	111.42	37	63	71.6
May-22	15.98	103.44	40	60	73.3
June-22	15.68	93.01	45	55	77.67
July-22	13.65	84.86	53	47	80
Aug-22	14	69.66	45	55	73.88
Sep-22	13.18	68.28	42	58	76.87
Oct-22	13.67	68.35	47	53	75.29
Nov-22	13.67	69.26	56	44	79.52

Table 22. Costs of Nickel Ore and Other Materials

Period	Use of Nickel Ore A (USD)	Use of Nickel Ore B (USD)	Other Direct Material (USD)
Jan-22	941201	4718803	924103
Feb-22	489257	5418946	898300
Mar-22	649412	5182983	804874
Apr-22	862386	3783510	1199426
May-22	863950	3086916	1130525
June-22	1143397	3426609	1598403
July-22	1177741	7378372	1717068
Aug-22	897271	7272027	1185589
Sep-22	852259	7626154	1360274
Oct-22	1059405	7651965	1062771
Nov-22	1359383	6434757	1023138

### Direct Material Cost

In this study, the required indicators are standard direct wage rates and standard direct labor hours. Based on the table above, it can be described that the wage standard has immediately increased and decreased. This is due to the standard direct working hours which experience instability. One of the factors is the number of production volumes that have changed, thereby increasing overtime hours for workers.

Table 23. Direct Material Cost

Period	Standard Direct Wage Rates (USD)
Jan-22	2089804
Feb-22	2540132
Mar-22	2083522
Apr-22	1976707
May-22	3806431
June-22	1917986
July-22	2179386
Aug-22	1990495
Sep-22	2013680
Oct-22	3954282
Nov-22	1603679

### Factory Overhead Cost

Factory overhead costs studied include fixed factory overhead costs, variable factory overhead costs and overall factory overhead costs.

Table 24. Factory Overhead Cost

Period	Overhead Cost (USD)
Jan-22	11487729
Feb-22	13342825
Mar-22	15596997
Apr-22	16833384
May-22	16498926
June-22	22844934
July-22	20224216
Aug-22	19404533
Sep-22	21283766
Oct-22	21303675
Nov-22	23579996

### Ferronickel Production Cost Category

The cost of producing ferronickel is divided into nickel ore A; nickel B ore and other raw materials; services, transportation, transportation and mining of ore; salaries, wages, bonuses and employee benefits; fuel



consumption; taxes and other levies; third party services; rent; use of spare parts; maintenance and repair; and other production expenses.

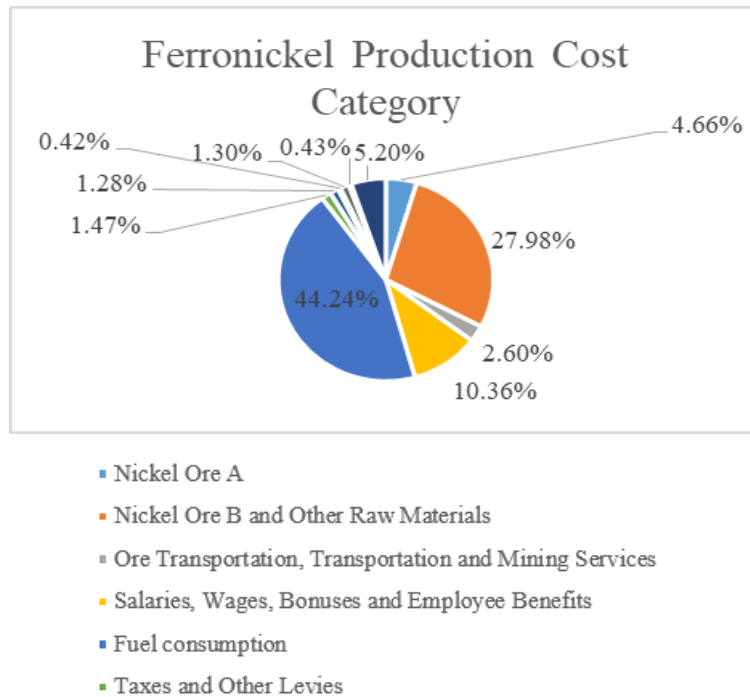


Figure 6. Ferronickel Production Cost Category

From the diagram above, the cost of using fuel contributes a large value of 44.24%. As for the events resulting from the Russia – Ukraine war, the price of coal and crude oil experienced a significant price hike. So that it affects the number of fuel consumption for the ferronickel production process, especially in the process of rotary dryers, rotary reduction furnaces and electric furnaces. Where these processes require the use of electricity and heat is quite high. This can also be proven in the world coal and crude oil price indices.

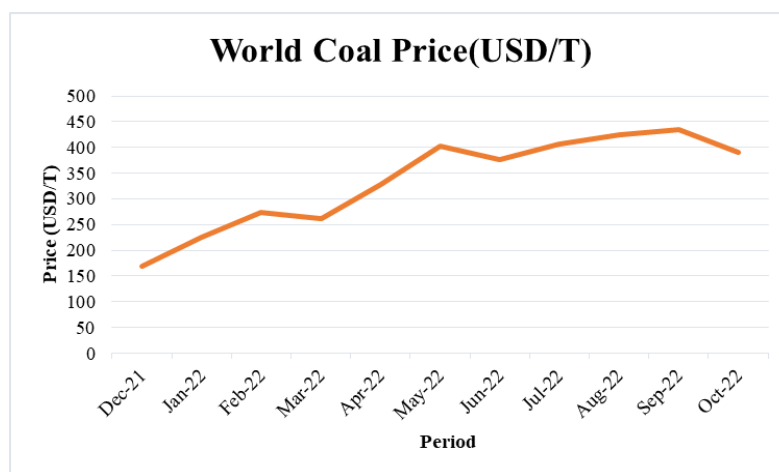


Figure 7. World Coal Price (USD/T)

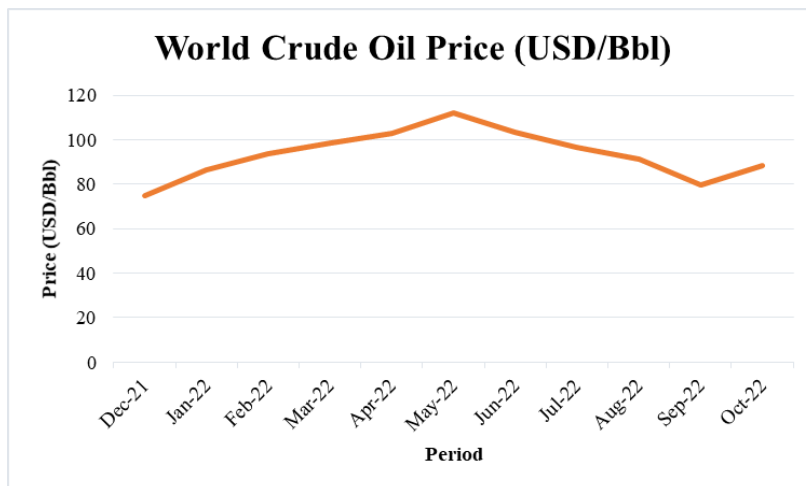


Figure 8. World Crude Oil Price (USD/Bbl)

## Conclusion

The results of this study indicate that the increase in the price of ferronickel production was caused by the increase in the price of fuel consumption that occurred in connection with the events of the Russia – Ukraine war. Where commodity market prices globally affect production prices and ferronickel selling prices. This research can identify other factors that affect the increase in the price of ferronickel production. For further research, it is necessary to control the increase in production prices, so that business actors can determine the right steps in controlling price fluctuations.

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## Synthesize a Conceptual Framework for Athlete's Selection with Data Fabric Sports Statistical Technique

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**Abstract:** The purpose of this research is to present an overview of the conceptual framework of sports statistical data fabric techniques as an approach for using information technology systems for analyzing sports statistical data to develop athletes' potential. This literature review shows that the development of advanced statistical methods for match prediction and selection of athletes by using sports statistical data to analyze the correlation and correlation of the data creates an information system with sports statistics data fabric techniques provide excellent cognitive results. The information obtained is accurate and accurate. From the results of the study, it was born as a new body of knowledge with in-depth conceptual frameworks in sports and scope of information as a basis for development sports with specific characteristics of physical fitness. The knowledge gained from the conceptual framework, this research can create new norms and knowledge in sports toward the development of athletes to their highest potential.

**Keywords:** Data Fabric, Decision Support System, Physical Fitness, Sports Technical Skills, Sport Statistics

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### Introduction

Sport is a health-promoting activity that builds strength for people of all genders and ages. It can also make income and fame for professional and amateur athletes. The goal in a competition is to win, which is the highest

priority in the sport. Because the winner will receive reputation and rewards. Each country's participation in sporting events is seen from competition in a global sport such as World Cup, Olympics. The Summer Olympics begin for the first time in 1896 (Zhenyu Gao, 2020). This competition is a platform for every country to show their sporting potential and talent. This causes competition that has trends and approach for development of athletes towards excellence.

Now, the benefits of objective analysis of data to find answers or solutions are becoming popular because of the accuracy and precision of the results. Sports organizations and institutions that operate with a focus on resource management as well as human capital development. Therefore, actualize studies and research by analyzing information about athletes and sports competitions such as sports statistics, competitions, physical fitness, sports skills training, sports psychology, etc. (Chou; et al., 2021). Combination aesthetic studies and sports is rhythmic body movements provide mental enrichment and physical fitness are consistent. It is the harmonious development of body and mind, the highest embodiment of sports aesthetic education and sports science information, mainly focusing on erection the potential of athletes. The elements that influence the peak performance of athletes such as skill and technique, physical fitness, mental performance, a person's physical strength. It determines his athletic abilities. Statistical analysis was used to specify the effects of time and condition on neuromuscular assessment parameters, anthropometric data, and physical performance. It is a performance measure that has a strong correlation between the amount of technical and tactical training and the anthropological performance variables. The body's function amount and skill training techniques and tactics showed an extreme correlation with aerobic fitness tests (Da Silva et al., 2022).

According to research studies on sports data analysis, recent research was conducted to predict the outcome of football matches basketball player prediction (Chou; et al., 2021) and player ranking in e-sport and other sports research (Umemura; et al., 2021). In addition to the findings in these studies, the results are excellent. The findings from this study also serve as further development approach for data analysis and a knowledge leading to the development of the research conceptual framework in this research. The resulting in a new knowledge and approach to develop athletes to their highest potential. The resulting in a new knowledge and approach to develop athletes to their highest potential. This conceptual framework can be applied to the development of other similar sports. Because in the research, there are groups of sports that have the same or similar characteristics such as competition, time, equipment, and environment into categories clearly.

## **Research Objectives**

The research objectives are:

- To analyses component of sports statistics, physical fitness, sports technical skills, data fabric and decision support system.
- To synthesize a conceptual framework for athlete's selection with Data Fabric Sports Statistical technique.

## Related Work

### Sport statistics

According to the relating literature, the analysis of sports data consists of physical fitness data such as sports skills, mental skills or mind, sports statistics information, which applied to develop information technology systems related to data analysis and data management. There is a semantic data structure that is related by separate the data relationships or merge data relationships together. Characteristic of the data can be either structured, semi-structure and unstructured. In data correlation analysis is will continue to organize information that is continuity and complex data to be able to extrapolate the data. Therefore, data can be deployed in any environment (Portanova, 2021a). Based on several research studies related to the development of advanced statistical methods for football match predictions or use it to create a strategy from a score-driven model can get accurate forecasts (Mattera, 2021). The key factors in influencing athletes were age and gender, which were related to the competitive level of each sport (Götze; & Hoppe, 2021). Matching analysis, it can be performance emphasized using statistical and mathematical criteria. It is not only during the competition used at high speed that determines. Though, at each interval is the acceleration and slowdown values will also cross above the high intensity threshold (R.; et al., 2021). Therefore, sports statistics are performance parameters and influence the performance of athletes. Preparation of good techniques and tactics, this creates effective competitive behavior and leads to success.

### Physical fitness and Sports technical skills

Generally, physical fitness refers to the effects of motor skills that are fundamental to sports training, regardless of sport type (Ambroży et al., 2022). Physical fitness are data on body proportion and physical fitness that are related. Relationship between anthropometric measurements physical fitness and performance indicators from physical training. This is a variable of anthropological efficiency. Performance assessments such as strength, endurance and power muscle, performance of movements, joints, etc. Test activities include Vertical Jump, CMJ Standing Long Jump, Short Run, Long Run, Running Anaerobic Sprint Test. Fatigue Index can also be measured by calculation of best running and worst running (Sattaburuth & Wannapiroon, 2021). Sports technical skills in relationship to physical fitness performance are essential to movement for effective sports performance. Especially sports that are technically, tactically, structurally complex, intricately movement, and requires a sufficient level of motor skills to provide a basis for activities during competition (Ambroży et al., 2022). The development of an athlete's motor skills varies depending on the sport. There are elements of technical skills such as tactics, structure of movement. Levels of sports skills classified in each sport include assessment fitness, flexibility, dribble, balance, etc. These unique technical abilities need to be properly trained in order to maximize their performance in each sport. Therefore, technical skills in sports are important skills and have a unique influence on the success of each sport. Improving an athlete's performance is both physical and technical (Gidu et al., 2022).

## Data Fabric

Managing data and databases with Data Fabric technology is a rationalism concept of a technological approach that includes the process of separation data into segments. To support the process of datafication in the computer system (Portanova, 2021b). The goal of Edges of Internet Computing is to offload the computational load of IoT data streams to Cloud Computing for computation. Data storage, reasoning and intelligence Based on the Computing Fabric's complex, high-performance computing architecture, big data streams provide fast connectivity for storage (Xhafa, 2020). Big data platform with organized cloud computing nature. In which the data lake architecture is a storage area. Imported data is organized to avoid large volumes of data overflow, which is structured data semi-structure and unstructured a fast-growing that comes from a variety of sources. A data lake architecture is data storage that is consistent and available. It has access for end-to-end analytical applications, therefore making the most benefit (Munshi & Alhindi, 2021). A data lake is therefore a logical view of all data sources and raw datasets accessible to a data scientist or statistician. All types of data are merged Logical and physical. It can resize the storage and processing of data (Sawadogo; & Darmont, 2021). Data lakes are therefore an important part of data management. Adopting a data fabric that resembles an enterprise data structure, where data often resides in different legacy systems and has different sources. A focus on data source integration through semantic data structures, the data fabric supports the creation of valuable insights and a consolidated views of data through integration, requiring knowledgeable technical expertise and specific model only (Ghiran & Buchmann, 2019).

## Decision Support System: DSS

Use of Decision Support System (DSS) as a decision-making tool to eliminate potential bias. There are several techniques for decision support systems that help make decisions depending on the suitability of each situation (Planas et al., 2022). The model used is based on decision analysis and multi-attribute utility theory, such as Multi-criteria Decision Analysis methods: MCDA or Multi-Attribute Utility Theory: MAUT, mainly based on criteria and indicators to assess the impact of variables on decision making. In addition, decision support systems can help with highly complex decisions (Labella et al., 2020). Multi-criteria decision analysis (MCDA) is a method that considers decision elements with many alternatives to find the best possible solution. Each criterion must be measurable either quantitatively or qualitatively to what extent each option will achieve objective outcomes. The significance of the criteria and alternatives is in the form of a score or as a weight value (Urbaniak et al., 2020). Although the so-called multi-criteria decision-making method Characteristic Objects METHod (COMET) is a method for specifying a decision model to solve a multi-criteria decision based on a set of basic expert rules. This is not the same as the multi-criteria decision analysis (MCDA) method. But the COMET method does not have a problem with ranking lists and this technique uses associations with decision makers. The COMET method does not use any significant weights. Rather, the proposed approach makes it possible to estimate significant weights. The Analytic Hierarchy Process method (AHP) is also used as a possibility to analyze time-extended decisions. For explain which aspects influence the final, result to Spearman correlation coefficient was used to measure the correlation of input data and output data. It can be concluded



that there are three main concepts and methods for multi-criteria decision analysis: Method 1. Simple Additive Weighting (SAW) use the principle based on the weighting average. Method 2. Analysis Hierarchy Process (AHP) pairwise the decision components one by one and sort the alternatives. Method 3. Ideal Point Technique this method focuses on the determination of positive and negative ideals. The best option is to get as close to the positive ideal and as far away from the negative ideal as possible.

## Research Methodology

The technique of systematic literature search and review by analytical method Meta-analysis by synthesizing and analyzing information from documents, textbooks and research articles from international research databases including Scopus, SpringerLink, Science Direct, Web of Science, Wiley, IEEE. According to the method of content analysis of documents according to the steps of PRISMA analysis as shown in Figure 1. Show the process of searching and selecting research articles by following the steps below. Step 1: Define the scope of the synthesis. Step 2: Conduct research and collect research papers according to the screening criteria by using Boolean operation (AND OR, NOT, ADJ) according to the advance search principle. Step 3: Perform qualification screening by studying, analyzing, discriminating, screening, and categorizing, i.e., crude extraction from abstract content (Abstract screen), selection and evaluation from research content (Full-text) and analyze all contents by Content Analysis method.

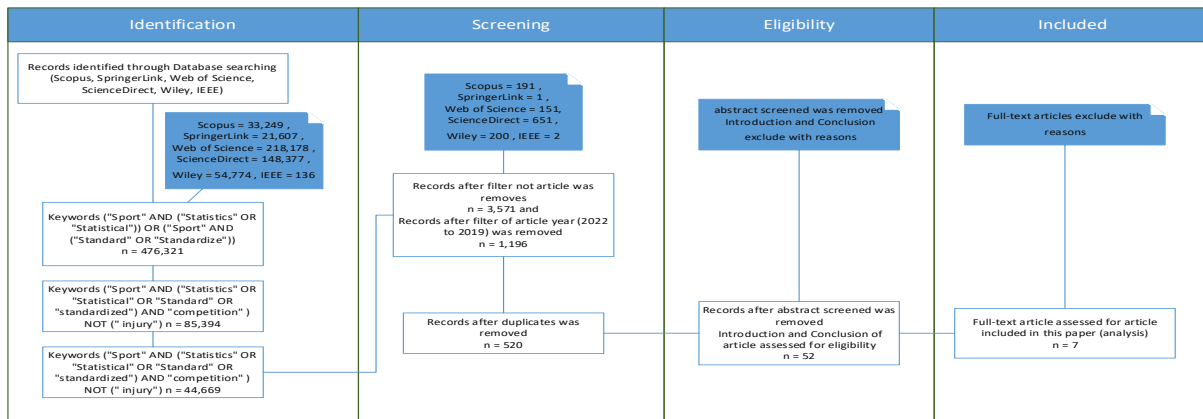


Figure 1. Procedure for research articles selection to synthesize the characteristics of sports statistics

From figure 1 shows the process of selecting research articles for data synthesis and analysis. In searching for documents and research articles, different search terms are used according to the purpose of the synthesis as follows: 1) Synthesis of attributes of sports statistics, using the keywords namely sport, statistical, standard, standardize, competition without the keyword injury. 2) Synthesis of elements of physical fitness and athletic technical skill, using the keyword namely sport, physical fitness, technical skills without the keyword injury. 3) Synthesis data fabric processes using the keywords namely data fabric, data lake, database, architecture. 4) Synthesis the processes of decision support systems using the keywords namely decision support system, multi-criteria decision making. Search for documents and research articles according to steps 1 to 4 for research article selection. Then the synthesis results

will be as shown in Tables 1, 2, 3 and 4 according to the objectives of the synthesis.

## Research Results

### 1. The synthesis result of sports statistics characteristic

From Table 1, it can be concluded that there are 2 main characteristics of sports statistics, namely the individual statistics group and group statistics from the game the details are as follows: The first group, Athlete or Player statistics, consists of anthropological characteristics and physical components such as age, sex, experience, height, weight, limb length, stretching and flexion, body mass index, fat mass, movement, strength, etc. Sports skill level, player ranking, scoring performance, performance, success ratio, training, strength, power, endurance, distance, average speed, acceleration and deceleration, volume, intensity, accuracy, distribution of work during the match, defense, attack, pass ball, lose ball, sport-specific techniques or skills, tactic, penalties, or fouls, offside, etc. The second group, statistics from the game, consisting of competition results such as the best record (win, loss, draw, ranking, award, score, scoring ratio, etc.), difficulty or easy level of the game, the level of competition of sports in divisions (leagues, world levels. Asia, European level, etc.), ranking of teams, scoring goals (gaining and losing points, etc.), match statistics (defense and attack strategies, etc.), attack and defense ratio.

Table 1. The synthesis results of sports statistics characteristic.

Synthesis of Sports Statistics	AYDEMIR, ET AL., 2021	GÖTZE & HOPPE, 2021	R., ET AL., 2021	GARDANOVIC, ET AL., 2021	SALABUN, ET AL., 2020	ILJUKOV, ET AL., 2020	RESHTIDAR, ET AL., 2020	NAVARRO, ET AL., 2020	MARTINEZ-SANZ, ET AL., 2020	MOHAMMAD, ET AL., 2020	FOXID, & BRUCE, 2020
	<b>Athlete or Player</b> (Anthropological features, Physical composition, Skills level, ranking, Scoring, Match and Practice Statistics, Player's Position)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Competitions or Matches</b> (Results (Stats. Record, win, lose, Scoring ratio), Level of game (difficulty or ease), Match Statistics, Attack and Defense Ratio)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

### 2. The synthesis result of the components of physical performance and athletic technical skills.

From Table 2, it can be concluded that physical fitness and sports technical skills It consists of three main groups: anthropological attributes, Sport-specific skills or technical skills and skill practice activities. The anthropological characteristics were gender, age, height, weight, experience, expertise, the aptitude for using body parts is a motor skill in humans, body fat mass, BMI, body proportions, muscular strength, power, flexibility, recovery, mobility, accuracy, agility, multi-directional movement, body endurance Including metabolism and oxygen consumption of the body, characteristics of the aerobic and anaerobic systems. Sport-specific skill groups or technical skills, including dribbling skills, hitting ball, strength, attacking, defending, agility, speed, balance, movement, motor skills, sport-specific techniques, strategy, experience, control. Finally, training activities group include jumping, endurance, muscle strength, fitness test, dynamic stretching, plyometric, handgrip exercises, joint movements (kicks, punches, body moves), core grip, balance training, change of direction, zigzag running, practice, agility test.

Table 2. The synthesis results of the components of physical performance and sports technical skills.

Synthesis of Physical Fitness and Sports technical skills	Pradas; et al., 2021	Cyranowski; et al., 2021	Hammami; et al., 2021	Picabeau; et al., 2021	Saiz de Villarreal et al., 2021	J. Li, 2021	Martinez-Rodriguez et al., 2021	Alves & Coimbra-Ferreira, 2021	Prieske; et al., 2020	Huentas; et al., 2019	Botonis; et al., 2019
	1. Anthropological features	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Sports Specific Skills or Technical skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Activity or Practice or Training	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

### 3.The synthesis of the data fabric process.

From Table 3, it can be concluded that the main components of data fabric are six groups: The first group, the user and administrator. The second group, devices used mainly are personal computers and mobile computers as well as host computers in conjunction with storage devices. The third group, software and systems or platforms such as cloud solution, tools, UI, DBMS, Machine Learning, DSS and OS etc. The fourth group, communication, network connection and services such as IoT, Internet, Cloud, XaaS (Anything as a Service), social media, etc. The fifth group data and databases such as metadata, raw data, data marts, data pond, data set, catalog data (i.e., smart grid data, SQL, Semi-structured, NoSQL) Database such as MySQL, PostgreSQL, Oracle, HDFS, MapR., CloudMdsQL, MongoDB, JSO, OLAP, Cloud Data Lake etc. Finally, the sixth group, performance and work overview the performance aspects are data volume, data transfer rate, data diversity, data reliability, data cleansing, security, data access, data processing. The overall performance aspects are data access, data ingestion, data discovery, data management, data orchestration, data processing.

Table 3 The synthesis results of data fabric process.

Synthesis of Data fabric	SHARADIA & LAMBERTY, 2021	BELOV ET AL., 2021	MUNSHI & AJIBER, 2021	MURUGAN ET AL., 2021	HELIOANNIS ET AL., 2020	THOROGOOD, 2020	YANG ET AL., 2020	SHARADIA ET AL., 2020	SCOTT, 2019
	1. Personal (user, admin, administrator)	✓	✓	✓	✓	✓	✓	✓	✓
2. Equipment (Computers, mobile server, data storage, proactive storage)	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Software and System/Platform	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Communication/Networks and Services (IoT, Internet, cloud, XaaS, social media)	✓	✓	✓	✓	✓	✓	✓	✓	✓
5. Data and Database	✓	✓	✓	✓	✓	✓	✓	✓	✓
6. Performance (volume, transfer rate, reliability, cleansing, security, access, processing)	✓	✓	✓	✓	✓	✓	✓	✓	✓

### 4.Process synthesis of decision support systems.

From Table 4, it can be concluded that the decision-making process has four main parts: 1) Preparation such as source of knowledge, collection, feature requirements and quality concerns, domain and solutions, deep information preparing, analyze alternative and requirements and decision criteria decision data set. 2) Criteria Creation such as decision model, generation of alternatives, identifying requirements and creating decision-making criteria, create metrics for evaluating decision-making criteria. 3) Decision-Making such as steps to use, Option comparison, ranking, classification. 4) Decision Support System such as reporting, evaluation,

investigation, model improvements, Improving decision criteria, alternative improvements. A review of the synthesis literature based on Table 1 to Table 4 from the synthesis of sports statistics. Synthesize physical fitness and technical skills in sports, synthesize of data fabric, synthesize decision support systems were analyzed as shown in Table 5. It was found that the conceptual framework for athlete selection by data fabric techniques for sports statistics was shown in Figure 2.

Table 4 The synthesis results of decision support systems process.

Synthesis of Decision Support System	Farshidi et al.	Kazerooni et al.	Abdelkader et al.	Rahman et al.	Dremvdiéné	Ziamba, 2021	Tabelle et al.
1. Preparation (source of knowledge, collection, feature, domain)	✓	✓	✓	✓	✓	✓	✓
2. Criteria Creation (decision model, generation of alternatives, identifying)	✓	✓	✓	✓	✓	✓	✓
3. Decision-Making (steps to use, Option comparison, ranking, classification)	✓	✓	✓	✓	✓	✓	✓
4. Decision Support System (reporting, evaluation, investigation, model improvements, Improving decision criteria, alternative improvements)	✓	✓	✓	✓	✓	✓	✓

Table 5 Synthesis of Conceptual Framework for Athletes Selection with Data Fabric Sports Statistical Technique

Conceptual Framework	Independent variable	Process / Method	Dependent variable
<b>Sports Statistics</b>	Anthropological features, Physical composition, Sport Skills level, Player's ranking or Player's level, Results (Stats. Record, win, lose, Scoring ratio)		Score/ ranking of athletes and Selected athletes
<b>Physical Fitness and Sports technical skills</b>	Anthropological features and Sports Specific Skills or Technical skills	Activity or Practice or Training	athletes
<b>Data fabric</b>		Personal, Equipment, Software and System/Platform, Communication / Networks and Services, Data and Database, Performance and Overview working	
<b>Decision Support System</b>		1. Preparation, 2. Criteria Creation ((decision model), 3. Decision-Making, 4. Decision Support System	

Figure 2 shows the conceptual framework of athlete selection by data fabric techniques for sports statistics, the primary variables or input factors were sports statistics, physical fitness, sports technical skills, principles of data fabric and principles of decision support systems. The methodology of the athlete selection system was used by data fabric techniques of sports statistics data by using athlete model analysis according to sports statistics to work together in the system. The dependent variables or results were shown athletes who were selected and athletes ranked according to their performance in each sport.

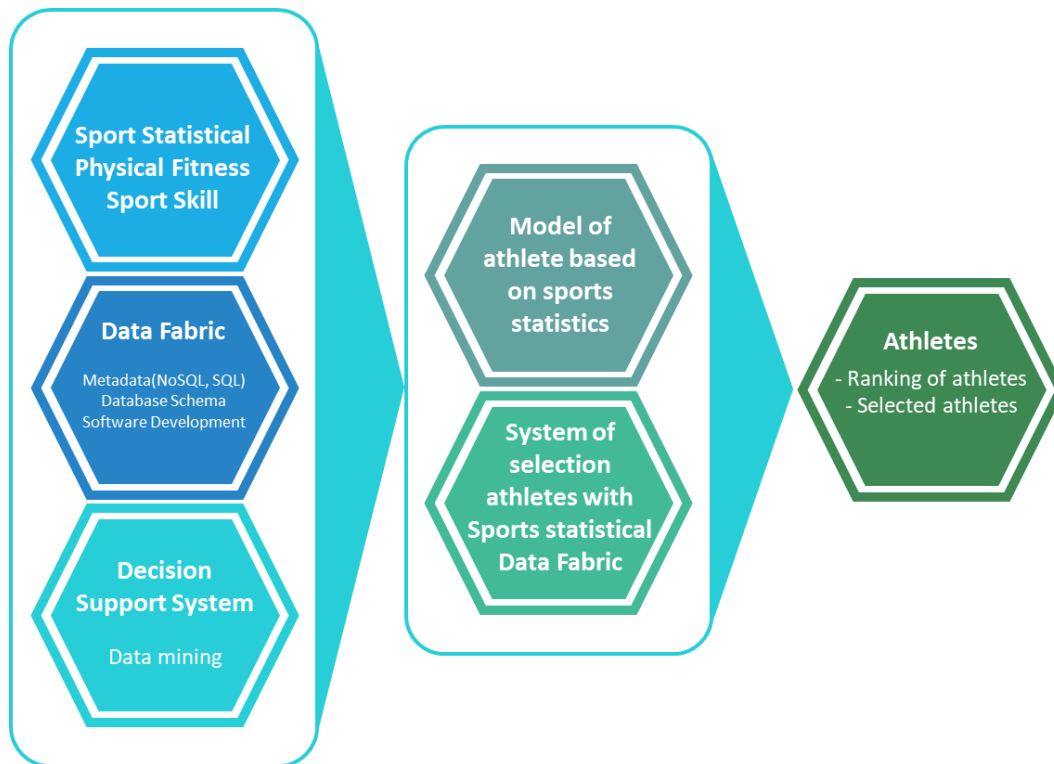


Figure 2. Propose Conceptual Framework for Athletes Selection with Data Fabric Sports Statistical

## Discussion

In this study, the results of the synthesis of the conceptual framework for athlete selection by data fabric techniques of sports statistics revealed that the important input factors affecting the model of athletes with high potential in each sport were sports statistics, physical fitness, sports technical skills. The sports statistics are information about physical fitness and technical skills in sports. It has the same elements and looks and varies according to the type of sport. Because each sport has a different playing style and duration. Makes it emphasize the use of physical skills and various organs and varies depending on the sport. For example, speed skills are used in group sports such as water sports, athletics, flexibility skills are used in the sport of beautiful arts, muscle strength skills are used in martial arts, and agility skills are used in net or racket sports and all skills are used in team sports or on the field, etc. These data are important factors that can be used to analyze and create a model of athletes according to sports statistics and to develop an athlete selection system by data fabric techniques of sports statistics. Prepare athlete ranking reports to select athletes with the highest potential in each sport.

## Conclusions

The conceptual framework of athlete selection by data fabric techniques of sports statistics is a approach for developing athletes to achieve their highest potential. Due to the process of synthesis and analysis of information from documents, textbooks, and research articles from the research database with the technique of systematic literature search and review by analytical method meta-analysis and content analysis according to PRISMA analysis and the content about the attributes of sports statistics. The components of physical fitness data fabric process and process of decision support system. Analyze the relationship between physical fitness data and sports statistics to find indicators that influence the development of athletes' potential. The concept of data fabric sports statistics can be used as a guideline for development athletes of all types to reach their full potential. The discovery of the conceptual framework in the research is very useful for developing athletes to achieve the goal of competition, such as winning, getting promoted to a higher ranking, a world record, or a competition, etc. Therefore, the conceptual framework of data fabric sports statistics in this research will be a framework or path for developing athletes of all types in the future. In addition, the researcher will use this conceptual framework to further develop and study the research results.

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# High-Temperature Stable Anatase Phase Nanocomposite $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$ Synthesized by Hydrothermal Method Using Pyrrolidinium-Based Ionic Liquids

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**Abstract:** Using high-temperature stable anatase  $\text{TiO}_2$  for environmental applications such as gas sensors, self-cleaning ceramic tiles, and anti-microbial sanitary wares is essential and still challenging today. To overcome these problems,  $\text{TiO}_2$  is combined with  $\text{ZnO}$  and  $\text{SiO}_2$  to form a  $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$  composite, producing  $\text{TiO}_2$  material that is effective in the visible light region and has anatase phase  $\text{TiO}_2$  which is stable at high temperatures. Nanocomposite  $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$  was synthesized by hydrothermal method at  $180\text{ }^\circ\text{C}$  for 24 hours using 1-butyl-1-methyl pyrrolidinium salicylate ionic liquids as structuring agent morphology particles. Various calcination treatment was carried out in the temperature range from  $450$  to  $1000\text{ }^\circ\text{C}$ . TG-DTA and XRD results showed no anatase to rutile transformation was observed up to  $1000\text{ }^\circ\text{C}$ . SEM results showed that particle morphology  $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$  synthesized using water has a sphere-like shape while using ionic liquids-water mixture has a nanorod and nanoflower-like shape.  $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$  composites have suitable properties for photocatalytic and self-cleaning applications in the ceramic industry.

**Keywords:**  $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$ , High-Temperature Stable Anatase  $\text{TiO}_2$  Phase, Ionic Liquids, Hydrothermal Method

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Liquids In M. Koc, O. T. Ozturk & M. L. Ciddi (Eds.), *Proceedings of ICRES 2023-- International Conference on Research in Education and Science* (pp. 2202-2216), Cappadocia, Türkiye. ISTES Organization.

## Introduction

TiO<sub>2</sub> is one of the most utilized semiconductor materials due to its unique properties. It is non-toxic, abundant in nature, has high physical and chemical stability, wide bandgap, and excellent photocatalytic effectiveness (Ferreira-Neto et al., 2021). TiO<sub>2</sub> has undergone substantial research about its possible use in photocatalysts, photovoltaic devices, sun energy conversion, self-cleaning surfaces, and gas sensors (Q. Zhang & Li, 2020). However, TiO<sub>2</sub> has two main drawbacks: a large energy band gap (3.2 eV for anatase and 3.0 eV for rutile) and high recombination of photogenerated electron-hole pairs. The large bandgap of TiO<sub>2</sub> causes TiO<sub>2</sub> to work more effectively in the ultraviolet range of light, whose abundance in sunlight is only about 5% compared to visible light. Modifying the electronic band structure, such as doping elements, and forming oxygen vacancies can narrow the large bandgap of TiO<sub>2</sub>. The high recombination of photogenerated charge carriers can limit its overall photocatalytic efficiency. Changing the charge transfer effect, including the addition of suitable electron acceptors, heterojunction, and z-scheme, can correct the high recombination of TiO<sub>2</sub> (Guan et al., 2020).

One of the dopants used so that TiO<sub>2</sub> can effectively work in the visible light region is ZnO to form a TiO<sub>2</sub>/ZnO composite (Ali et al., 2021), (Rokhmawati, 2019). ZnO has similar characteristics to TiO<sub>2</sub>. Additionally, compared to TiO<sub>2</sub>, ZnO exhibits greater electron mobility and a longer lifetime for photogenerated electrons. ZnO semiconductors have several advantageous properties: a wide band gap, an intense emission spectrum at room temperature, being transparent (semiconductive) when exposed to light, and having higher electron movement so that it is widely applied as an additional material to increase the photocatalyst activity of TiO<sub>2</sub> to form heterojunction (Zulfikar et al., 2020).

Anatase, rutile, and brookite are the three crystalline phases of TiO<sub>2</sub> that are the most common (Esch et al., 2014). Anatase has a superior photocatalytic activity compared to other phases of TiO<sub>2</sub> for the following reasons: (i) indirect and slightly wider (by 0.1 eV) band gap of anatase, which slows down the rate of recombination of the photogenerated e-h<sup>+</sup> pair; (ii) anatase has greater electron mobility than rutile, enabling effective bulk transport or charge diffusion through the crystalline structure to the surface (iii) the ability of anatase to specifically promote the formation of peroxy species on its surface (iv) the generation and diffusion of photogenerated mobile OH radical to bulk solution only in anatase (Ferreira-Neto et al., 2021). Anatase, however, is metastable after being heated at a high temperature and is readily convertible to the most stable phase of TiO<sub>2</sub>, the rutile phase. According to the reported study, depending on the fabrication process and precursors, the anatase to rutile transformation occurs at temperatures between 450 and 850 °C (Q. Zhang & Li, 2020). In the ceramic tiles industry, anatase function is an antibacterial agent when coated on ceramic tiles' surfaces or as a glaze material (Hasmaliza et al., 2016), (Maryani et al., 2020). High-temperature stable anatase TiO<sub>2</sub> without phase change to rutile is required for various environmental applications such as gas sensors, anti-

microbial sanitary goods, and self-cleaning ceramic tiles (Padmanabhan & John, 2020). Therefore, it would be ideal if TiO<sub>2</sub> could generate a high-temperature stable anatase phase (over 1000 °C) (da Silva et al., 2018).

The resistance to the anatase-rutile transformation has been studied using various techniques, including metal dopant and morphological control. However, there has not been any information about successfully fabricating until now. Anatase often turns into rutile between 400 and 700 °C, depending on factors including preparation technique, grain size, morphology, degree of agglomeration, kind of impurities, and reaction environment. The mechanism of anatase to rutile transformation is based on breaking two Ti-O bonds in the anatase structure, then rearranging the Ti-O octahedra leading to a dense rutile phase in a smaller volume. Numerous variables, including the use of dopants, the synthesis process, and heat treatment, might influence the breakdown of these bonds. According to the literature on high-temperature stable anatase TiO<sub>2</sub>, there are four basic ways to increase anatase TiO<sub>2</sub>'s high-temperature stability, including (i) doping non-metal ions, (ii) co-doping with metal ions, (iii) and non-metal ions, (iv) oxygen richness stability of dopant-free materials (Periyat et al., 2016). One of the dopants used is the addition of SiO<sub>2</sub>. SiO<sub>2</sub> has functions to form Ti-O-Si bonds to inhibit the transformation of anatase to rutile, increase the mechanical strength of TiO<sub>2</sub> thin films, and form transparent coatings when applied to substrates of ceramic and glass products (Sun et al., 2017). The presence of SiO<sub>2</sub> will increase the surface area of TiO<sub>2</sub> material and increase photocatalytic activity efficiency (Rosales et al., 2021).

To produce TiO<sub>2</sub> materials with a particular morphological structure, modification of the particle shape is carried out using ionic liquids. Ionic liquids have been widely employed in organic synthesis, electrochemistry, molecular self-assembly, and biocatalysts due to their excellent chemical and physical features, such as negligible vapour pressure, low toxicity, low melt points, and excellent chemical and thermal stability (Y. Zhang et al., 2020), (Ghandi, 2014). Recently, ionic liquids have received much attention because they may be readily employed to create functional nanoparticles and other inorganic nanostructures (Liu et al., 2009). The ionic liquids function as a solvent and a structuring agent for a nanocrystalline of particle morphology (Łuczak et al., 2016a) (Łuczak et al., 2016b). The ionic liquids used in this study are pyrrolidinium-based ionic liquids. This pyrrolidinium-based ionic liquid is potentially an electrolyte liquid in lithium batteries (Asha et al., 2019). It shows extensive features, such as aliphatic, positive charge localization, and greater flexibility than imidazolium-derived ionic liquids (Shimizu et al., 2012). In addition, this liquid is also used as a heat transfer process fluid (Sharma et al., 2016). Based on cytotoxic studies, pyrrolidinium-based ionic liquids are environmentally friendly because they are less toxic than piperidinium and imidazolium-based (Musiał et al., 2017). In this study, we prepared 1-butyl-1-methylpyrrolidinium salicylate ionic liquids with the reflux method as a structural agent for TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> composite morphology particles. Salicylate ionic liquids containing -OH and -COO groups offer strong hydrogen-bonding properties effective for dissolving biomaterials, including DNA, cellulose, and other carbohydrates (Wang et al., 2015). Furthermore, the synthesized ionic liquids are then used as a medium for synthesizing TiO<sub>2</sub>/ZnO/SiO<sub>2</sub>.

In this paper, we prepared TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> composites synthesized by hydrothermal method using pyrrolidinium-based ionic liquids as media and structuring agent morphology particles. This study aims to make

TiO<sub>2</sub> composite materials practical in the visible light region and have anatase phase TiO<sub>2</sub> which is stable at high temperatures. The synthesized TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> composite is suitable for applications such as photocatalysts, photovoltaic devices, sun energy conversion, self-cleaning ceramic and glass surfaces, and gas sensors.

## Method

### Materials

All chemicals are in an analytical grade without any further purification. Tetrabutyl ortho-titanate (TBOT) was obtained from Sigma-Aldrich. Zinc acetate dihydrate (Zn(CH<sub>3</sub>COO)<sub>2</sub>·2H<sub>2</sub>O), tetraethyl ortho silicate (TEOS), isopropanol (C<sub>3</sub>H<sub>8</sub>O), hydrochloric acid (HCl), sodium hydroxide (NaOH), 1-butyl-1-methylpyrrolidinium chloride, acetone (C<sub>3</sub>H<sub>6</sub>O), sodium salicylate (C<sub>7</sub>H<sub>5</sub>NaO<sub>3</sub>), n-hexane (C<sub>6</sub>H<sub>14</sub>), were purchased from Merck company. Anion exchange resin Amberjet 4200 Cl and deionized water were used in experiments.

### Synthesis of ionic liquids 1-butyl-1-methylpyrrolidinium salicylate

15 grams of 1-butyl-1-methylpyrrolidinium chloride and 13.5 grams of sodium salicylate were mixed in a round-bottom flask in acetone as a solvent with a reflux condenser. This mixture was stirred with a magnetic stirrer at 50 °C for 48 hours until a white solid formed. This solid was filtered and washed using acetone. The ionic liquid is then passed through an anion exchange resin previously saturated with sodium salicylate solution to remove the dissolved Cl<sup>-</sup>. The filtrate of ionic liquid was evaporated using a rotary evaporator to remove the excess acetone. The solution was cooled, and the yellow clear 1-butyl-1-methylpyrrolidinium salicylate was obtained. <sup>1</sup>H NMR analyzed the structure of synthesized ionic liquids.

### Synthesis of TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> composites

Synthesis of TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> composites was carried out using water media and with a mixture of ionic liquid and water as follows: 5.56 grams of TBOT was dissolved in 10 mL of isopropanol to make solution A. 3.40 grams of TEOS was dissolved in 10 mL of isopropanol to make solution B. 4.78 g of Zn(CH<sub>3</sub>COO)<sub>2</sub> was dissolved with 1.5 mL of distilled water and mixed with 10 mL of NaOH 3 M to produce solution C. Solution A was then added dropwise to 30 mL distilled water with a few drops of HCl 1:1 until pH reached at 3, followed by solution B. White precipitates of hydrous oxides were produced instantly. The mixture was stirred for 2 hours at room temperature. Solution C was added to the mix and stirred again for 2 hours using a magnetic stirrer at room temperature to produce a white precipitate. The precipitate was transferred to 100 mL Teflon-lined stainless steel and placed in an autoclave at 180 °C for 24 hours. The precipitate was filtered, washed with distilled water, and dried at room temperature for 12 hours. Liquid ions trapped in TiO<sub>2</sub> were removed by calcination at 450 °C, 650 °C, 850 °C, and 1000 °C. The final product was a white powder. The molarity

fraction of the three components was 30% TiO<sub>2</sub>/40% ZnO/30% SiO<sub>2</sub> and was further called TZS. Experimental variations were carried out by varying the pH of the solution from pH 3, 5, 7, 9, and 11 with the addition of HCl and NaOH. For the synthesis of TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> with ionic liquids-water mixture media, the synthesis procedure is the same as the synthesis using water media, except that the media used is a mixture of ionic liquid with water in a ratio of 3:7.

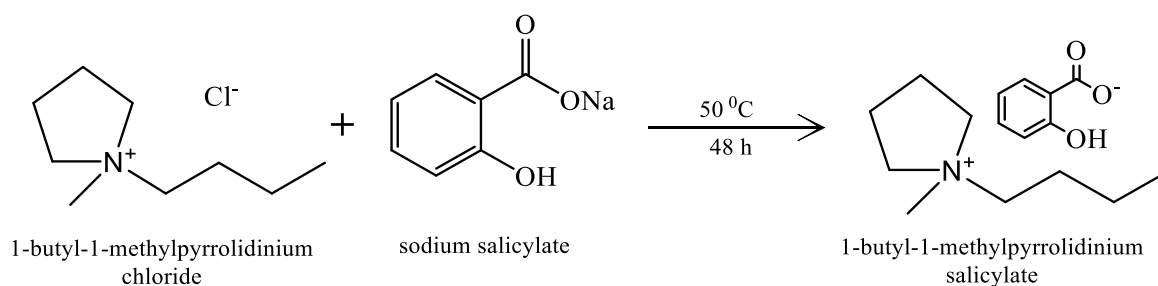
## Characterization

The phase and crystallinity of the composite were studied by X-ray powder diffraction (XRD) (Bruker D-8 Advance) diffractometer with Cu  $\alpha$  radiation (40 kV, 40 mA). The structure analysis of ionic liquids was identified using NMR (Nuclear Magnetic Resonance) Spinsolve Magritek. The morphology of the composites was investigated using a Scanning Electron Microscope with Energy Dispersive Spectroscopy (SEM-EDS) (JEOL Model JSM 6360). The thermal analysis was measured by TGA-DTA (Setaram Setsys). The bandgap energy was measured by UV-Vis Diffuse Reflectance Spectra (DRS) (Thermo Scientific Evolution 220) over the 200-800 nm range. BaSO<sub>4</sub> (Labsphere USRS-99-010) was used as a reference in the measurement. The measured spectra were converted from reflection to absorbance by the well-known Kubelka-Munk method.

## Results and discussion

### Synthesis of ionic liquids

The reaction for the synthesis of ionic liquids can be observed in Scheme 1 as follows:



Scheme 1. Synthesis reaction of ionic liquids 1-butyl-1-methylpyrrolidinium salicylate

The formation of the 1-butyl-1-methylpyrrolidinium salicylate ionic liquids is an anion exchange from Cl<sup>-</sup> to salicylate (Wang et al., 2015). The solubility of these two precursors (1-butyl-1-methylpyrrolidinium chloride and sodium salicylate) in water is very high. Likewise, the resulting product (1-butyl-1-methylpyrrolidinium salicylate and NaCl) will make the separation more complex because the liquid ion product is miscible and prefers to be in the water phase. The reaction is carried out in a hot acetone medium to separate products and reactants. After heating, the precipitate of NaCl (white solid) is formed because the solubility of NaCl in acetone is very low (Wang et al., 2015). The ionic liquids still contain Cl<sup>-</sup> due to residual NaCl, which is slightly soluble in the ionic liquid product. The purification of ionic liquids from Cl<sup>-</sup> is carried out by passing through an anion

exchange resin previously saturated with sodium salicylate solution to remove the dissolved  $\text{Cl}^-$  (Zhou et al., 2018). This saturation is intended for  $\text{Cl}^-$  to be bound by the resin and release salicylate in its ionic liquids (Alcalde et al., 2012). The acetone phase in the liquid ion, free  $\text{Cl}^-$  evaporates using a rotary evaporator. At last, viscous, yellowish liquid was obtained with 84.11 % yield. Analysis using  $^1\text{H}$  NMR for the ionic liquids is shown in Figure 1:

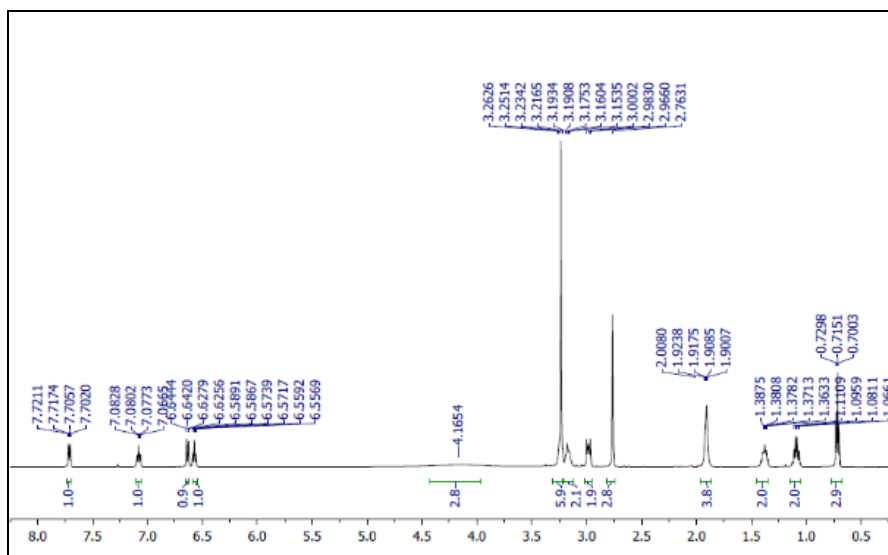
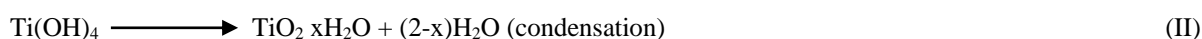
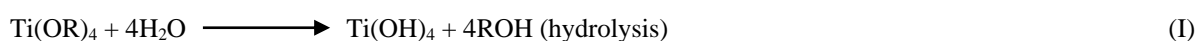


Figure 1.  $^1\text{H}$  NMR spectrum of ionic liquids 1-butyl-1-methylpyrrolidinium salicylate

The chemical shift for 1-butyl-1-methylpyrrolidinium salicylate ionic liquids is:  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  (ppm): 7,71(dd,  $J_1 = 7,70$   $J_2 = 5,85$  Hz, 1H), 7,08(td,  $J_1 = 1,9$   $J_2 = 5,3$  Hz, 1H), 6,63(dd,  $J_1 = 1,2$   $J_2 = 7,05$  Hz, 1H), 6,58(td,  $J_1 = 1,20$   $J_2 = 6,4$  Hz, 1H), 3,19(m,  $J = 5,6$  Hz, 6H), 2,76(s,3H), 1,92(qi,  $J = 3,15$  Hz, 4H), 1,38 (sext,  $J = 3,35$  Hz, 2H), 1,1(sext,  $J = 4,85$  Hz, 2H), 0,72(t,  $J = 7,35$  Hz, 3H).

### Synthesis of $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$ using hydrothermal method

The formation of  $\text{TiO}_2$  using the hydrothermal method is carried out through a hydrolysis reaction between TBOT in aqueous media. Alkoxides hydrolyze to polymerize and form three-dimensional oxides in water (Mahshid et al., 2007). The reaction that occurs is as follows:



where R is ethyl, i-propyl, n-butyl, etc.

However, condensation occurs from the oxolation reaction as follows:



In acidic media,  $\text{H}^+$  ions catalyze the hydrolysis of  $\text{Ti}(\text{OR})$  and protonate the  $\text{Ti-OH}$  group. This protonation inhibits the nucleophilic attack of the  $\text{Ti-OR}$  group by  $\text{Ti-OH}$  so that the condensation reaction is inhibited.

However, when hydrolysis is carried out without using acid catalysts (HCl, H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>), the hydrolysis and condensation reactions will occur simultaneously, and precipitation will occur (Stallings & Lamb, 2003).

pH synthesis conditions were conducted from pH 1, 3, 4, 5, 7, 9, and 11 to determine the optimum pH. Each pH condition was observed, and the mineral phase was characterized using XRD. Temperature calcination was carried out at 450 °C, and the results of the mineral phase are shown in figure 2:

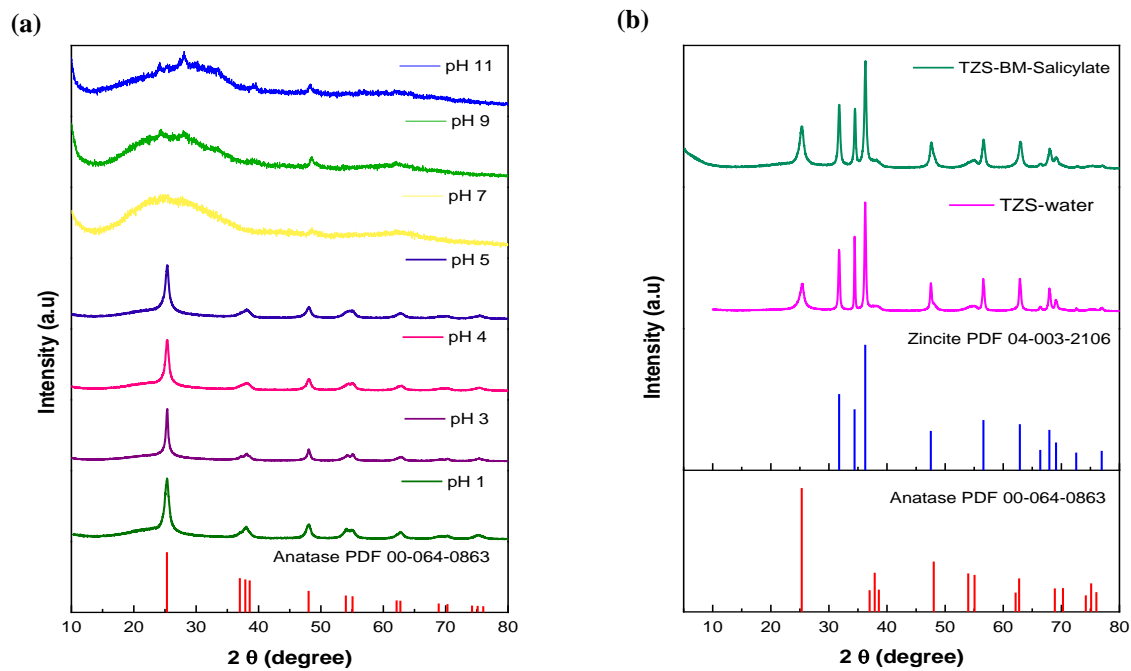


Figure 2 XRD pattern (a) variations pH in TiO<sub>2</sub> synthesis (b) TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> composite (TZS)

Figure 2 (a) shows the anatase mineral phase at pH 1, 3, 4, and 5, with the highest intensity produced at pH 3. According to sol and gel form and the most effective TiO<sub>2</sub> photocatalysis activity, the optimum pH in synthesizing TiO<sub>2</sub> is pH 3 (Robert & Weber, 1999). While at pH 7-11, the mineral phase is amorphous. XRD patterns of TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> composites (Fig. 3b) show characteristic peaks at 2θ values of 25.31, 36.99, 37.88, 38.58, 48.03, 53.98, 55.06, 62.13, 62.74, 68.88, 70.28, 75.12 and 76.03, which are strictly related to the anatase (TiO<sub>2</sub>, PDF 00-064-0863). There are also characteristic diffraction peaks of zincite (ZnO, PDF 04-003-2106) at 2θ values of 31.77, 34.42, 36.25, 47.54, 56.59, 62.85, 66.37, 67.94, 69.08, 72.56 and 76.95. While SiO<sub>2</sub> amorphous shown at 2θ 10° - 30°. From the results of the XRD analysis, the estimated average crystallite size formed is determined by the Modified Scherrer formula as follows (Monshi et al., 2012):

$$\ln \beta = \ln \frac{K \lambda}{L \cos \theta} = \ln \frac{K \lambda}{L} + \ln \frac{1}{\cos \theta} \quad (I)$$

Where L is the average crystallite size, λ is the X-ray wavelength in nanometers (nm), β is FWHM, the peak width of the diffraction peak profile at half maximum height resulting from small crystallite size in radians (FWHM, full width at half max), K is a constant related to crystallite shape, normally taken as 0.9, and θ is Bragg angle in radians. The optical properties of TiO<sub>2</sub> formed are then determined by the band gap value, which

is based on the measurement of the maximum wavelength based on the % reflectance using UV-Vis DRS. Determination of the TiO<sub>2</sub> band gap is conducted indirectly using the Kubelka-Munk equation as follows:

$$F(R_{\infty}) = \frac{(1 - R_{\infty})^2}{2R_{\infty}}$$

Where  $F(R_{\infty})$  is the Kubelka-Munk function, and  $R_{\infty}$  is  $R_{\text{sample}}/R_{\text{standard}}$

The value of  $F(R_{\infty})$  is proportional to the absorbance of a material, so to get the absorbance of a sample is conducted by plotting  $F(R_{\infty})$  with its wavelength. Meanwhile, the band gap was measured by making a Tauc plot  $[F(R_{\infty})hv]$  against  $hv$  so that the equation can determine the band gap ( $E_g$ ):

$$[F(R_{\infty})hv]^2 = C_2(hv - E_g) \tag{III}$$

Band gap measurement using UV-Vis DRS for TZS composite can be observed in Figure 3 as follow:

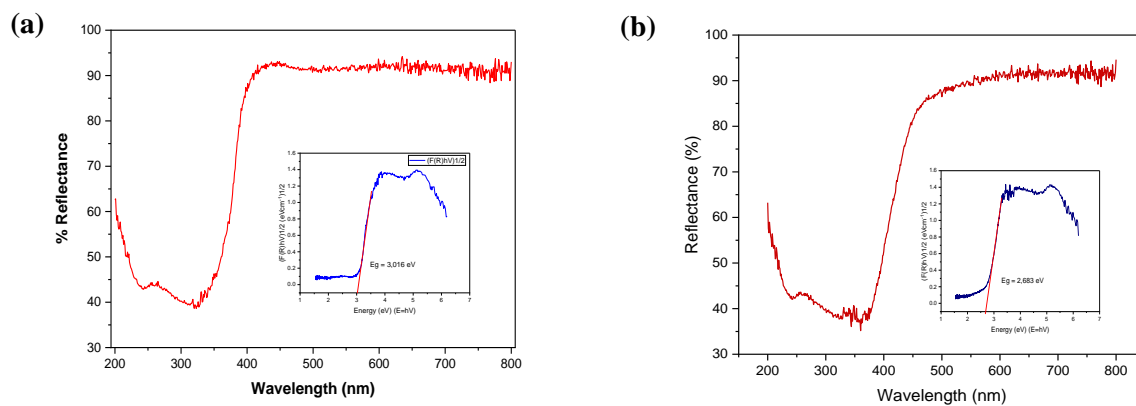


Figure 3. Band gap measurement (a) TZS composite synthesized with water media (b) with water and 1-butyl-1-methylpyrrolidinium salicylate ionic liquid

The average crystallite size and bandgap composite synthesized with water media and a mixture of water and ionic liquids media can be observed in Table 1 as follow:

Table 1. Average crystallite size and bandgap composite TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> (TZS)

No	Composite	The average crystallite size (nm)		Bandgap (eV)
		Anatase	Zincite	
1	TZS with water media synthesis	16.2377	34.6635	3.016
2	TZS with a mixture of water and ionic liquid media synthesis	12.9329	31.9978	2.683
3	TiO <sub>2</sub>	22.4980	-	3.227

Silica addition affected titania phase composition, crystallite size, and surface area and delayed anatase-rutile polymorphic transformation when fired in high temperatures. It can be observed in Table 1 that the average crystallite size of the anatase phase in the TZS composite decreases when compared with pristine TiO<sub>2</sub>. Finer

silica ones partially surround larger titania particles. This way, the amorphous SiO<sub>2</sub> matrix behaves as a barrier, reducing the coarsening of anatase by preventing titania particles from coming into mutual contact and delaying the critical size beyond that anatase transforms to rutile (Tobaldi et al., 2010).

The metal oxides TiO<sub>2</sub> and ZnO synergize to modify their electronic states and generate charge carriers that help separate electron pairs. As a result, electrons move from the conduction band (CB) of ZnO to the conduction band (CB) of TiO<sub>2</sub>, while holes move from the valence band (VB) of TiO<sub>2</sub> to the valence band (VB) of ZnO. The heterostructure simultaneously lengthens the lifespan of carriers and speeds up the semiconductor's decline in electron-hole pair recombination (Xu et al., 2020) (Mousa et al., 2021). From table 1, adding ZnO to TiO<sub>2</sub> can reduce the bandgap of TiO<sub>2</sub>. Likewise, the addition of ionic liquids in the composite makes a synergy effect of reducing the bandgap of TiO<sub>2</sub> (Łuczak et al., 2016b).

Application of ionic liquids (ILs) in modification of titania is one of the effective methods to enhance photocatalysts titania under visible irradiation. The function of ionic liquids (ILs) is as structuring agents which possess surface activity in the synthesis of titania. Several reasons for photoactivity enhancement of titania prepared with ILs media were as follows: (i) doping of the titania lattice with non-metal elements derived from the ILs structure; (ii) favoring the formation of oxygen vacancies and the Ti<sup>3+</sup> species (electron traps, ETs) by ILs; (iii) promoting titania hollow structure formation, thereby shortening the diffusion length of the charge carriers as well as increasing the number of reactive sites (Łuczak et al., 2021). For this reason, in table 1, the addition of ionic liquid 1-butyl-1-methylpyrrolidinium salicylate can decrease the bandgap of TiO<sub>2</sub>.

Thermal analysis using TGA-DTA is carried out to determine the phase changes that occur during heating. TGA-DTA analysis was conducted by weighing 10-30 mg samples in a platinum cup heated from room temperature to 1000 °C with a burning rate of 10 °C/minute (Muniz et al., 2011). Figure 4. a shows a thermal analysis of TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> synthesized using water media. The graph shows a decline in the TGA graph characterized by an endothermic peak at 126 °C that indicates the evaporation of absorbed water and volatile organic compounds. An endothermic peak and a decrease in mass on the TGA graph occur when the temperature is at 246 °C. This decline indicates the carbonization or combustion of organic compounds and the loss of carbon, hydrogen, and oxygen (Que et al., 2000). An exothermic peak on the DTA graph occurs when the temperature is increased to 300 °C, indicating the precursor's dehydroxylation and the formation of the TiO<sub>2</sub> anatase phase and the burning of residual -OC<sub>2</sub>H<sub>5</sub> groups (Hao et al., 2015). Another exothermic peak appears at 400°C, indicating the conversion of Zn(OH)<sub>2</sub> to ZnO. Another exothermic peak occurs at 865 °C on the DTA graph showing the reaction of ZnO with SiO<sub>2</sub> to form the mineral willemite (Zn<sub>2</sub>SiO<sub>4</sub>).

Figure 4. b shows a thermal analysis of TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> synthesized using water and ionic liquid media (7:3). From the analysis, it can be seen that there is a decrease in the TGA graph, which is characterized by the presence of an endothermic peak at 122 °C - 131 °C, which indicates the evaporation of absorbed water and volatile organic compounds. An endothermic peak and a decrease in mass on the TGA graph occur at 251 °C - 277 °C. This decline indicates the carbonization or combustion of organic compounds and the loss of carbon,



hydrogen, and oxygen (Que et al., 2000). When the temperature was increased to 312 °C, there was an exothermic peak on the DTA graph, indicating the dehydroxylation of the precursor and the formation of the anatase TiO<sub>2</sub> phase, and the burning of the residual -OC<sub>2</sub>H<sub>5</sub> group (Muniz et al., 2011). Another exothermic peak appears at 400 °C, indicating the conversion of Zn(OH)<sub>2</sub> to ZnO. At 533°C-550°C an endothermic peak occurs, showing the degradation of the ionic liquid used. Another exothermic peak occurs at 865 °C on the DTA graph indicating the reaction of ZnO with SiO<sub>2</sub> to form the mineral willemite (Zn<sub>2</sub>SiO<sub>4</sub>).

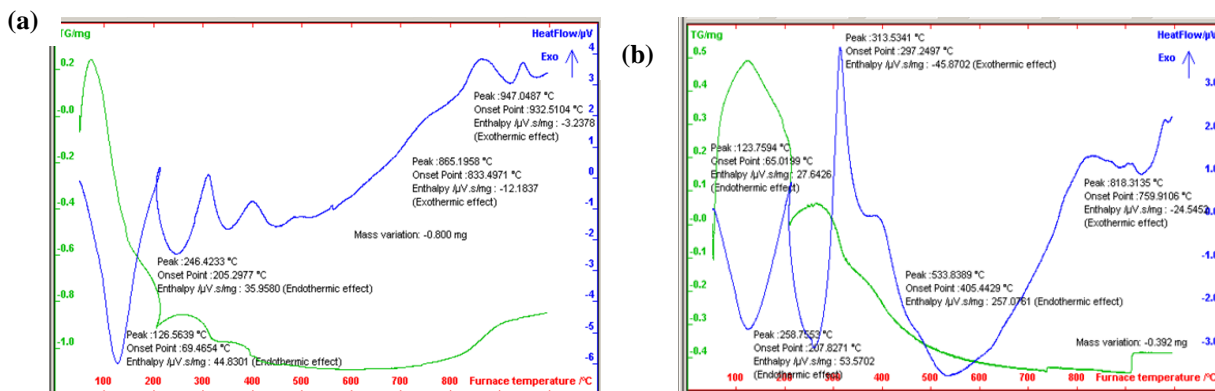


Figure 4. Thermal analysis of TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> synthesized with media a) water b) mixture of water and ionic liquid 1-butyl-1 methylpyrrolidinium salicylate

The resulting TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> composite was then varied in composition and calcination temperature to see the thermal stability and mineral phase changes during heating. The results of XRD analysis with variations in composition and calcination temperature can be observed in figure 5 as follow:

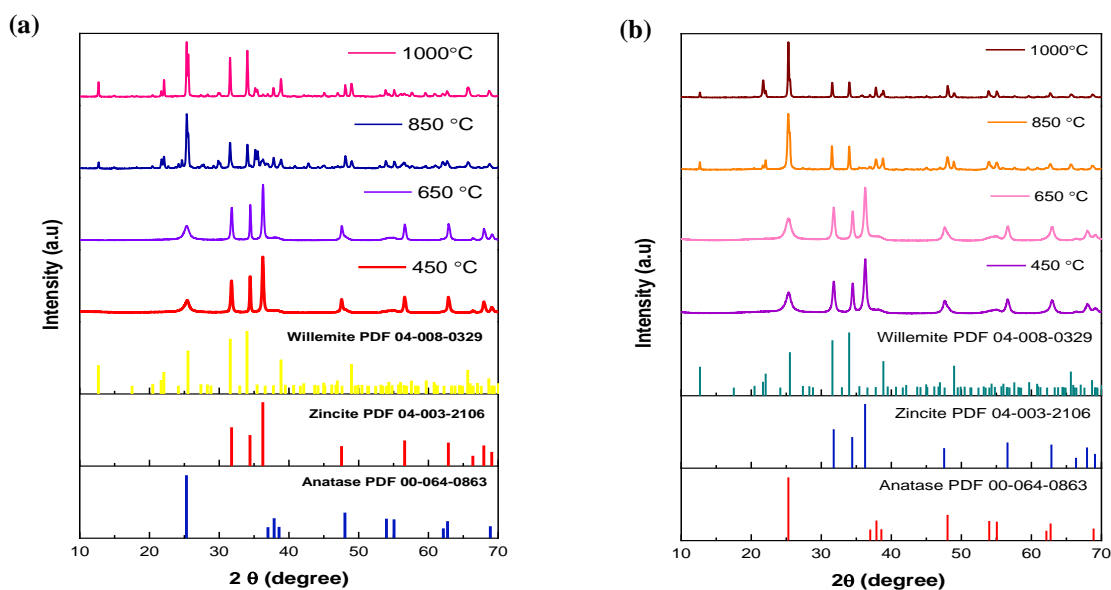
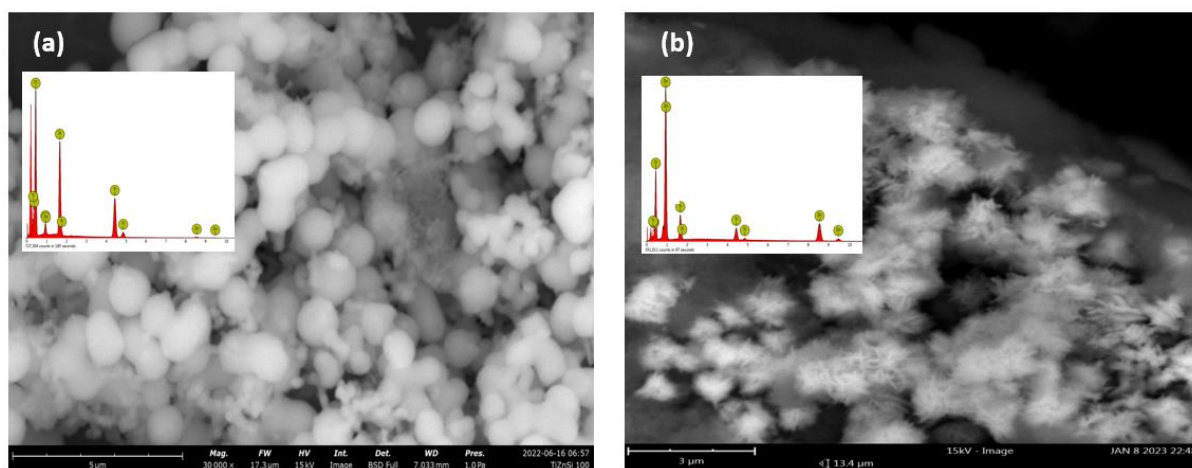


Figure 5. XRD pattern of TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> with composition and calcination temperature variations. The synthesis media are a) water, b) water mixture, and ionic liquid 1-butyl-1 methylpyrrolidinium salicylate.

Figure 5 shows the variation in calcination temperature from 450 °C - 1000 °C using water and a mixture of water and an ionic liquid as media synthesis. Both XRD patterns show the form of mineral phase anatase and do not turn into rutile even at high calcination temperatures. Neto et al. (2021) stated the effect of SiO<sub>2</sub> addition on the formation of stable anatase at high temperatures in TiO<sub>2</sub>/SiO<sub>2</sub> composites. Silica is a support material due to its wealthy and well-known surface chemistry, low cost, good thermo-, mechanical-, and electrical stability, and large absorption capacity. Additionally, the surface silanol (Si-OH) groups of SiO<sub>2</sub> are active and offer sites for efficient functionalization and the formation of interfacial Ti-O-Si bonds in TiO<sub>2</sub>-SiO<sub>2</sub> mixed oxide materials, which have been found to affect the optical and thermal properties of the silica-supported TiO<sub>2</sub> materials. SiO<sub>2</sub> is also optically transparent in the UV-visible region and essential for photocatalysis.



Element Number	Element symbol	Element name	Atomic conc.	Weight conc
8	O	Oxygen	84.11	68.92
22	Ti	Titanium	6.75	16.56
14	Si	Silicon	8.42	12.11
30	Zn	Zinc	0.72	2.41

Element Number	Element symbol	Element name	Atomic conc.	Weight conc
30	Zn	Zinc	24.61	55.33
8	O	Oxygen	70.35	38.70
14	Si	Silicon	3.63	3.51
22	Ti	Titanium	1.31	2.16

Figure 6. SEM-EDX image (a) TZS synthesized with water media (b) TZS synthesized with a mixture of water and ionic liquid 1-butyl-1-methylpyrrolidinium salicylate

SEM-EDX investigates the TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> composite's morphological features, as shown in Figure 6. Figure 6 shows TiO<sub>2</sub>/ZnO/SiO<sub>2</sub> synthesized using water has a uniform sphere-like shape while ionic liquids-water mixture has a nanorod and nanoflower-like shape. The EDX results from Figure 6 (a) show that all three TiO<sub>2</sub>, ZnO, and SiO<sub>2</sub> have sphere-like-shaped particles. While the TZS composite synthesized with ionic liquids in Figure 6 (b), both TiO<sub>2</sub> and SiO<sub>2</sub> have a sphere-like shape, and ZnO has a nanorod-like shape.

The addition of RTIL (room-temperature ionic liquid) is a great surfactant for forming nanostructured material. RTILs have been utilized for synthesized inorganic nanomaterials with specific morphologies and characteristics, such as solvents, reactants, or templates. The hydrothermal method is used for controllable size and morphology (Mali et al., 2014). Luczak et al. (2015) state that ionic liquids in the nanostructure preparation

process act as follows: (i) ionic liquid protective layer formation, (ii) viscous stabilization, (iii) stabilization by intermediates or by-products, (iv) stabilizing or destabilizing role of the ionic liquid impurities, (v) stabilization by ligands, (vi) source of fluoride anions generated in situ, (vii) micellar solutions, (viii) agent promoting reduction, (ix) ILs may be used as morphology templates.

## Conclusion

Nanocomposite  $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$  has been synthesized using a hydrothermal method at  $180^\circ\text{C}$  for 24 hours at an optimum pH of 3. The synthesis medium used was a mixture of water: 1-butyl-1-methylpyrrolidinium salicylate ionic liquid with a volume ratio of 7:3. XRD analysis showed that the mineral phases formed were anatase, zincite, and amorphous silica. The anatase phase formed is stable until the  $1000^\circ\text{C}$  does not change to rutile. The composition (mole fraction) of the synthesized composite is  $\text{TiO}_230/\text{ZnO}40/\text{SiO}_230$ , which produces band gap energy reaching 2.683 eV so that photocatalytic activity can be effectively used in the visible light wavelength range. The results of morphological analysis using SEM-EDX show that the  $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$  composite synthesized using water has a sphere-like shape while using a mixture of water-ionic liquids has a nanorod and nanoflower-like shape.  $\text{TiO}_2/\text{ZnO}/\text{SiO}_2$  composites have suitable properties for photocatalytic and self-cleaning applications in the ceramic industry.

## Recommendations

For better performance when applied in photocatalysis activity and application in self-cleaning, the ionic liquids should be purified first to remove impurities or synthesis by-products. The composition of the water mixture with ionic liquids should also be optimized to produce a particular particle morphology. In addition, to ensure the bonds formed, such as Ti-O-Si, Ti-O-Zn composites should be further analyzed, for example, by using FTIR or XPS analysis.

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## Disclosing GHG Emissions in the Perspective of Strategy, Performance, and Reporting: A Y-Shape Mapping Approach


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**Abstract:** This study introduces a novel Y-shape mapping approach to visually represent greenhouse gas emissions (GHG) disclosure, aiming to improve the quality of disclosures and promote transparency for informed decision-making by stakeholders. By taking a conceptual approach, the study suggests that this new mapping method can offer several benefits. It can effectively identify inconsistencies or deficiencies in emissions disclosure categories and provide stakeholders with an initial understanding of a company's emissions based on a recognizable pattern. However, empirical testing in real-world scenarios is necessary to evaluate the approach's effectiveness and gather further evidence to support its potential advantages. Moreover, the proposed Y-shape mapping approach has the potential to facilitate stakeholder engagement by providing an intuitive language for discussing emissions disclosure and its sustainability implications. It may also inspire additional research and innovative strategies to enhance the quality of sustainability reporting and encourage responsible business practices. Ultimately, this study proposes that the Y-shape mapping approach can significantly contribute to the transparency and reliability of emissions data, ultimately promoting sustainability and responsible corporate behaviour.

**Keywords:** GHG emissions disclosure, Y-shape mapping, Strategy, Performance, Reporting

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### Introduction

Corporate environmental disclosure varies based on the type of firm, the country where it operates, and the sector it is a part of (Brammer & Pavelin, 2008; Hardiyansah & Agustini, 2020). However, it often consists of giving specific information about a company's environmental policies and procedures, performance in lowering

glasshouse gas (GHG) emissions and other pollutants, compliance with relevant environmental laws and regulations, and any risks or potential liabilities related to its activities. In addition, businesses may outline their efforts to cut down on energy use and waste, increase the effectiveness of their manufacturing procedures, protect natural resources, and lessen the effects of their operations on the environment. Corporate environmental disclosure may also provide details on the company's sustainability and responsibility reporting methods, such as using third-party certifications or sustainability reporting.

Companies may disclose environmental issues depending on their importance to their operations (GAO, 2020). A sustainability report that details a company's environmental obligations, guidelines, and objectives may be published. In addition, this report can be used to measure progress toward specific goals. Businesses may also disclose how they manage environmental risks and reduce emissions. They frequently share information about their efforts to conserve resources, such as water usage and electricity usage. Furthermore, businesses may disclose details on the policies and initiatives they have in place to cut back on waste and pollution.

Meanwhile, businesses must provide environmental data following laws, interests, and government actions (Delgado-Márquez, Pedauga, & Córdón-Pozo, 2017). For instance, in the United States, the federal government mandates that companies disclose data on air and water emissions and hazardous waste disposal (Abel, Stephan, & Kraft, 2007; Graham & Miller, 2001). The company's emissions data provides comprehensive information on all facilities' emissions and their variations over time. Corporations must also disclose any environmental infractions or penalties they have faced. Companies may occasionally be asked for more details regarding their energy usage or other practices that can harm the environment. States may also have additional reporting obligations for firms operating inside their territory in addition to federal restrictions.

Therefore, larger, more successful companies that operate in regulated sectors are more likely to be transparent about their environmental practices (Akhter, Hossain, Elrehail, Rehman, & Almansour, 2022; Chaklader & Gulati, 2015; Delgado-Márquez et al., 2017). The reason for this is that they must follow stricter industry requirements. The goal is to be open about how a company's operations affect the environment, such as carbon emissions. They might also be more likely to spend money on technological advancements and environmentally beneficial initiatives that could lessen environmental harm. Big businesses also have more resources to invest in sustainable initiatives. Transparency increases brand value and reaches, fostering trust and confidence among customers (Ferrell, Harrison, Ferrell, & Hair, 2019; Iglesias, Markovic, Bagherzadeh, & Singh, 2020; Kang & Hustvedt, 2014).

In the context of GHG emissions disclosure, guidance for measuring and reporting the emissions has already been developed by some organisations, such as the GHG Protocol, the Carbon Disclosure Project (CDP), the Global Reporting Initiative (GRI), the Global Framework for Climate Risk Disclosure, the Carbon Disclosure Standard Board, and the International Organization for Standardization (ISO) 14064-1. In addition, these organisations provide key principles, steps, and protocols, as well as sector-specific guidance such as boundary establishment, data collection, and reporting best practices. These guidelines assist corporations in accurately



measuring, tracking, and publicly reporting their emissions, aiding in their transition to net-zero emissions.

Although the guidelines raise the calibre of corporate emission disclosures, there is still a gap between what stakeholders want from corporations and what information is provided by companies (Busch, Johnson, & Pioch, 2022; Clementino & Perkins, 2021; Depoers, Jeanjean, & Jérôme, 2016). This discrepancy is seen in how companies disclose their strategy, performance, or sensitive data related to their carbon footprint. Past studies have shown that there are still many businesses, especially those in developing nations, that engage in symbolic-style carbon disclosure, which indicates that their commitment is driven by symbolic objectives to project an image of sustainability to stakeholders (Rahman, Rasid, & Basiruddin, 2020; Yin, Li, Ma, & Zhang, 2019).

In contrast to "hard disclosures," which are more specific and verifiable facts, they typically focus on qualitative and forward-looking information, or "soft disclosures," regarding their carbon footprint as well as their strategy, performance, and other aspects (Clarkson, Li, Richardson, & Vasvari, 2008; Plumlee, Brown, Hayes, & Marshall, 2015; Xie, Chen, & Chen, 2021; Xu & Liu, 2018). Clarkson et al. (2008) argued that only companies that provide more detailed and precise information, or "hard disclosure," on their environmental performance could close the gap with stakeholders. It is because this type of disclosure provides stakeholders with concrete evidence of a firm's commitment to environmental responsibility through emission levels, targeted reductions, and industry comparison data.

Hence, this study aims to create a Y-shaped map of GHG emissions disclosure to address the issue. This map is urgently needed to assist businesses in identifying areas related to their commitment to improvement. The map will divide disclosure into three areas: strategy, performance, and reporting, and provide levels of disclosure for each area. By using the map, the relationship between these aspects of the corporate GHG emissions disclosure evaluation could be quickly seen. This map will visualise any discrepancies or inconsistencies in their GHG emissions disclosure practices and identify potential opportunities for improvement and decisions for reducing emissions. As far as the authors' best knowledge goes, there are no conceptual or empirical studies that have developed a map of GHG emissions disclosure specifically for these areas. As a result, it might make an important addition to the body of literature.

Meanwhile, by assessing the level of disclosure, this map would help companies get critical feedback, allowing them to better serve their stakeholders. On the other hand, the map would be helpful for stakeholders to evaluate changes in corporate decision-making related to sustainability initiatives that create greater trust in the organisation and their dedication to positive change. In addition, the map could be used as a basis for further research into corporate carbon disclosures, especially from strategy, performance, or reporting perspectives. As a result of discussions regarding how a Y-shape mapping approach can be a useful tool for disclosing GHG emissions, authors expanded it to include three distinct categories of disclosure, such as strategy, performance, and reporting, to gain a fresh perspective on how these categories can be related to one another. This research also looks into how each category's levels are visualised by the method.

## The Y-shaped Matrix and Its Graph

The notion of a Y-shaped mapping approach is inspired by the Y-shaped matrix, which can connect three sets of elements in a way that they make a loop with each other (Shahin, Bagheri Iraj, & Vaez Shahrestani, 2018). This matrix was used to highlight relationships between three separate groups, simplify complex data sets, and uncover strengths and linkages between various data sets. When it was decided to map the three distinct groups, the matrix then could be transformed into a graph to show the relationship between them. Ultimately, a Y-shaped matrix and its graph are excellent for comprehending the intricacies of interactions between groups as correlation visualisations (Nguyen & Akerkar, 2020). Furthermore, Figure 1 shows the Y-shaped matrix, and Figure 2 depicts the Y-shaped graph.

For illustrative purposes, the following three groups: A, B, and C will be analysed. Group A is divided into three subgroups: A1, A2, and A3. Group B is divided into B1, B2, and B3, while Group C is divided into C1, C2, and C3, respectively. In the Y-shaped matrix, the relationship among Groups A, B, and C can be discovered by following pairs of their subgroups. For instance, the correlation between Group A and Group B can be shown as “A1B1”, “A2B1”, “A3B1”, “A1B2”, “A2B2”, “A3B2”, “A1B3”, “A2B3”, and “A3B3”. What makes this matrix a powerful tool is that the Y-shaped matrix also makes up the correlation between Group A and Group C, as well as between Group B and Group C (see Figure 1).

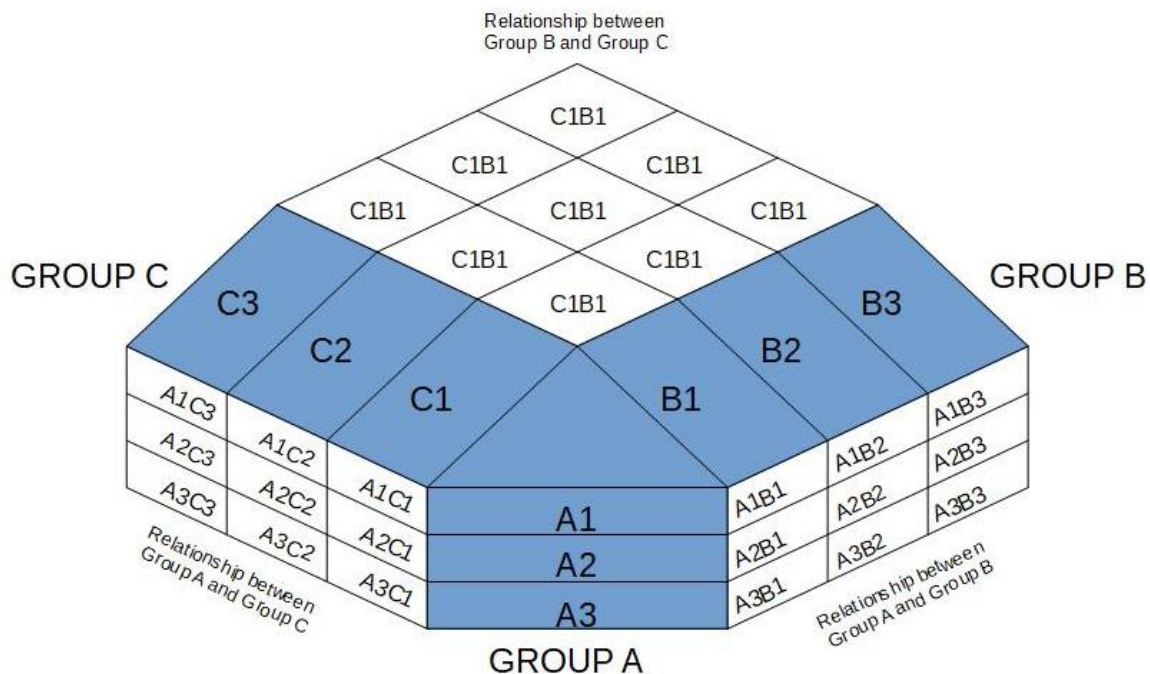


Figure 1. Y-shaped Matrix

The Y-shaped matrix is then converted into a Y-shaped graph to meet research purposes (see Figure 2). Three of the groups—Group A, Group B, and Group C—are transformed into three different types of axes that resemble

a capital Y in this form. The subgroups of Groups A, B, and C are further represented by three quadrants. The relationship between Groups A, B, and C will be shown by pairing the subgroups in these quadrants. These connections might be thought of as coordinates that come from combining different axes. For instance, the coordinates for Group A and Group B's two axes can be used to determine the relationship between the two groups, i.e., (“A1,B1”), (“A2,B1”), (“A3,B1”), (“A1,B2”), (“A2,B2”), (“A3,B2”), (“A1,B3”), (“A2,B3”), and (“A3,B3”). Meanwhile, the correlation between Group A and Group C can be shown as coordinates, i.e., (“A1,C1”), (“A2,C1”), (“A3,C1”), (“A1,C2”), (“A2,C2”), (“A3,C2”), (“A1,C3”), (“A2,C3”), and (“A3,C3”), while the link between Group B and Group C can be seen as coordinates, i.e., (“B1,C1”), (“B2,C1”), (“B3,C1”), (“B1,C2”), (“B2,C2”), (“B3,C2”), (“B1,C3”), (“B2,C3”), and (“B3,C3”).

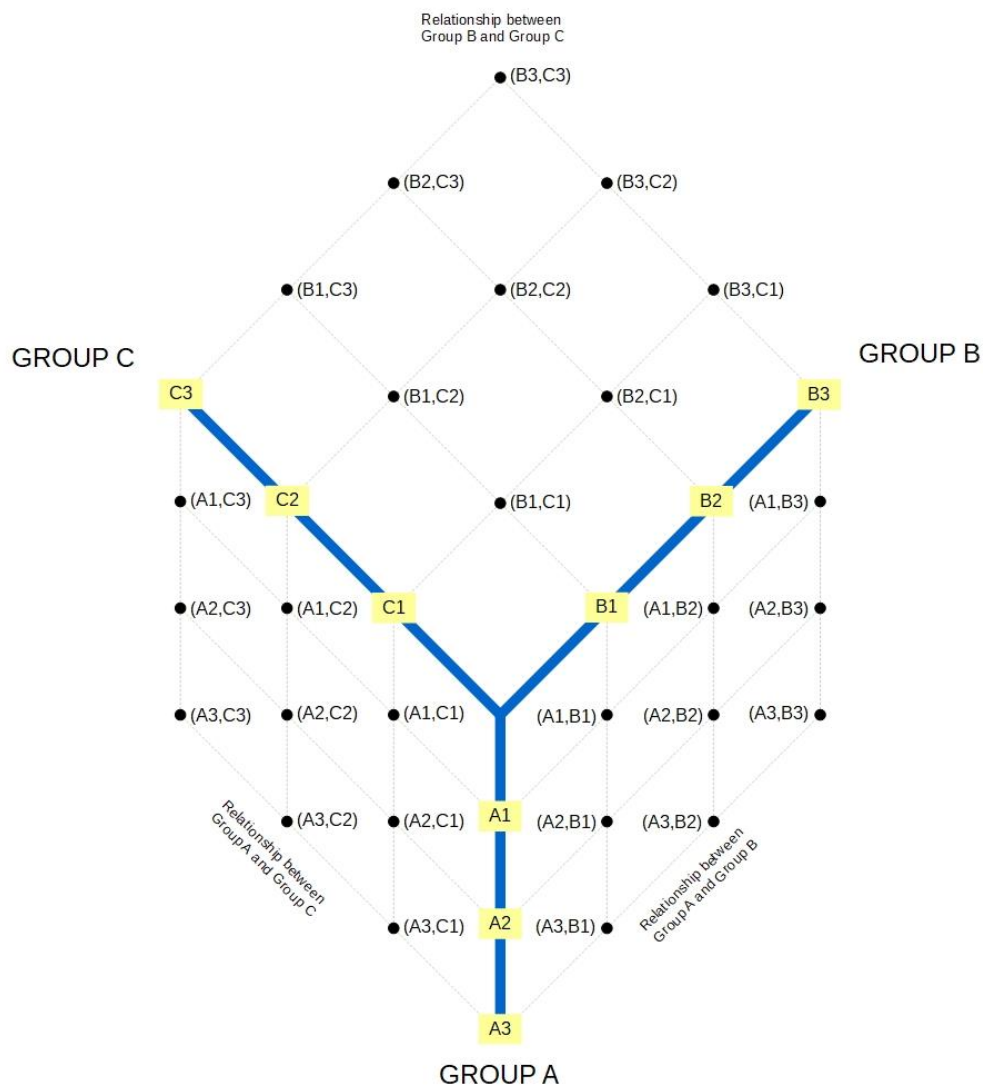


Figure 2. Y-shaped Graph

## **The Areas in Assessing the Quality of GHG Emissions Disclosure**

In recent decades, there have been several studies concerned with measuring the quality of corporate GHG emissions disclosure. For instance, Freedman and Jaggi (2005) created a disclosure index by focusing on the content of what is disclosed rather than just counting the lines of disclosure. They identified five categories for building a protocol-related disclosure index: global warming, plans to deal with global warming, potential costs to achieve global-warming objectives, current costs to reduce greenhouse-gas emissions, and current emissions. They applied weights based on their assessments to assess the success of the company's anti-global warming initiatives. Meanwhile, a plethora of information on the topic of the study was compiled into a 19-item index by Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Álvarez, and García-Sánchez (2009). They decided on an unweighted index and determined the index's components in accordance with Global Reporting Initiative (GRI) standards. Furthermore, Bo Bae, Lee, and Psaros (2013) developed a "checklist" to assess the volume of voluntarily disclosed information regarding climate change and carbon emissions in reports made available to the public.

Climate change-related aspects have been highlighted by the Carbon Disclosure Project (CDP), including risk and opportunity, accounting for glasshouse gas (GHG) emissions, accounting for energy usage, reducing GHGs, and holding people accountable for costs and carbon emissions. Using these elements, a checklist was constructed and then separated into five major areas. The weight of each item is equal. Additionally, Tauringana and Chithambo (2015) established an index of disclosure to measure GHG disclosure from corporations' annual or sustainability reports. They categorised the items into qualitative (34 items) and quantitative (26 items) disclosures. For each company in the sample, their total disclosure index score was calculated by dividing their total disclosure score by the highest possible score they could have received, and then expressing that quotient as a percentage. The newest study came from de Waard, Marra, Kranenburg, and van Oorschot (2020), who divided Tauringana and Chithambo's index into three categories: reporting, performance, and performance. This improvement enhanced the index. However, the maximum score is 59 points because they also erased one indicator. For research purposes, this study used the index of de Waard et al. (2020) as it is the most recent and comprehensive.

### **The Strategy of Emissions Disclosure**

The strategy for disclosing and measuring carbon-related information, such as symbolic, substantial, engaged, or transparent disclosure, may change based on institutional or stakeholder pressure (Herold, Farr-Wharton, Lee, & Groschopf, 2019). The symbolic disclosure could be used as a strategy if both institutional and stakeholder pressures are relatively low (Hrasky, 2011; Nye & Owens, 2008). For instance, a study of 32 businesses that took part in the UK Emission Trading Scheme between 1999 and 2002 found that their participation in carbon disclosure was motivated by symbolic goals to advance rhetorical "green impression management" (Nye & Owens, 2008). While substantial disclosure might be used if institutional pressure is stronger (Busch &

Schwarzkopf, 2013), engaged disclosure might be established if stakeholder demand is stronger (Damert & Baumgartner, 2018). The ideal action to take for businesses would be transparent disclosure, nevertheless, if institutional and stakeholder demands are both significant. For example, Kolk (2008) listed Ford, Merck, Shell, and British Petroleum (BP) as corporations with a clear strategy for transparency in carbon-related information by hiring independent consultative agencies and establishing specific board committees. However, the effectiveness of these four approaches for businesses in emerging markets has not been proven since no empirical studies have tested them; therefore, alternate strategies may be more appropriate for their circumstances.

### **The Performance of Emissions Disclosure**

Companies need to disclose performance metrics for their GHG emissions. Research has shown that disclosing this information is indicative of a company's actual carbon performance and can provide value for investors (Luo & Tang, 2014). Others have also found that investors can potentially gain abnormal returns by investing in companies that disclose information about their climate change performance and actions (Liesen, Figge, Hoepner, & Patten, 2017). Additionally, companies in industries related to greenhouse gas emissions typically disclose information about a variety of indicators related to this issue (Prado-Lorenzo et al., 2009). Meanwhile, corporations vary in their disclosure of GHG emission performance metrics. In the Conference Board research, for example, it was discovered that larger businesses disclose GHG emissions at a rate that is 2.5 times higher than that of smaller businesses (2022), with more than half of S&P 500 businesses mentioning climate risks in their annual reports, and less than one-third of S&P MidCap 400 companies do (US SEC, 2022).

Hoffmann and Busch (2008) established four indicators—intensity, dependency, exposure, and risk—to assess corporate carbon performance from both a physical and a financial flow standpoint. Carbon intensity is a measure of a company's usage of carbon in relation to its business activities and production, for a specific fiscal year and scope (p.509). It reflects the company's physical carbon performance. This indicator is crucial since it shows how much carbon the business uses during operations and its carbon footprint.

Carbon dependency compares the current carbon intensity with the anticipated carbon intensity and expresses the difference as a relative change to determine how a company's physical carbon performance changes over time (p.512). It helps to understand how much the company's carbon footprint is increasing or decreasing over time, whereas carbon exposure is a measure of the financial impact of a company's carbon usage on its business activities, for a specific fiscal year and scope (p.512). It reflects the company's monetary carbon performance and helps to understand the financial consequences of carbon usage. Additionally, carbon risk measures the financial impact of the changes in a company's carbon usage over a period (p.514). It is calculated by comparing the current carbon exposure with the predicted carbon exposure and expressing it as a relative change. This metric helps to understand how much the financial consequences of carbon usage are increasing or decreasing over time.

## **The Reporting of GHG Emissions**

High-quality environmental reporting is crucial to fully understand the effects that business has on the environment and to make informed decisions about how to decrease those effects. The quality of environmental reporting is evaluated using several factors, including credibility and relevance (Dragomir, 2012). Relevance is the usefulness of information for comprehending and resolving environmental concerns, whereas credibility is the correctness and dependability of the data and procedures used to compile the report. Environmental reports frequently lack fundamental information that is necessary for guaranteeing trustworthiness, such as a thorough explanation of data gathering, calculation, and aggregate procedures. The research conducted by Liesen, Hoepner, Patten, and Figge (2015), for example, showed that stakeholder pressure influenced the decision of 431 EU companies to disclose partial information on GHG emissions between 2005 and 2009. Despite this, a significant portion of the disclosure was found to be incomplete. Incomplete disclosures may appear to be a demonstration of their responsiveness to stakeholder pressures. However, it is important to note that this level of disclosure may not provide meaningful accountability.

Besides the procedures, criteria, and methodologies that established the data, the report on GHG emissions should disclose the total tonnes of carbon dioxide equivalents (tCO<sub>2</sub>e). Meanwhile, LoPucki (2022) conducted a comprehensive examination of the GHG emissions reports from 200 companies listed on the Standard and Poor's 500 and found several important insights. Her findings revealed that the GHG protocol was the most prevalent framework used in the reports and that most of the companies focused primarily on reporting Scope 1 and Scope 2 emissions. It is crucial to remember that reporting GHG emissions is a voluntary process, therefore businesses are not required to adhere to reporting requirements. Even though they had specifically reported on Scope 1 and 2 emissions, many of the companies in the study neglected to calculate the levels of specific gases that they left out of their reporting. This highlights a potential issue with the voluntary nature of GHG emissions reporting and the need for improved accountability and transparency in this area.

## **The Y-shape Mapping Approach in Disclosing GHG Emissions**

As was already mentioned, this study referred to the work of de Waard et al. (2020) in employing a Y-shaped graph and in mapping GHG emissions disclosure. They divided the 59 indicators into three categories of disclosure and ten subcategories as well. Four subcategories made up the category of structured disclosure: strategy and risk analysis (7 indicators), business model (3 indicators), corporate governance (2 indicators), and policies and targets (2 indicators). Overall, 14 indicators were included in this category. The performance disclosure category was further broken down into four subcategories: concrete measures and actions (3 indicators), future outlook (4 indicators), results (15 indicators), and analysis of results (7 indicators). This category had a total of 29 indicators. Meanwhile, the reporting category was separated into two subcategories: the measuring methods (7 indicators) and the reporting criteria (9 indicators). This category consisted of 16 indicators in total. Details of these indicators, categories, and subcategories are displayed in Table 1.

Table 1. The Structure of GHG Emissions Disclosure Index

Category	Subcategory	Number of Indicators	Total
"Strategy"	"Strategy and Risk Analysis"	7	14
	"Business Model"	3	
	"Corporate Governance"	2	
	Policies and Targets	2	
"Performance"	Concrete Measures and "Actions"	3	29
	Future Outlook	4	
	"Results"	15	
	Analysis of Results	7	
Reporting	Measuring Methods	7	16
	Reporting Criteria	9	
Total Indicators			59

Table 2. The Level of Disclosure

Category	Level	Value
Strategy	Inadequate	0.00 – 0.19
	Average	0.20 – 0.39
	Above average	0.40 – 0.59
	Exceptional	0.60 – 0.79
	Significant	0.80 – 1.00
Performance	Inadequate	0.00 – 0.19
	Average	0.20 – 0.39
	Above average	0.40 – 0.59
	Exceptional	0.60 – 0.79
	Significant	0.80 – 1.00
Reporting	Basic	0.00 – 0.32
	Moderate	0.33 – 0.65
	Detailed	0.66 – 1.00

Each of the indicators was given a score in order to evaluate the quality of disclosure. An indicator would receive a score of 1 if a disclosure for that indication was present, while a score of 0 would be assigned if that disclosure was not present. As a result, the indicator score could go as high as 59 or as low as 0, depending on

whether or not all disclosure indicators were present. However, this scoring system would be transformed into a proportion and calculated for each category to create levels of disclosure. With the aid of proportional computation, the inadequate level might fall between 0.00 and 0.19, the average level between 0.20 and 0.39, the above-average level between 0.40 and 0.59, the exceptional level between 0.60 and 0.79, and the significant level between 0.80 and 1.00. On the other hand, the reporting category was broken down into three levels of quality: basic, moderate, and detailed. The basic reporting level might fall between 0.00 and 0.32, the moderate level between 0.33 and 0.65, and the detailed level between 0.66 and 1.00. The details of these levels are shown in Table 2.

Moreover, Figure 3 shows how a Y-shape mapping approach can be used to translate all of the data in Table 2. The axes are all set to be the categories (i.e., strategy, performance, and reporting). Every level is set to match its range proportion value. In addition, the relationship between two categories will be represented graphically as a pair of coordinates are derived from two proportion values. It also depicts the levels at which quality disclosure takes place.

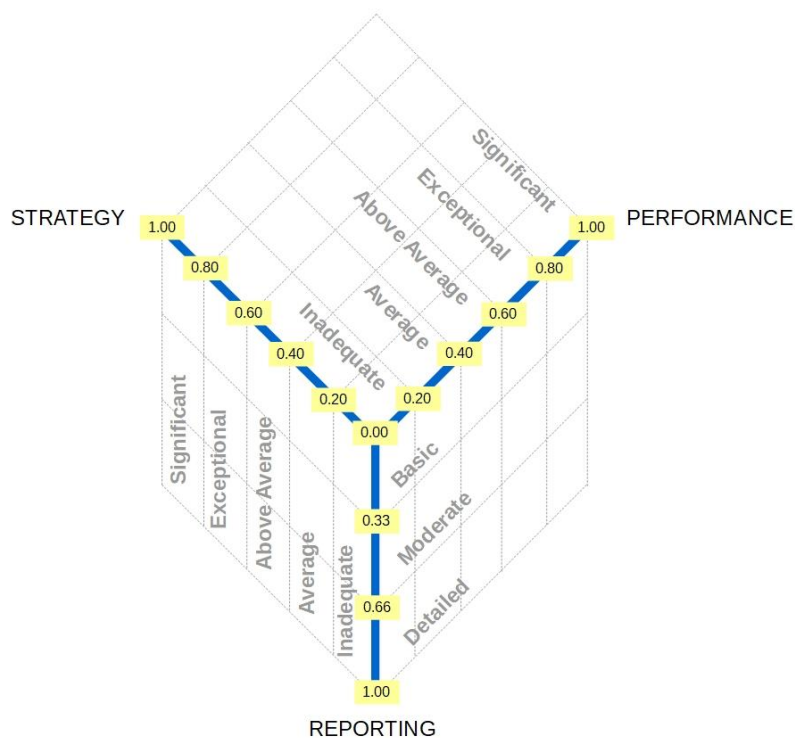


Figure 3. The Y-shape Mapping Approach

For simulation purposes, Table 3 presents the findings from evaluating a corporation's GHG emissions disclosure. “Strategy and risk analysis” (4), “business model” (1), “corporate governance” (2), and “policies and targets” (2) add up to the total score of strategy disclosure (9). Consequently, this total score is converted to a proportional value of 0.64 by dividing it by the maximum total score of the strategy category (14). Since the value of the strategy category is 0.64, the level of this disclosure is exceptional (0.60 – 0.79). Similar techniques were also used to determine the performance category, which also produced an exceptional level with a



proportional value of 0.75. The reporting category, on the other hand, had a moderate level (0.33 – 0.65) with a proportional value of 0.56. Based on all of this data, a Y-shape graph can be created to acknowledge a mapping for the GHG emissions disclosure of this company (see Figure 4). Three pairs of coordinates were also created to visualise the relationship between the strategy and the reporting (0.64, 0.56), between the performance and the reporting (0.75, 0.56), as well as the strategy and the performance (0.64, 0.75).

Table 3. The Simulation

Category	Subcategory	Score	Total	Value	Level
"Strategy"	"Strategy and Risk Analysis"	4	9	0.64	Exceptional
	"Business Model"	1			
	"Corporate Governance"	2			
	Policies and Targets	2			
"Performance"	Concrete Measures and "Actions"	2	22	0.75	Exceptional
	Future Outlook	3			
	"Results"	10			
	Analysis of Results	7			
Reporting	Measuring Methods	4	9	0.56	Moderate
	Reporting Criteria	5			

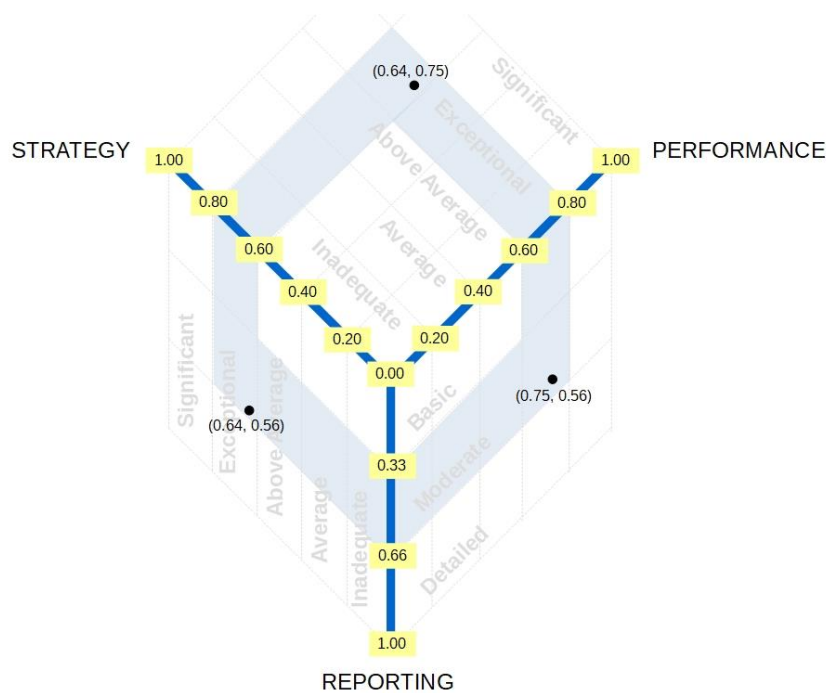


Figure 4. The Simulation of Y-shape Mapping

## Discussion

Focus on lowering carbon emissions and lessening the effects of climate change has increased in recent years. Numerous studies have demonstrated that businesses have a sizable impact on global carbon emissions (Dietz et al., 2018; Dietz, Gardiner, Jahn, & Noels, 2021; Ducoulombier, 2021). As a result, academics and decision-makers have been thinking about how to get businesses to disclose their emissions more accurately and to take action to lower their carbon footprints. Firms will be held responsible for their environmental impact when this information is made available, and stakeholders will be better equipped to choose the firms they should support. Meanwhile, emissions transparency has been evaluated traditionally using table formats, which detail emissions data in a structured and standardized way. (Bo Bae et al., 2013; de Waard et al., 2020; Freedman & Jaggi, 2005; Prado-Lorenzo et al., 2009; Taurigana & Chithambo, 2015). However, this approach has limitations and may not be the most effective way to communicate information to stakeholders. In this context, this study proposed an alternative approach called the Y-shape mapping approach. This approach uses graphical representations to present emissions data in a more intuitive and accessible way. This approach could be an alternative to shifting from the conventional method of examining emissions disclosure.

Furthermore, the quality of category disclosures can vary depending on their level. It is clearly demonstrated through the Y-shape mapping approach discussed in the preceding sections. By visually representing the category, it becomes easier to identify any inconsistencies or shortcomings. The Y-shape mapping approach can help to highlight any areas that may require improvement and allow for a more comprehensive understanding of the category being disclosed. As such, utilising graphical representation can greatly enhance the quality of disclosures at various levels to increase transparency and accountability, and promote more informed decision-making among stakeholders.

For instance, even though the company is at an exceptional level in the other two categories, the simulation findings in Figure 4 indicate that the company receives a moderate level for its reporting category. Therefore, the company needs to focus on enhancing its reporting category and ensuring that its emissions information is described comprehensively. Stakeholders will receive a concrete disclosure of their measuring methods and an explanation of the standard that they used in reporting. This summary will pop up easily when a Y-shaped graph shows its mapping. However, it can be a bit challenging to capture the summary briefly if the assessment results are shown in a table.

The Y-shape mapping method also sheds light on the potential interactions between the three categories at once. When stakeholders seek to understand the importance of these categories in terms of reducing companies' emissions, this feature might be essential. Figure 4 shows how three different coordinates connected might result in a distinct pattern. Stakeholders can receive a preliminary picture of the company's emissions disclosure based on this pattern, whether it practises hard disclosure or soft disclosure. If the pattern relates to high-quality levels of disclosure, it can be concluded that the company discloses detailed information about its carbon impact and

reduction strategies. On the other hand, if the pattern indicated low-quality levels of disclosure, it can be concluded that companies may provide only the bare minimum of information required to comply with regulations. Hence, this unique pattern would be a beneficial insight for investment decisions, regulatory compliance, and other business practices, ultimately promoting more sustainable and responsible corporate behaviour.

## Conclusion

The key point of a Y-shape mapping approach is that it is a graphically effective way of disclosing GHG emissions. This study provides conceptual explanations for why this approach can be an effective method. In this case, the Y-shape mapping approach makes it possible to simplify complex evaluation results if linking three different categories of disclosure is needed, whereas it is commonly found challenging to capture them in table format. It is because the approach provides a clear visual representation of the relationships between them. Thus, this method can be useful for stakeholders who need to quickly understand a company's emissions disclosure. By presenting the information in a clear and concise manner, stakeholders can receive key information briefly, helping them to develop an initial picture of the company's emissions disclosure.

Overall, this study contributes to suggestions for a new strategy to improve the quality of emissions disclosures by using a more user-friendly and accessible visual representation of emissions data. It also shows how this strategy may benefit stakeholders and encourage more ethical and sustainable corporate behaviour.

## Recommendations

The following are some potential recommendations for future research:

1. More research is needed to determine the effectiveness of different methods of emissions disclosure, including the Y-shape mapping approach. Studies should compare different approaches to emissions disclosure and assess stakeholders' comprehension and decision-making based on the different methods.
2. The Y-shape mapping approach has the potential to enhance the quality of emissions disclosures, providing a more comprehensive and intuitive understanding of emissions data. More research is needed to determine how this impacts stakeholders' decision-making, such as investment decisions or regulatory compliance.
3. The Y-shape mapping approach uses graphical representations to present disclosure levels of information in an intuitive and accessible way. Future research should investigate how stakeholders use visual representations to make decisions and how different visual representations may impact their decision-making.
4. The Y-shape mapping approach has advantages over traditional table formats but may have

limitations that need to be further explored. For example, it may not be suitable for all types of emissions data or stakeholders. Future research should investigate the potential limitations of this approach and identify strategies to overcome them.

- Investigate the impact of emissions disclosure on corporate behaviour to reduce carbon footprints and promote more sustainable and responsible corporate behaviour. More research is needed to determine how emissions disclosure impacts corporate behaviour and what factors contribute to successful emissions reduction strategies.

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## Variant Alleles and Tri-allelic Patterns Observed in Short Tandem Repeat (STR) Typing of Albanian Population

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**Abstract:** During STR typing, it sometimes happens that increasing or decreasing signal length can bring variant alleles into the size range of a locus close to it. Examples of these alleles are often reported in the literature and are also stored in STRbase. When the allele overlaps with an allele adjacent to it, the situation becomes more problematic. The kits available are designed to avoid such problems called "out of phase" in relation to the repeat units. The aim of this study is to identify and report these rare, off-ladder alleles, triallelic and other genotyping irregularities related to the rare population genetic variation observed in STR of Albanian population. DNA was extracted from saliva swabs relating to reference samples from a sample of 2000 individuals from Albanian population, and typed using Applied Biosystem AmpFLSTR™ NGM Select™ kit. There were 6 distinct off-ladder alleles observed in 4 of the 16 STR loci (D2S1338, FGA, SE33 and D2S441), of which 1 have not been previously reported. Furthermore, 17 instances of triallelic patterns were observed in 6 of the 16 loci. The recognition and identification of these rare alleles, helps to solve specific situations and has a special importance in cases of paternity tests.

**Keywords:** STR loci, Off-ladder alleles, Forensic, Albania

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### Introduction

Albania is a small country in Southeastern Europe and Western Balkans, strategically positioned on the Adriatic and Ionian Sea. In the northwest, it is bordered by Montenegro, in the northeast by Kosovo, in the east by North Macedonia, and in the southeast by Greece. The current population in Albania is 2,868,593 based on Worldmeter elaboration of the latest United Nation data (June 2023). In Europe and other countries in the world, there are many Albanians, but this study did not include them. The purpose of this study was to provide a



comprehensive list of off-ladder alleles and other genotyping irregularities observed in short tandem repeats (STR) for the Albanian population. In forensic genetics and human identity testing, PCR followed by capillary electrophoresis (CE) remains the gold standard. As part of commercial kits for forensic short tandem repeat (STR) multiplexes, allelic ladders are included to assist the user in determining alleles by reproducing any common allelic variants observed in the population (Griffiths RA, Barber MD, Johnson PE, Gillbard SM, Haywood MD, Smith CD, *et. al.*, 1998). Allelic ladders are based on variation observed in the development process. In large population samples, however, variants not detected in developmental screening are encountered. This is particularly true when the populations under testing differ from those studied during kit development.

Forensic practitioners need to be aware of the possibility of rare variants, so they can be recognized and dealt with properly in casework interpretation. A variant allele can sometimes greatly enhance the discrimination power of DNA comparisons if it is designated correctly (Allor C, Einum DD, Scarpetta M *et. al.*, 2005). The possible reasons for new length variants not represented on the allelic ladder are insertion or deletion of full repeat units, of partial repeats or of single bases. The most common cause of length variants that differ significantly from those in the allelic ladder are insertion or deletion of full repeat units and when this happens it can create an allele with a noticeably different length. Partial repeats can insert or delete within the tandem repeat region, leading to alleles that are slightly longer or shorter than the nearest ladder allele. Insertion or deletion of partial repeats and/or single are known also as a microvariant (Allor C, Einum DD, Scarpetta M *et. al.*, 2005; Mizuno N, Sekiguchi K, Sato H, Kasai K *et. al.*, 2003; Heinrich M, Felske-Zech H, Brinkmann B, Hohoff C *et. al.*, 2005; Grubwieser P, Mühlmann R, Niederstätter H, Pavlic M, Parson W *et. al.*, 2005). In some cases, alleles that differ significantly in length from those on the original allelic ladder can end up overlapping or falling within the allelic ladder of an adjacent locus (Heinrich M, Felske-Zech H, Brinkmann B, Hohoff C *et. al.*, 2005; Grubwieser P, Mühlmann R, Niederstätter H, Pavlic M, Parson W *et. al.*, 2005). This could lead to confusion and misidentification of the alleles. So it's important to consider this potential source of confusion, especially when interpreting new or atypical length variants. So it's important to consider this potential source of confusion, especially when interpreting new or atypical length variants.

Triallelic patterns (Lukka M, Tasa G, Ellonen P, Moilanen K, Vasiljev V, Ulmanen I *et. al.*, 2006; Clayton TM, Guest JL, Urquhart AJ, Gill PD *et. al.*, 2004; Rolf B, Wiegand P, Brinkmann B *et. al.*, 2002) can arise due to several different mechanisms such as post-zygotic length mutations, localized duplication and chromosomal trisomy. Post-zygotic length mutations occurs when a length mutation arises and segregates during an individual's development. This can produce two distinct populations of cells with different alleles at a given locus. When DNA is sampled from multiple cell types, a triallelic pattern can result. Localized duplication refers to a duplication of a chromosomal region containing the locus of interest can produce three possible alleles: the original allele and two copies of the duplicated allele. Chromosomal trisomy refers to individuals with certain types of chromosomal trisomies, such as trisomy 21, can show triallelic patterns at loci located on the trisomic chromosome. This is because there are three copies of the chromosomal region, and thus three possible alleles. Determining the most likely cause in a given case would require further analysis and genetic testing.

The data used for this study are obtained in Institute of Scientific Police in Albania which is the only organization performing DNA analysis for investigation purposes. The DNA analyses started in 2009 and the DNA typing for database purposes is an ongoing process based on the actual legislation. We present here a list of off-ladder alleles and instances of triallelic patterns that have been observed in a subset of the 2000 albanian individuals profiles obtained saliva sample reference.

## Method

Saliva swabs from 2000 unrelated individuals from all over Albania are used for obtaining the STR data. These STR data are evaluated for the presence of variant alleles for this study. All the samples used for the study are anonymized, no personal data are recorded, only the name of the city and a barcode. When variant alleles were tabulated, they were checked to determine if they appear in the same city. To estimate allele frequencies (relating to the chance that a randomly selected allele from the population will match the variant), the number of unique (unrelated) occurrences was divided by 4000 “unrelated” alleles.

### *DNA Extraction from Saliva Swabs*

DNA from reference samples was isolated from saliva swabs using QIAamp DNA Investigator Kit for extraction. The kit combines the selective binding properties of a silica-based membrane with flexible elution volumes between 20 and 100  $\mu$ l, in our case the final volume of extracted DNA is 50  $\mu$ l, DNA is eluted in buffer ATE. Manual and robotic extraction with QiaCUBE were performed, dividing the total samples in half 1000 manual and 1000 robotic extraction. Both methods were performed according to the manual of the QIAamp DNA Investigator Kit for saliva samples.

### *STR Typing*

The commercial STR kit used for this study is Applied Biosystem AmpFLSTR™ NGM Select™ kit (Thermo Fisher) a five dyes kit which simultaneously amplifies 16 separate STRs: D3S1358, vWA, D16S539, D2S1338, D8S1179, D21S11, D18S51, D19S433, TH01, FGA, D10S1248, D22S1045, D2S441, D1S1656, D12S391 and SE33 and the sex determining marker Amelogenin. All the off-ladder alleles and triallelic patterns cases are re-extracted and re-amplified with the same pcr kit or alternative pcr kit. PCR reactions using mix and primers according to following changes-reaction volumes were halved and the final volume of PCR product is 12.5  $\mu$ l.

Reference samples were amplified with Applied Biosystem AmpFLSTR™ NGM Select™ kit (Thermo Fisher) in Veriti™96-Well Thermal Cycler according to manufacturer’s guidelines. After the validation of the kit we perform 29 cycles for buccal swabs, but the number of cycles can differ from a laboratory to another depending on sensitivity experiment results for internal validation purposes.

*Electrophoresis and Analysis*

Fragment separation was performed using ABI PRISM® 3500 Genetic Analyzer (Applied Biosystems) using POP-4 polymer and the collection software Data Collection, version 2.0. Data was sized using GeneMapper™ID-X Software version 1.5 (Applied Biosystems). All off-ladder alleles and triallelic patterns were confirmed by re-extraction and amplification with the same kits or alternative pcr kits. Results obtained after re-extraction and re-amplification re-confirmed the off-ladder alleles and the composition of triallelic patterns.

**Results**

There were observed 6 distinct off-ladder alleles in 4 of the 16 STR loci (D2S1338, FGA, SE33 and D2S441) amplified from the AmpFLSTR™ NGM SElect™ kit. Of these 6 alleles, 1 have not been previously reported. Furthermore, 17 instances of triallelic patterns were observed in 6 of the 16 loci.

**Off-ladder Alleles**

A total of 6 off-ladder alleles were observed in a subset of saliva swabs- reference samples from 2000 unrelated individuals. The off-ladder alleles and the loci are presented in Table 1.

Table 1. Off-ladder Alleles Identification and Designation

Locus	Anomaly type	Locus designation
FGA	Off-ladder, rare	15,24
FGA	Off-ladder, rare	15,20
FGA	Off-ladder, rare	15,22
FGA	Off-ladder, rare	15,22
SE33	Off-ladder, rare	27.2,43
SE33	Off-ladder, rare	23.2,42
D2S4	Off-ladder, rare	6,12
D2S4	Off-ladder, rare	8,14
D3S1338	Off-ladder, rare	13,18

The estimated frequency for the off-ladder alleles in shown in Table 2.

Table 2. Number of Observation and Frequency

Locus	Allele	No of observation	Frequency
FGA	15	4	0.001

D2S4	6	1	0.00025
D2S4	8	1	0.00025
D2S1	13	1	0.00025
SE33	42	1	0.00025
SE33	43	1	0.00025

In the SE33 loci were identified two off-ladder alleles 42 and 43, in D2S1 also two rare alleles 6 and 8, in D2S4 one allele 6, in FGA loci is identified four times the rare allele 15. An example of rare allele 13 in D2S1 locus is shown (see Figure 1), where the peak fall between D16 and D2S1.

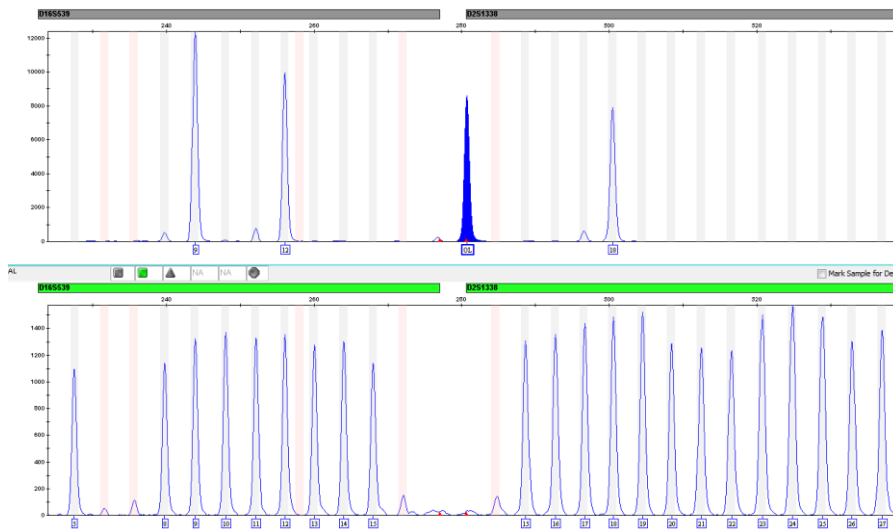


Figure 1. Off-ladder Allele 13

NIST National Institute of Standards and Technology U.S. Department of Commerce								
STRBase (SRD-130)								
HOME	UPDATES	INFO	Human STRs	Other Markers	Resources			
				Metropolitan Police Department Crime Lab				
13 [11]	232.41	ABI 3500	PP21	Massimo Mangiola, Rhode Island Blood Center	Re-amplified & re-analyzed	Immigration case (four CH in same family)	4	in 2730
13 [12]	280.75	ABI 3500	NGM SElect	Ela Zaimi, Institute of Scientific Police Albania	Re-amplified and re-analysed	The peak fell in between D16 and D2S1338	1	
14	302.50	ABI 3100	ID	Marsha Garcia, Orchid Cellmark, Nashville TN	Re-extracted			
14 [2]	303.85	ABI 310	ID	Demeter József Szabolcs, Popescu Octavian, Molecular Biology Center, Interdisciplinary	Re-extracted and re-amplified			1 of 424

Figure 2. Photo from STRbase.nist

The off-ladder alleles were searched in the STRbase for confirming that they were present in other populations studied. It resulted that allele 43 is not yet reported in this STRbase, but it can be found in other populations which has not yet reported it. The allele presented in fig.1 allele 13 of D2S1338, was reported in STRbase previously and our reportation was for the 13-th time (see Figure 2).

### Triallelic patterns

A total of 17 three allele patterns were observed in our study, involving the following six loci: SE33, vWA, D21, D2S4, D18 and FGA (see Table 3). The loci with the highest rate of triallelic bands include SE33 (7 cases), vWA (3 cases), and D21 (3 cases). There is a combination of three alleles in SE33 and in vWA which are repeated two times. We controlled if the samples were collected in the same area, but they were from different areas.

After the first observation of a third allele in a loci, as a working procedure there is a second re-pcr and then a re-extraction. For the purposes of this study regarding the concentration of extracted DNA (Gavazaj FQ, Mikerezi II, Morina VH, Cakaj FA, Maloku EB, Gavazaj BB, Kastrati DS, Muriqi-Maloku BA *et al.*, 2012), different dilutions of extracted DNA were used for PCR reactions. Analyzing multiple dilutions of extracted DNA is an important quality control step to confirm true allelic patterns, especially triallelic patterns. Different dilutions of the extracted DNA are useful because they can reveal if suspicious allele peaks are present due to factors like excess PCR products or contaminants. These suspicious peaks may disappear at higher dilutions. By performing different dilutions we can confirm true heterozygote or triallelic patterns, which will remain consistent across dilutions. Different dilutions can identify allele drop-out, where one allele fails to amplify properly. This will appear inconsistently across dilutions. All the triallelic patterns shown in table 3, were present in dilutions until 1:100. One case of triple in FGA locus in dilution 1:100 is shown in figure 3.

Table 3. Triallelic Patterns Identification and Designation

Locus	Anomaly type	Locus designations
SE33	Third allele	14,16,27.2
SE33	Third allele	14,16,27.2
SE33	Third allele	17,31.2,32.2
SE33	Third allele	21.2,22.2,25.2
SE33	Third allele	18,32.2,33.2
SE33	Third allele	15,29.2,30.2
SE33	Third allele	18,19,31.2
vWA	Third allele	16,17,18
vWA	Third allele	16,17,18
vWA	Third allele	16,19,20
D21	Third allele	28,32.2,33.2

D21	Third allele	30,31,33.2
D21	Third allele	29,30,31
D18	Third allele	16,17,18
D18	Third allele	14,16,17
FGA	Third allele	23,24,25
D2S4	Third allele	11,12,14

SE33 has long been a locus of interest to the human identity community. The highly polymorphic and heterozygotic nature of SE33 provides a more discriminating genotype, but these advantages are tempered by technical genotyping/separation issues, a complex sequence motif and a high mutation rate (Borsuk LA, Gettings KB, Steffen CR, Kiesler KM, Vallone PM *et al.*, 2018). SE33 is also known to have an elevated frequency of triallelic variants and there is currently no clear evidence that these variants have any important functional consequences. More targeted studies would be needed to determine if the triallelic variants in this region could impact nearby gene regulation or have other functional effects.

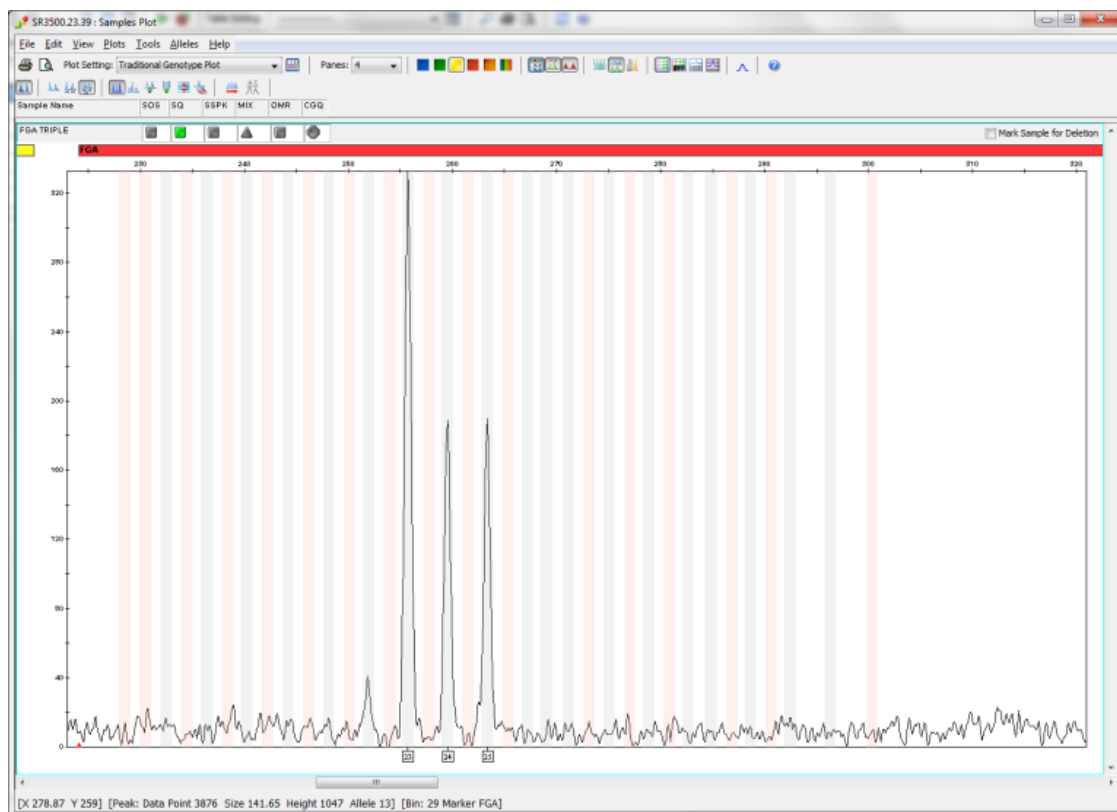


Figure 3. Triple FGA in Dilution 1:100

## Discussion

In this study a total of 6 distinct off-ladder alleles and 17 triallelic patterns were observed in profiles amplified using the AmpFLSTR™ NGM Select™ kit. These 6 off-ladder alleles observed in Albanian population, are

found in 4 of the 16 STR loci respectively in D2S1338, FGA, SE33 and D2S441. Of these 6 alleles, 1 has not been previously reported in STRbase allele 43 in the SE33 loci. In the SE33 loci were identified two off-ladder alleles 42 and 43, in D2S4 two off-ladder alleles 6 and 8, in D2S1338 one off-ladder allele 13, in FGA loci is identified four times the off-ladder allele 15. Except allele 15 in FGA, all the other alleles has a nominal frequency of 0.00025 (Table 2). The most observed off-ladder alleles is 15 in FGA - 4 times, with a value of frequency 0.001. FGA known also with the historic name FIBRA is located in chromosome 4, with the cytogenetic location 4q31.3, with the mutation rate of 0.28% (<http://www.cstl.nist.gov/biotech/strbase/>).

Allele 13 of D2S1338 was reported 12 times in STRbase amplified with different amplification kits, with NGMSelect is reported for the first time.

A variant allele can sometimes take up the size range of an adjacent locus if its length increases or decreases; several examples have been reported in the literature (Heinrich M, Felske-Zech H, Brinkmann B, Hohoff C *et al.*, 2005; Grubwieser P, Mühlmann R, Niederstätter H, Pavlic M, Parson W *et al.*, 2005) or in STRbase. This is most problematic when the allele falls within an allelic bin from the adjacent locus. Multiplex kits are generally designed to avoid this problem by ensuring that adjacent loci are out of phase with respect to full repeat units, so that off-ladder alleles from one locus are not mapped to the adjacent locus' allele bins. This helps to ensure accurate results, as allele bins from one locus will not overlap with allele bins from the adjacent locus. This helps to prevent misidentification of alleles, and allows for more accurate genetic analysis and profiling.

Rare alleles can play an important role in forensic identification and differentiating between individuals. Some of the reasons why their role is important are higher power of discrimination, increased sensitivity, account for genetic variation. Higher power of discrimination is related with the presence of rare alleles at certain loci that have a higher power of discrimination, meaning they are better able to differentiate between unrelated individuals. This is because by definition, rare alleles occur less frequently in the general population. So seeing the same rare allele in two individuals provides stronger evidence they may be related. Increased sensitivity is related with the fact that inclusion of rare alleles can increase the sensitivity of forensic matching by allowing for the detection of more unique DNA profiles. This improves the ability to distinguish between similar profiles from unrelated people.

Rare alleles represent the full spectrum of genetic variation present in a population. Including them in forensic databases and analyses helps account for the full spectrum of alleles that may occur. Also rare alleles may be the only matching feature between two otherwise unlikely individuals, such as distant relatives. Their rarity makes a match more convincing evidence of a biological relationship. And sometimes matching rare alleles can inform the need for additional confirmation testing, such as forensic genealogy or Y-STR profiling for distant relatives. Rare alleles can also play an important role in paternity testing, sometimes the presence of matching rare alleles between a child and alleged father can provide insight into inheritance patterns and recombination events, strengthening inferences about paternity. In terms of rare alleles the off-ladder alleles are specifically rare and that fact impacts on the work of forensic fields and it is important to know their presence in a certain population.

Triallelic patterns are classed in two types. Type I occurs when an allele is somatically mutated during an individual's development, resulting in cells containing some of the original allele and some of the mutant allele. These patterns are characterized by uneven peak heights for the two variants of the affected allele that sum to the height of an unmutated allele (see Figure 3). All triallelic patterns observed in this study were type I as for most of the cases the height of one of the peaks was approximately the sum of two other peaks. In two cases we had the situation where the ratio of the peaks were different although re-processing and for these two cases other testings as amplifying with different kit, might be done to conclude about the height ratios.

Multiple alleles often appear with equal heights in Type II as a result of a localized duplication event, or chromosomal aneuploidy (Clayton TM, Guest JL, Urquhart AJ, Gill PD *et. al.*, 2004; Findlay I, Tóth T, Matthews P, Marton T, Quirke P, Papp Z *et. al.*, 1998). The Y-chromosome has a higher rate of localized duplication than the autosomes (Butler JM, Decker AE, Kline MC, Vallone PM *et. al.*, 2005). For confirming the inheritance of duplicated alleles responsible for Type II triallelic patterns, the parents should also be typed. Autosomal trisomy is another reason for type II patterns. Some of the cases involving autosomal trisomy can be detrimental to the health of the developing fetus. But there are cases of aneuploidy involving chromosome 13, 18, and the most common, 21, result in live births (12). STR analysis can be helpful in diagnosing some trisomies (Findlay I, Tóth T, Matthews P, Marton T, Quirke P, Papp Z *et. al.*, 1998; Hassold TJ, Jacobs PA *et. al.*, 1984; Yan J, Wu J, Li Y, Wang H, Huang Z, Zhou X, *et. al.*, 2006).

Having an extra copy of a chromosome means there will be an increased number of repeats for STRs on that chromosome. This can be detected through STR analysis. By comparing the STR profile of a potentially trisomic individual to a normal control, the extra repeats associated with the trisomy will be evident. STR analysis provides a rapid and relatively inexpensive screening method to indicate the possible presence of a trisomy. In some cases, if the location of the extra STR repeats can be linked to a specific chromosome, it can help pinpoint which chromosome is involved in the trisomy. While STR analysis alone cannot definitively diagnose a trisomy, it can provide useful information and clues that a trisomy may be present. The STR results typically need to be confirmed through other tests like chromosomal microarray analysis or karyotyping to determine the specific trisomy (Petersen MB, Mikkelsen M *et. al.*, 2000). But STRs can be a useful first-line screening tool as part of a comprehensive diagnostic evaluation.

## Conclusion

In this study we present an overview of distinct off-ladder alleles in our population. The recognition and identification of these rare alleles, helps to solve specific situations and has a special importance in cases of paternity tests and in forensics. This study also helps us shed light on the specifics of the genetic structure of our population, bearing in mind the specific structure that the Albanian population presents and the need that still needs to be explored (Xhetani *et. al.*, 2014; Mikerezi *et. al.*, 2003). All off-ladder alleles and triallelic patterns discussed in this paper will be uploaded to STRbase.



## Recommendations

Genetic structure of a certain population might represents small changes in terms of evaluating several parametres when it is studied in different periods of years and these changes needs to be studied taking in consideration factors that impacts. We recommend that all the off ladder alleles and triallelic patterns once identified, should be re-pcr with different commercial kits containing the same loci or the same kit as least twice and we strongly recommend to upload all the findings in STRbase. The identification of these irregularities in population might be very helpful in specific areas of usage.

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## Performance Evaluation of Solar Shading & Night Ventilation at An Eco-Sensitive Home, Baitykool-Dubai, UAE Designed for The Extreme Warm Climate of United Arab Emirates

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**Abstract:** The windows and doors facing the exteriors on envelope systems of a building are an important source of light and ventilation but become a point of solar heat gain. The size of openings, the operation of shutters for ventilation, orientation, glazing type, and the material of windows and doors influence the solar heat gain and lighting levels indoors. Shading and its integration in the design of envelope systems for openings become effective in reducing the solar heat gain and create the potential to the reduction of cooling load requirement and reduce glare indoors. The paper aims the study and discussion on experiments on solar shading and natural night ventilation at the Baitykool prototype a 90 sq. M eco-responsive, energy-efficient, solar-powered prototype house designed and built for the Solar Decathlon Middle East 2018 presently functioning as a living lab located at The Sustainable City Dubai. Experiments were conducted under varied scenarios of solar shading and natural ventilation using different types of shading devices and architectural actions for external-facing windows, doors, and ventilators under passive conditions to analyze the effectiveness of the thermal

comfort condition and potential of energy saving for cooling the house indoors with the use of solar shading for external facing doors and windows. The benefits of natural ventilation at night are analyzed to improve the air quality and temperature indoors taking advantage of lower outdoor temperatures. The data collected for specific dates of the experiment and hours of the day based on the experiments and architectural actions analyzed and results discussed to understand the benefits of night ventilation and cross ventilation on indoor air quality. The potential for a reduction in the use of air conditioning systems to cool the indoors during the day helps develop the annual cooling strategy with potential energy-saving measures.

**Keywords:** Solar Shading, Night Ventilation, Thermal Comfort, Energy Efficiency

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## Introduction

Buildings are high consumers of energy due to the cooling demand required to maintain thermal comfort conditions in extremely warm climates. The high solar heat gain contributes to overheating of indoor spaces during the day caused due to solar transmittance, heat transfer from surfaces and poor solar shading strategies for openings and facing exteriors in building. The design of envelope system, orientation of opening, its size, glazing type with shading devices can minimize solar heat gain for openings and opaque surfaces and improve the thermal comfort condition of indoors without compromise of day lighting factors (Dudzinska, 2021). The use of internal and external solar shading with appropriate strategies can create minimized cooling loads and is valuable for the challenging environments, shading becomes a powerful tool to reduce overheating. A reduced cooling hours by 4% reduction was discovered with shading devices using simulation studies with IESVE (Mamdooh Alwetaishi, 2021). Dynamic solar shading with venting strategies can reduce overheating at indoors evaluated in accordance with adaptive thermal comfort model with the dynamic shading providing user the control to the indoor environment (Gunnlaug Cecilie Jenson Skarning, 2016). Responsive building envelopes (RBEs) with the smart windows controls the light and heat flux based on users defined program (Rosa Francesca De Masi, 2022). Just adopting to materials and construction technology for energy efficiency is not sufficient, its important to integrate appropriate automation systems to achieve enhanced performance for energy saving with building automation and control systems (TAC) and technical building management (TBM) to be integrated at the design phase (Pawel Kwasnowki, 2017). The developed framework of window opening and closing strategy and the operation of shading device type to perform solar shading can work with adaptation of AI based technology and BAC & TBM systems. The control of windows and natural ventilation has significant benefits on adding thermal comfort with passive cooling (Vijayalaxmi & Sekar, 2011). A significant

correlation has been found between the solar heat gain, day lighting and access of sun light in to the building. Alteration is required with different shading angles and sun control measures based on the orientation of buildings in the hot region when analyzed using simulation using grasshopper code gave positive results achieved with use of smart shading and smart arduion system with specification of shading device to maintain the desired indoor temperature at different times of the day. The orientations had varied priority for the shading devices (Mamdooh Alwetaishi, 2021). The dymanc solar shading showed flexible solution for reduction in time of operative temperature exceeding the adaptive thermal comfort limits with sufficient day lighting at indoors but has variable requirement with window opening size to floor area ration for cold climate zone with need for heating (Gunlauge Cecilie Jenson Skarning, 2016). The solar shading solutions cannot be considered in a universal way at a global level and needs to consider the cliomatic zone, orientation and the contextual setting the movable shading lamena with inclination depending on suns angle of incidence and brise-soleils with appropriate overhand create solar protection. Incorporating overhangs, roller blind shading used together get favourable results with attempted research on various shading strategies shows passive protection as an effective method to reduce solar heat gain blocking the solar radiation to interiors and effectively cooling the building and improving the energy efficiency of the building. Natural night ventilation has potential to reduce th accumulated heat gain by solar and internal energy (Dudzinska, 2021). The desirable micro climate at indoors vary between winter and summer and buildings needs to meet the thermal comfort throughout the period of climate warming. A study of passive school building shows the operation of opening of windows, lowering of roller shutters and controlling air movement and flow by the occupants can have effect on increase or reduction of internal temperature. It is important to have forms of shading devices and night ventilation strategies combined with high thermal inertia in building structure. Only carrying out solar shading could reduce the cooling load but do assure the achievement of thermal comfort. This is associated with the users of the indoors facilities and their activity, dressing, gender, age and acceptance level to comfort codition levels. Conventionally in passive buildings natural night cooling, heat exhangers are desirable during summers to reduce discomfort with lowered temperature at night and cool temperature retained for the next hot day (Rajagopalan & Luther, 2013). This is the simplest and cheapest way to reduce the internal temperature low energy reliance and cost. But this strategy depends on the local climatic conditions and with the diference in indoor and out door temperature, wind speed, direction, orientation of building, its windows, thermal inertia of buildings, the thermal mass, ventilation system. A number of studies are conducted on the influence of night ventilation in shaping the thermal comfort during summers and have shown reduction in cooling load by 40% and 30% of energy consumption a narrow office building in great Britain with high mass. The use of mechanical night ventilation showed improvement in predicted mean vote for comfort measurement at University of La Rochelle This shows that climatic condition and air flow rate has an impact on this type of cooling. Moderate climate with large fluctuation in daily temperature is the most favourable for application of natural ventilation during the summers. The minimum difference in diurnal temperature recommended is 10-12K. Aso there is reduction of cooling potential due to urban context and reduced wind speed. Another research in energy efficient office building in Belgium showed night cooling more effective than ground air heat exchanger for the simulation analysis results of thermal comfort (Anna Dudzinska, 2021).

The built environment, building design, materials, and construction technology in the UAE have a fast pace of development to cater to the needs of the urban population. However, its architecture shows a poor response to the local context and climate of the region. A serious concern prevails in the way buildings are disconnecting the inhabitants from nature and the context of the place. The hot climate prevails for more than six months of the year with hot, sunny during the day, and cold by night, the desert region apart from the summer seasons has cool winters, springs, and autumn seasons. The contemporary buildings in UAE use large glazed walls with fixed glazing and the indoor comfort conditions have a full dependency on the air-conditioning across the year making the building highly energy reliant. The residents use about 550 liters of water and 20 to 30 kilowatt-hours of electricity a day and as the economy grows, the energy demand is expected to increase by 9 percent annually. UAE consumes 220-360 kWh/Sq. m / year in the present scenario, with the use of appropriate design strategies the energy efficiency has the potential to improve to 110-160kWh/Sq. m/ year. There is a need for design intervention and research with Bioclimatic architecture suited for the warm climate with the use of passive and active strategies.

The article attempts to find answer to the potential of improving thermal comfort conditions at indoors using solar shading and natural night ventilation in low rise residential building in warm climate. Experiments conducted to analyze the change in temperature, relative humidity and air quality, the factor that impacts indoor thermal comfort condition. The objective of the study is to understand the performance of solar shading for the windows & doors facing exteriors to improve the thermal comfort conditions of indoors. Analyze the thermal comfort conditions with the varied architectural actions like opening and closing of shading devices, windows and doors at times of the day and night. Investigate the potential of night ventilation for the indoors from the Patio. Evaluate the effect of natural ventilation at night on temperature, relative humidity & Air quality at indoors. Examine energy conservation strategies for reducing use of cooling unit with the adaptation of passive strategies to maintain the thermal comfort condition at indoors. The assessments carried out at the Baitykool living lab with and without occupancy and data acquisition done on the parameters under varied architectural actions.

### **The eco-sensitive home Baitykool living lab as a tool for experimentation**

The eco-sensitive, energy efficient prototype house Baitykool as shown in images Fig.1 was designed and constructed for the Solar Decathlon Middle East 2018 and the winning entry for the competition commissioned at the Sustainable City Dubai (TSC), UAE. The prototype designed for the warm climate works with innovative systems to conserve and produce solar energy to sustain the house function, recycle water, use radiative sky cooling to enhance the thermal comfort of indoors, biological water filtration system, architectural design and strategies suiting to warm climate, specifically designed envelop system, sustainable materials and construction technology which could be referred in the article (Samuel A. K., et al., 2020). The functional prototype is the living laboratory with experiments conducted on the performance of the designed bioclimatic strategies, thermal comfort conditions, the aquaponics system, biologic water filtration, radiative sky cooling and solar energy systems. The prototype is a self-sustaining eco-responsive habitat designed for the extremely hot climate

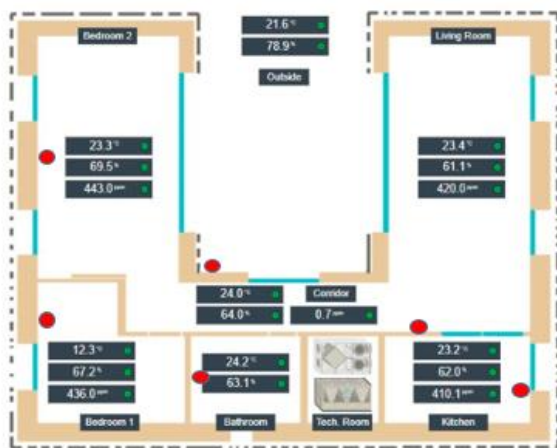
and serves as a tool for experimentation with its bioclimatic architecture for the climatic conditions. The research lays focus on testing the prototype with architectural actions for improving the thermal comfort condition with the passive strategies having the objective of minimized energy consumption and energy balance maintained with the energy produced by solar. Baitykool as a model with energy balance using bioclimatic architecture for extreme warm climates its design strategies can be referred in the article (Samuel, et al., 2022)



Figure 1. Left: Baitykool Living Lab view at TSC , Center left: The green core patio, Center right: The Living & Co-working spaces at the Lab, Right: the experimental space Bedroom (BRm)

*Data acquisition:*

The experiment data acquired with the measurement tools as shown in Fig.2 Black Globe Sensor for Temperature, Relative Humidity & Carbon Dioxide installed at all the rooms of the prototype and data logged on DISTECH a building management portal with control of Air conditioning, hydraulics, and display of the real-time sensor data's. Portable Black Globe sensor to collect data at experimental locations. A weather station installed at the site location TSC over the Prototype roof with all weather data at the prototype location recorded. Real-time Energy data was acquired using ENERGYWISER.



REALTIME DATA FOR HOUSE PLAN ● Sensor location



Figure 2. Sensors and data acquisition systems at Baitykool Living Lab: top left the Black globe sensors with data management by DISHTECH, top right: HOBO sensors for second set of data for calibration, bottom left, DISHTECH sensor location and live interface, bottom center: HOBO Black Globe Temperature sensor located at the center of the bedroom, bottom right: weather sensor at context site at Baitykool roof top.

The Experimental measurement parameters for the analysis on thermal comfort condition :

Temperature in Degree Celsius ( $^{\circ}\text{C}$ ) at Indoor and outdoor, air temperature ( $T_a$ ), globe temperature ( $T_g$ ), Relative humidity (RH), Carbon dioxide ( $\text{CO}_2$ ), Solar radiation ( $\text{kW}/\text{m}^2$ ), Wind speed (mph), Wind Direction as per the (Orientation)

*Nomenclatures and abbreviation's:*

Temperature – T, Relative Humidity – RH, Solar Shading – SS, Roller Blind Blackout – RBB, Solar Shading with roller blind blackout – SS:RBB, Bedroom – BRm, Kitchen –Kit., Cross Ventilation – CV, Natural Ventilation- NV, Night Ventilation – NiV, Patio Ventilation – PV

## Method

### Experiment design to test the influence of bioclimatic factors on thermal comfort condition

The Baitykool prototype functions as the living laboratory with experiments conducted on solar shading and night ventilation. The prototype designed for the extremely hot climate and serves as a tool for experimentation with its bioclimatic architecture for the climatic conditions. Architectural actions like opening and closing of windows (W) / doors (D) / patio ventilator (PV) / solar shading devices like the roller blind blackout (RBB) made of White Thermal Blackout Curtain Lining 3 Pass Opaque Blackout Curtain Fabric 260 GSM. Experiments conducted in two seasons of the arid desert climate, the winter season (November to March) the summer season (April to October). The climate of Dubai, UAE analyzed across the year to find the potential in use of passive strategies and reduce the load on the active conditioning system.

*The experiments divided in to solar shading at the Bedroom (BRm) & night ventilation between Patio Ventilation (PV) & Kitchen (Kit.) window*

a) Solar shading: The external facing windows are shaded with an outer perforated envelope, a closed monolithic arid mineral façade made in Ultra High Performance Fiber reinforced concrete (UHPFC) as shown in Fig. 3 specifically developed for the project acting like a mashrabiya protecting the window opening behind providing comfort and maintaining privacy.

This multilayered wall system works to improve the thermal efficiency of the house, improving thermal comfort with the UHPFC acts as a strong shield against the hot weather shading the glazing and the buffer zone the air



gap between the window double glazing and the UHPFC in window areas and the layer of vapour barrier sticking the external façade reflects back the solar rays and reduces the heat gain to the indoors. The air between the UHPFC acts as an insulation and the perforations a means to keep the gap ventilated and allow day lighting for indoors. Along with this three layers of dynamic shading has been devised for the windows and doors. At the exterior of the window (i) a roller blind blackout (RBB) of material White Thermal Blackout Curtain Lining 3 Pass Opaque Blackout Curtain Fabric 260 GSM with electric control for its opening from room. (ii) an exterior translucent roller curtain fixed on the exterior side of the window (ETC) material 100% Polyester with acrylic coated; non-formaldehyde,  $136 \pm 5\%$  (gsm), woven translucent roller shade acting as a shade and dust barrier. (iii) an interior translucent curtain (ITC) for reducing glare and adding privacy, material 55% Cotton, 45% Polyester as indicated in Table 2. Experiments carried out based on orientation of window, with and without shading of RBB, with and without a conditioned environment, with and without occupancy at the living lab during the experimental duration.

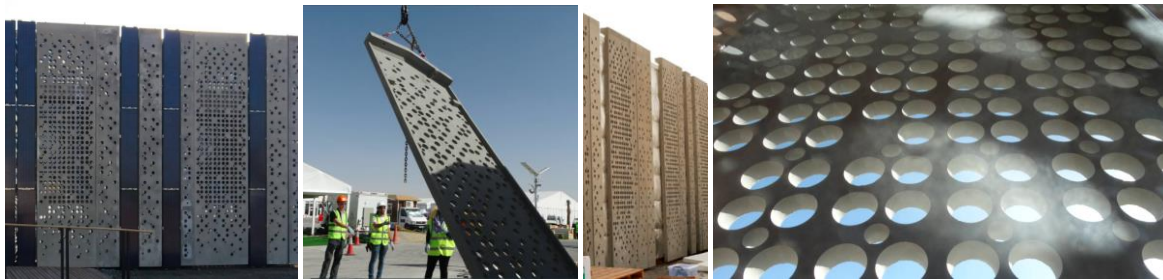


Figure 3. Left: Ultra-high performance fiber concrete (UHPFC) external layer as a solar shield, Center left: the precast UHPFC panel, Center right: the multilayered wall, Right: the porous UHPFC panel

The experiment discussed in this article is on the performance of the solar shading of exterior facing windows with the static UHPFC perforated panel and the RBB in open and closed position as indicated in Table 1, and night ventilation as in Table 4. to analyze the effect on indoor temperature and relative humidity and with no occupancy and no conditioned environment.





Table 1. Experiment plan for solar shading

Sr. No	Experiment Date	Duration	Architectural Action	Experiment space
1	24/01/2023	24 Hours	No solar shading for windows & doors	Bedroom of Baitykool Living Lab
2	25/01/2023	24 Hours	Solar shading: RBB on west facing windows	
3	27/01/2023	24 Hours	No solar shading for windows & doors	
4	28/01/2023	24 Hours	Solar shading: RBB on east facing windows	
5	29/01/2023	24 Hours	Solar shading: RBB for all windows & doors	
6	30/01/2023	24 Hours	No solar shading for windows & doors	

The experimental space as shown in Fig. 4, is the bedroom (BRm) 18.4 m<sup>2</sup> area, 54.7 m<sup>3</sup> volume oriented to the west with 2 external facing windows and on large sliding folding door facing east orientation opening towards

the the green patio and an entry door to the bedroom from the corridor connecting the living, dining, kitchen, washroom, another bedroom & a technical room. Only the Bedroom is considered for the SS:RR experiments with the details as indicated in Table 3. & The Bedroom, Living, Kitchen & corridor space for the night ventilation as indicated in the Figure. 7

Table 2. Solar shading device for exterior facing windows of Baitykool Living Lab

Shading devices from Exterior side (image on left)			
The double skin static perforated panel	Roller Blind Blackout (RBB)	Exterior translucent curtain (ETC)	Interior translucent curtain (ITC)
			
Ultra High Performance Fiber reinforced concrete with 50% perforation ratio to window opening size	White Thermal Blackout Curtain Lining 3 Pass Opaque Blackout Curtain Fabric 260 GSM	100% Polyester with acrylic coated; non-formaldehyde, 136±5%(gsm) woven translucent roller curtain	55% Cotton, 45% Polyester sheer curtain

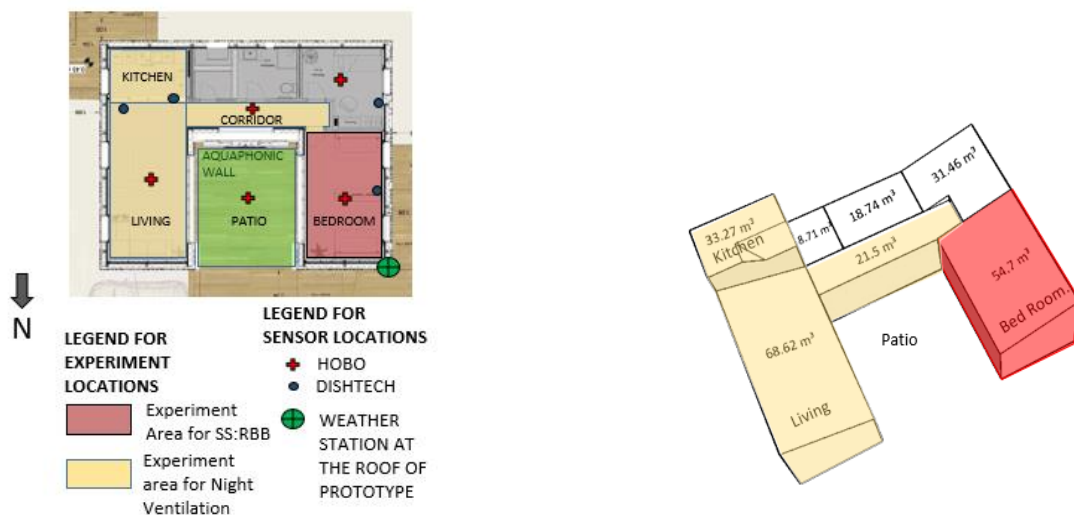


Figure 4. Left: Plan of the Baitykool Living lab with location of Sensors for data acquisition & the experiment space highlighted, Right: Baitykool indoor building volume

Table 3. Experimental spaces, envelop, windows and door at Baitykool Living Lab

Sr. No	Space/ Elements	Size (m)	Numbers	Area
1	Bedroom	3.4 x 5.4	1	18.36
2	Window	1.15 x 2.25	2	5.175
3	Door external facing	3.9 x 2.1	1	8.19
4	Door opening to corridor	0.9 x 2.1	1	1.89
5	External Facing Envelope oriented West (only the bedroom length)	5.5x4.9	1	26.95
6	External Facing Envelope oriented East	5.5 x 3.3	1	18.15

b) Night Ventilation: The fresh means of air naturally in to the building with passive forces like wind, its speed and the difference between internal and external preasure. Experiments conducted with crossventilation during day & night , night ventilation only with the favourable weather condition at the context site. The weather by month, weather averages in Dubai as shown in Figure 5 shows December, January, February, march having potential to use natural ventilation for indoors with average temperature ranging between 20 -24 °C. During these months crossventilation strategy can be adapted in building , the energy conserved by reduction in the use of conditioned enviromment. This improves the indoor air quality and flushes out the trapped heat in indoor spaces.

	January	February	March	April	Mag	June	July	August	September	October	November	December
<b>Avg. Temperature °C (F)</b>	19.4 °C (67) F	20.7 °C (69.2) F	23.3 °C (74) F	27.7 °C (81.8) F	31.8 °C (89.2) F	33.8 °C (92.8) F	35.6 °C (96.1) F	35.7 °C (96.2) F	33.2 °C (91.8) F	30 °C (85.9) F	25.5 °C (77.8) F	21.3 °C (70.3) F
<b>Min. Temperature °C (F)</b>	14.1 °C (57.5) F	15 °C (59) F	17.2 °C (62.9) F	20.8 °C (69.4) F	24.4 °C (76) F	26.6 °C (79.9) F	29.2 °C (84.5) F	29.2 °C (84.6) F	26.9 °C (80.4) F	23.5 °C (74.4) F	19.7 °C (67.5) F	15.8 °C (60.5) F
<b>Max. Temperature °C (F)</b>	24.3 °C (75.8) F	26.1 °C (79) F	29.4 °C (84.9) F	34.3 °C (93.8) F	38.8 °C (101.9) F	40.8 °C (105.4) F	42.1 °C (107.8) F	42.3 °C (108.1) F	39.9 °C (103.3) F	36.3 °C (97.4) F	30.8 °C (87.4) F	26.3 °C (79.3) F
<b>Precipitation / Rainfall mm (in)</b>	17 -0.7	15 -0.6	16 -0.6	4 -0.2	0 0	0 0	2 -0.1	0 0	0 0	1 0	3 -0.1	10 -0.4
<b>Humidity(%)</b>	61%	57%	52%	45%	42%	47%	47%	46%	52%	54%	57%	61%
<b>Raing days (d)</b>	2	2	2	0	0	0	0	0	0	0	1	1
<b>avg. Sun hours (hours)</b>	8.7	9.6	10.5	11.4	12	12.2	12.2	11.7	11	10.2	9.5	8.8

Figure 5. Climate data of Dubai, UAE accessed in June 2023 reference: <https://en.climate-data.org/asia/united-arab-emirates/dubai/dubai-705/>

The experiments at Baitykool on natural ventilation works with cross ventilation during day and night, cross ventilation at night only, which is one bioclimatic strategy of using ventilation at night through the green patio (courtyard) using patio ventilator opened to referesh and with cross ventilation take benefit of the cool night temperature to the indoors. The average hourly temperature graph in Dubai as indicated in Figure 6 shows the months with cool, in the months of December, January, February with crossventilation possible during the morning hours. Comfortable conditions are seen in the evenings and night in November, December, January, february & march which are five months of the year with potential use of passive strategies in residences along

with active once having a hybrid scenario with optimized energy use for conditioning the indoor environment.

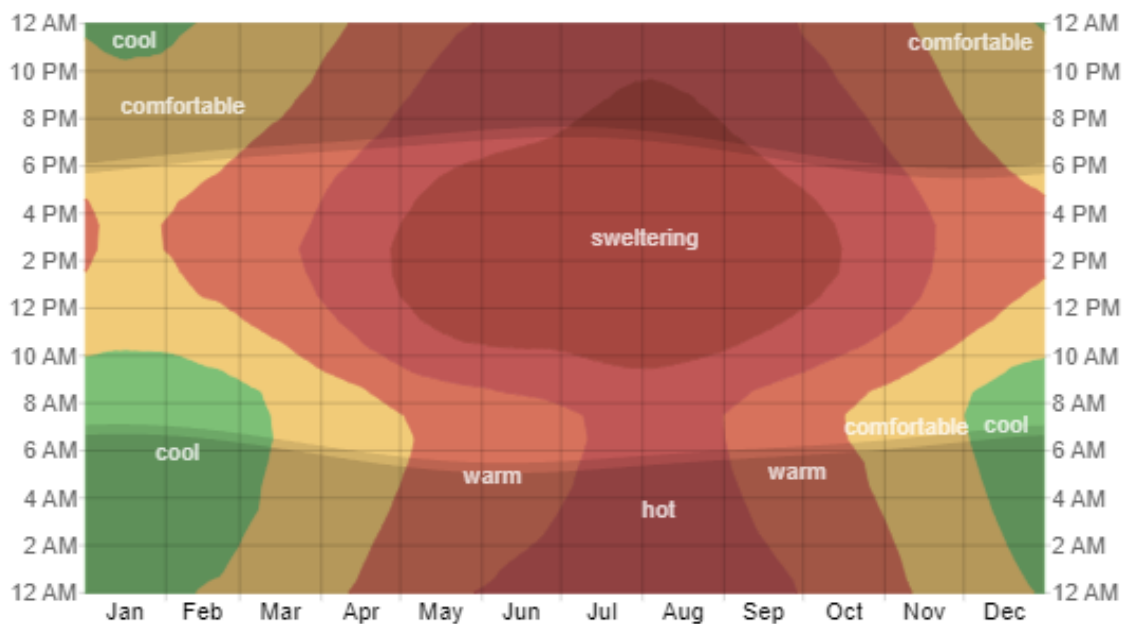


Figure 6. Average hourly temperature graph in Dubai, UAE accessed in June 2023 reference

<https://weatherspark.com/y/105470/Average-Weather-in-Dubai-United-Arab-Emirates-Year-Round#Figures-ColorTemperature>

The night ventilation strategy experiment use the window openings in kitchen one shutter window 1.15 x 2.25m, the patio ventilation 1.81 x 0.75 m with two ventilation shutters as shown in Figure 7. The air draft passes through the green patio with vegetated roof and courtyard, letting the air pass through the aquaponic wall having vegetations in the zip rows with flowing water filtering the air and keeping it cool (Samuel A. K., et al., 2020). This strategy is being tested for its functioning across all months to see the effect on the indoor thermal comfort condition. For this paper only one experiment set has been considered with the cross ventilation at night through the patio ventilator and the kitchen window as shown in Table 4. on 15<sup>th</sup> Jan 2023 compared to the scenario of no cross ventilation for the indoors during the experimental day on 16<sup>th</sup> January 2023 during day and night. This has been compared with no cross ventilation in the indoors during the 14<sup>th</sup> January day and night.



Figure 7. Left: plan view of Baitykool Living Lab with night ventilation strategy, Right: Image of Patio Ventilator with closed, open position & window in open position.

Table 4. Experiment plan for natural ventilation: night ventilation

Sr. No	Expeiment Date	Duration	Architectural Action	Experiment space
1	15/01/2023	24 Hours	Natural cross ventilation between Patio Ventilator – Ventilators – 2 nos. & Kitchen windows – 1 no. during night.	The Living, Kitchen, bedroom of the Baitykool
2	16/01/2023	24 Hours	No natural ventilation at indoors of Baitykool	Living Lab

The night ventilation experiments for the 15<sup>th</sup> January 2023 compares the difference in temperature , relative humidity, air quality between the cross ventilated living and Kitchen through the patio ventilator and not cross ventilated indoors of the full prototype on the next day of cross ventilation. The objectibe being to analyze the variance in the indoor conditions for temperature , relative humidity, air quality across the day and night. The experiment on the two days are with no occupancy at the living lab to analyze the indoor comfort condition with temperature, relative humidity and air quality . There are experiements also conducted with occupants during the varied weather conditions across the year. For this paper the experiement considered is for only one scenario of night ventilation.

## Results

### Effect of Solar Shading on indoor temperature and relative humidity

The solar shading experiment analyzed in three parts with the temperature and relative humidity comapered between the external context condition at site of prototype and the indoors of the Baitykool bedroom space to analyze the effect of the shading device Roller Blind Blackout (RBB).

- (i) the Solar shading for all the external facing windows and doors throughout the day.

Table 5. Data for solar shading of all windows at context site & the bedoom at Baitykool Living Lab

Architectural Action	Solar Shading: Rolleer Blind Blackout on all external facing windows & doors			No Solar shading for any external facing windows and doors		
	Context	Context	BK : Bedroom	Context	Context	BK : Bedroom
Date	29 Jan 2023	29 Jan 2023	29 Jan 23	30 Jan 2023	30 Jan 2023	30 Jan 2023
	TEMP	RH	TEMP	TEMP	RH	TEMP
Max	24.60	88	21.14	26.10	91	21.55
Min	12.70	36	20.18	13.50	51	20.24
Average	17.78	66	20.60	18.70	75	20.96
Difference	11.90	52	0.96	12.60	40	1.31

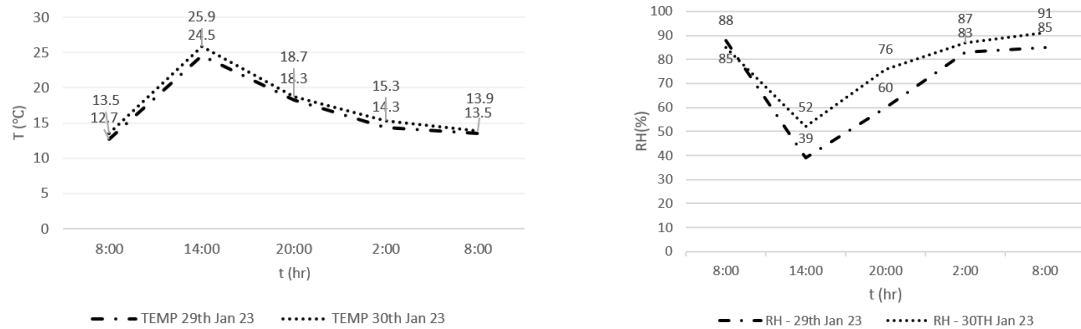


Figure 8. Context, Left: Temperature (T), Right : RH on on 29 & 30 Jan 23

The Fig. 8 shows the T & RH on the site location ‘Context’ of Baitykool livng Lab (BK), the T on both days difference of 0.8°C at 8am, 1.4°C at 2 pm, 0.4°C by 8pm, 0.4°C at 8am next day. RH has difference of 0.3 at 8 am, 13 at 2 pm, 16 at 8pm, 4 at 2 am and 6 at 8am next day. The comparison done with the AA -SS:RBB on 29 Jan & 30 jan as the reference.difference considering the variances in T & RH on the 2 days. Data for context and BRm as shown in Table 5.

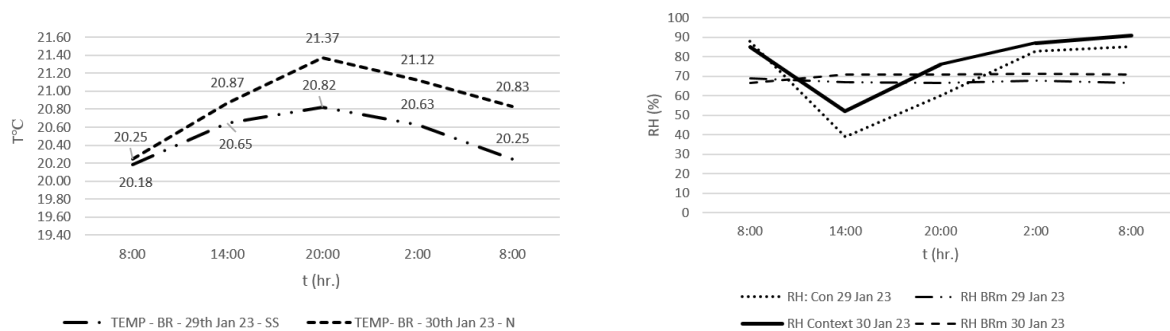


Figure 9. Left: Difference between T- BRm with SS on 29/01 & T- BRm – R 30/01, Right: T- BRm on 29/01 & Context T – 29/01

Temperatures as shown in Fig 9. shows difference achived in T & RH with Solar Shading (SS):Roller Blind Balckout (RBB) when compared with no shading on 30 Jan 23: 0.07 at 8am, 0.22°C at 2 pm, 0.55°C at 8 pm, 0.49°C at 2 am, 0.58°C at 8am next day. There is a 0.5°C benefit at indoors due to the roller blind blackout shading cutting down the effect of direct solar heat gain for the window glazing.

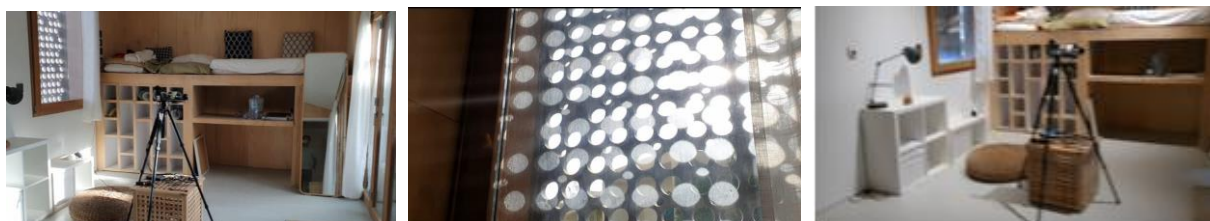


Figure 10. Left: Image of BRm with no SS, Center: Sun rays on glass at 8am, Right: BRm with SS:RBB blocking sun at 8 am

The perforated Ultra High Performance Fiber reinforced concrete (UHPFC) as shown in Fig.10 shields the window and blocks the sun rays with its opaque surface and the 50% perforations 50 mm dia each with its thickness 40 mm shades as the first layer protecting the external facing window from full exposure to direct solar rays. The SS:RBB cuts the solar rays and creates a reduction in solar heat gain in room there by reducing indoor T by 0.58°C at indoors.

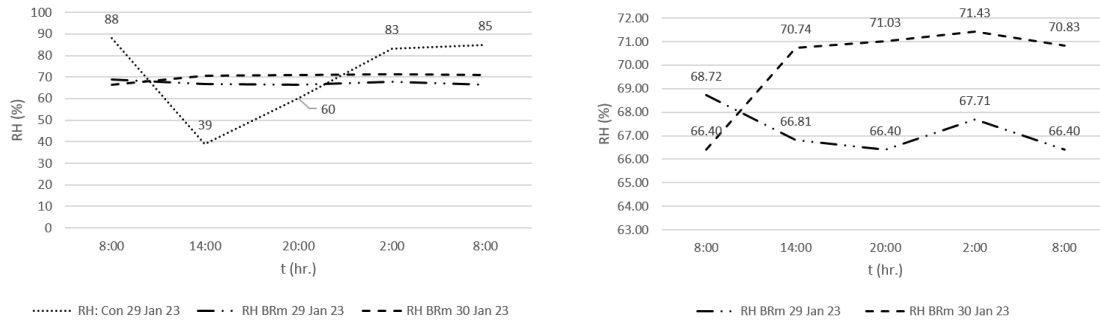


Figure 11. Context, Left: RH compared with BRm RH on 29/01 and 30/01, Right: RH in BRm on 29/01 with SS & 30/01 with no SS

RH in BRm shows reduction with SS:RBB as it reduces from 68.72 to 66.40 in 24 hours where as the RH with no SS shows increase from 66.40 to 70.83 as seen in Fig 11. There is an increase seen in RH in BRm at 2 am as the context T increases from 14.7°C to 14.9°C and reduces to 13.8°C between 1 am and 3 am. Benefit observed with use of SS:RBB on both T & RH with reduction in levels compared to context & the without SS.

ii) the solar shading done only to the west oriented external facing windows and doors.

Table 6. Data for solar shading for west orientation at context site & the bedoom at Baitykool Living Lab

Architectural Action	Solar Shading: Rolleer Blind Blackout for west oriented windows and doors			No Solar shading for any external facing windows and doors		
	Context	Context	BK : Bedroom	Context	Context	BK : Bedroom
Date	25 Jan 2023	25 Jan 2023	25 Jan 23	24 Jan 2023	24 Jan 2023	24 Jan 2023
	TEMP	RH	TEMP	TEMP	RH	TEMP
Max	23.10	91	22.16	25.60	83	21.64
Min	14.80	53	21.19	14.80	46	20.98
Average	17.40	77	21.62	19.60	62	21.34
Difference	8.30	38	0.97	10.80	37	0.66

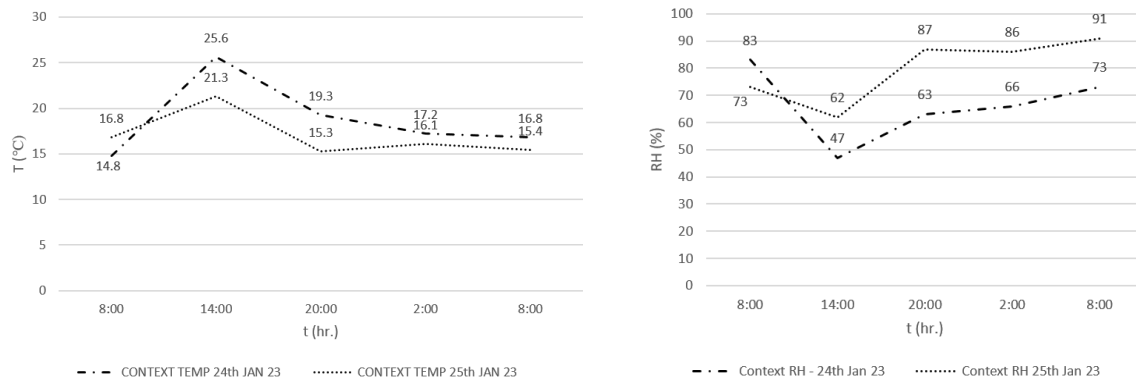


Figure 12. Context, Left: Temperature (T), Right : RH on on 24 & 25 Jan 23

Context T on 25/01 and 25/01 at a difference of 2.2°C at 8am, 4.3°C at 2pm, 4°C at 8pm, 1.1°C at 2 am, 1.4°C at 8am,

Temperature (T) on 24/01 the day of SS:RBB (West) lesser by 2.2°C than 25/01 but rises from 14.8°C to 25.6°C by 2pm and drops gradually to 15.4°C by 8am next day

Context RH shows the variance of 83 at 8 am dropping to 47 at 2pm with rise in T on 24/01 and shows the gradual rise to 73 by 8 am next day. RH on 25/01 shows drop from 73 at 8am to 62 at 2pm and rise to 91 by 8 am next day. Difference of 10-20 in RH observed between the two days. Data of context and BRm as indicated in Table 6

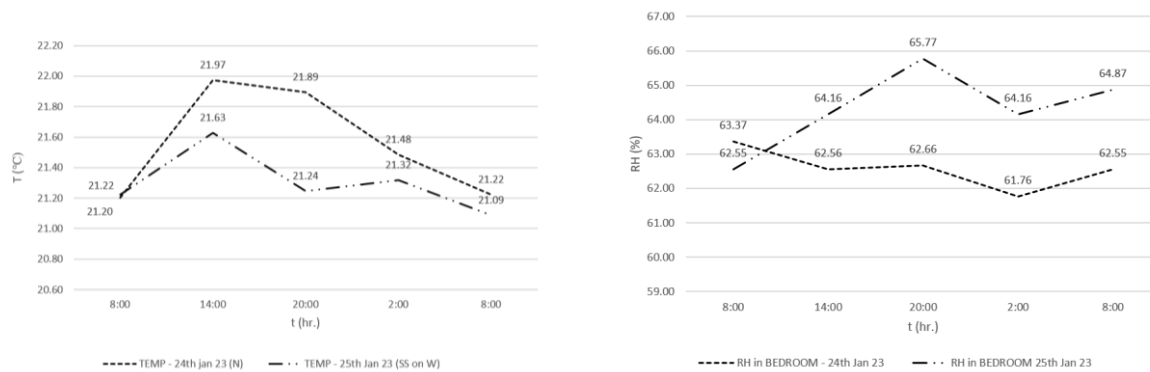


Figure 13. Left: Difference between T- BRm - R 24/01 & T- BRm - SS:RBB (West) 25/01, Right: RH - BRm on R - 24/01 & SS:RBB (West) 25/01

Temperature rise from 21.20°C at 8am to 21.63°C at 2pm and drops to 21.24°C by 8pm, when compared with the temperature on 29/01 refer Fig. 13, there is rise in temperature by 0.17°C whereas with SS:RBB (West) there is drop in T by 0.39°C, this is due to the shading on west with the roller blind blackout.

Fig. 13 shows a gradual drop in RH level in BRm from 65.77-64.16 (1.61 difference) between 8pm to 2am and a rise to 64.87. The context T is 16.1°C lowering from 19.3°C, the drop in RH is due to the transmittance of heat from the RBB material with the exchange of cooler T from the context.



The SS:RBB (west) shows an effect if shading when compared the temperature difference in BRm on 24/01 is 0.08°C and on 25/01 is 0.39°C which is due to the blocking of solar rays from the west.

(iii) solar shading for the east oriented external facing windows and doors.

Table 7. Data for solar shading for east orientation at context site & the bedroom at Baitykool Living Lab

Architectural Action	Solar Shading: Rolleer Blind Blackout for east oriented windows and doors			No Solar shading for any external facing windows and doors		
Location	Context	Context	BK : Bedroom	Context	Context	BK : Bedroom
Date	28 Jan 2023	28 Jan 2023	28 Jan 23	27 Jan 2023	27 Jan 2023	27 Jan 2023
	TEMP	RH	TEMP	TEMP	RH	TEMP
Max	23.10	91	22.16	25.60	83	21.64
Min	14.80	53	21.19	14.80	46	20.98
Average	17.40	77	21.62	19.60	62	21.34
Difference	8.30	38	0.97	10.80	37	0.66

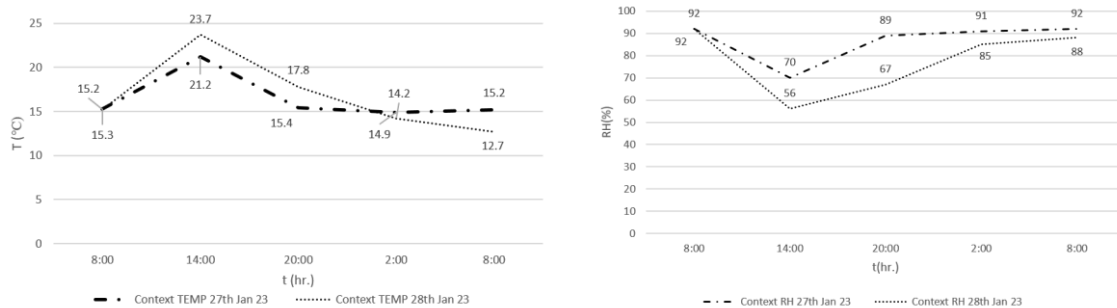


Figure 14. Context, Left: Temperature (T), Right : RH on on 27 & 28 Jan 23

Fig. 14 shows temperatures on 27/01 & 28/01 at same level 15.2-15.3°C at 8am difference of 2.5°C at 2pm, 2.4°C at 8pm, 0.7°C at 2 am & 2.5°C at 8am next day.

RH on 27/01 same level 92 and drops as T rises and shows difference of 0 to 20 between the two days.

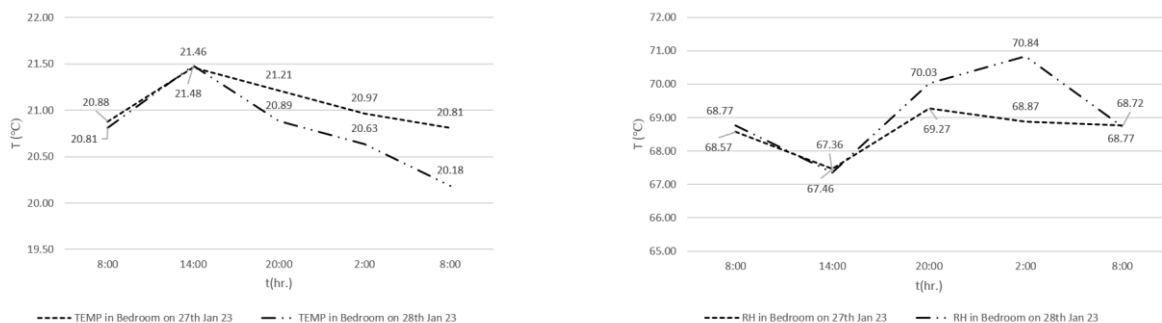


Figure 15. Left: Difference between T- BRm - R 27/01 & T- BRm – SS:RBB (East) 28/01, Right: RH - BRm on R - 27/01 & SS:RBB (East) 28/01

The SS:RBB on east did not show a difference in BRm with the day of shading and non shading show the same rise in T 0.67°C as seen in Fig. 15, this is due to the pergola shading at the patio (courtyard) and the shade of the east block in the morning achieved with the design proportion of the architectural form, height of the building around the patio.

RH drops gradually with rise in T and rises after 2 pm as context T drops to 15.4°C at 8pm and 15.2°C by 8am next day. RH drop after 2 am due to transmittance of heat from the RBB radiating heat inwards to the glazing having higher temperatures in air gap between the glazing & RBB (10 cm), also the T at the context 14.9°C makes the RBB to cool from the exteriors leading to transfer of heat waves inwards.

**Natural Ventilation: Night ventilation**

Effect of night ventilation between the patio ventilator and Kitchen window

Table 8. Data for night ventilation at context site & the bedoom at Baitykool Living Lab

Architectural Action	Natural Ventilation: Night ventilation between patio ventilator & kitchen window					No natural ventilation/ cross ventilation				
	Context	Cont ext	BK : Living	BK: Bedroom	BK: Kitchen	Conte xt	Conte xt	BK : Living	BK: Bedroom	BK: Kitchen
Date	15 Jan 2023	15 Jan 2023	15 Jan 2023	15 Jan 2023	15 Jan 23	16 Jan 2023	16 Jan 2023	16 Jan 2023	16 Jan 2023	16 Jan 2023
	TEMP	RH	TEMP	TEMP	TEMP	TEMP	RH	TEMP	TEMP	TEMP
Max	26.90	85	22.50	22.70	22.53	29.90	86	22.92	23.20	22.96
Min	15.60	45	20.70	21.52	20.71	16.90	44	21.01	21.53	20.99
Average	20.37	70	22.11	22.11	21.80	21.74	69	22.53	22.57	22.51
Difference	11.30	40	1.80	1.18	1.82	13.00	42	1.90	1.67	1.97

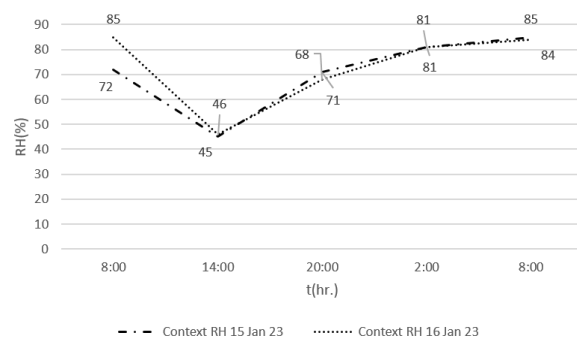
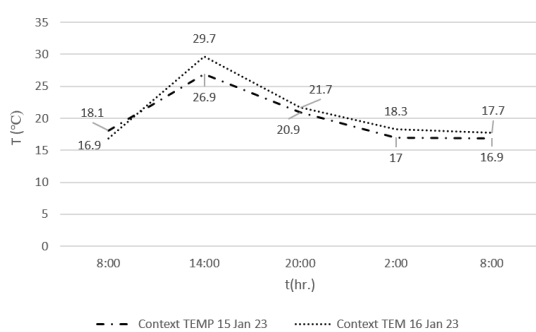


Figure 16. Context, Left: Temperature (T), Right : RH on on 15 & 16 Jan 23

Fig. 16 shows temperature on 15/01 ad 16/01 are shows a variance of 1.2°C at 8am, 2.8°C at 2pm, 0.8°C at 8pm,

1.3°C at 2am and 0.8°C at 8am. RH shows 72,85 at 8am dropping to 45,46 and gradually rising to 85,84 and the drop is with T rise and rise with T drop.

The comparison in T and RH is done between the Kitchen (Kit) and Bedroom (BRm) spaces as the night ventilation had the patio ventilator (PV) one and the Kit. window open. The BRm door and windows were closed and had no crossventilation. The draft of air was between the corridor with PV – Kit passing through the living with the Kit door kept open as in Fig. 7

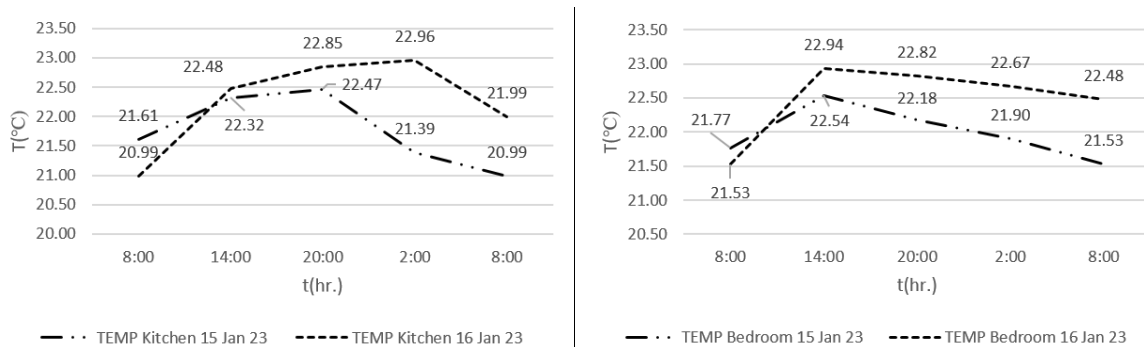


Figure 17. Left: Difference in T- Kit – NtV 15/01 & T- Kit – R 16/01, Right T - BRm – NtV 15/01 & T- BRm – R 16/01,

Fig. 17 shows temperature drops in Kitchen at 8pm from 22.47 to 20.99 on 15/01 and in BRm T drop from 22.54°C at 2 pm to 21.53°C at 8 am next day. A benefit of 0.54°C achieved due to night ventilation . T in living at 21.01°C and Kitchen 20.99°C at 8am next day. There is drop in T in Kit. Between 8pm and 2 am is 1.08°C and in BRm is 0.23°C this shows that the air draft was between the corridor with night cooling.

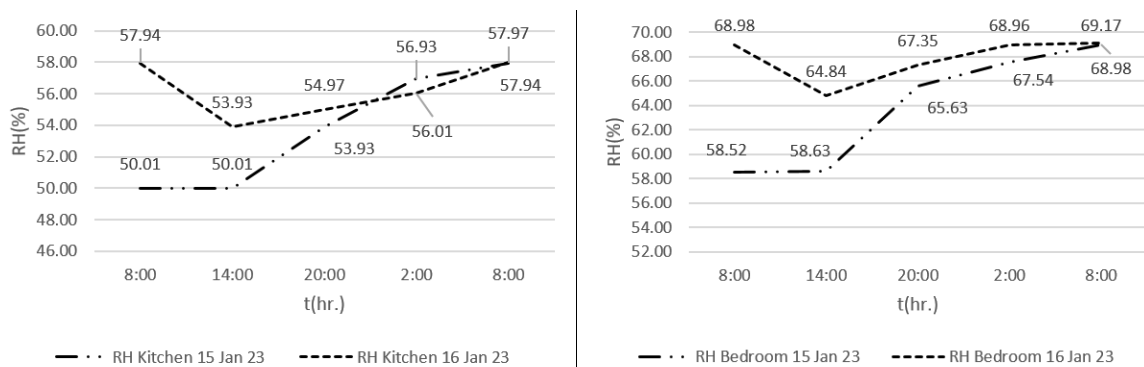


Figure 18. Left: Difference between T Right: RH - Kit on NtV - 15/01 & R 16/01 Right: RH - BRm on NtV - 15/01 & R 16/01

RH in Kitchen shows a 11.7 difference between the BRm and Kit., there is variance in RH as seen in Fig. 18, in Kit. when compared with the context reference RH on 16/01 where as there is no variance seen in graph in Fig. 16 in BRm when compared with reference RH on 16/01.

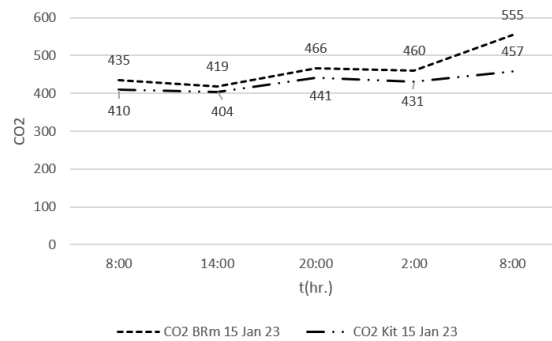


Figure 19. CO2 levels in Kit. & BRm on 15/01 with NtV

CO2 level in Kit. Lower than BRm as seen in Fig. 19, Difference of 98, Living room showed CO2 482 at the same time 8am on 16/01. When compared with the Kit. level a 25 difference observed which is due to the air draft being between the kit and corridor. The context wind direction from 8pm to 8 am was from East side with the very low wind speed of 0-0.4 km/h which means the air draft would be between the Kit window and PV between 8 pm to 8 am.

## Discussion

### Solar shading (SS) using roller blind blackout (RBB)

The SS:RBB for all exterior facing Windows & doors showed Difference in T by 0.6°C due to shading device RBB. East oriented opening of bedroom showed slow T increase in morning due to the shading at Patio by the east block. Temperature increased by 2pm as the opening got exposure to the sun's rays. Difference observed in the temperature & relative humidity between Living-Kitchen which is one singular indoor space when compared with BRm due to the difference in size of glazed opening i.e., door ( 7.8 sq.m.) & window (3.85 Sq.m.).

The SS:RBB (West shading only) for exterior facing Windows & doors shows drop in temperature at indoors in evening after 2pm due to west shading, consistency in T & RH noticed with shading post noon. Temperature difference of 1°C between Living-Kitchen & bedroom due to the difference in volume in the space (Living + Kitchen + corridor = 123.36 Cum & Bedroom = 54.7 Cum), refer Fig. 4 also the opening sizes in to both the spaces are varying having exposure to solar radiation and infiltration of air from exteriors through the door gaps at bottom.

SS:RBB (East shading only) for exterior facing Windows & doors showed temperature increase at indoors only (0.3°C) seen due to East shading. The temperature in Living & Bedroom observed at the same range 20-21 °C between 8am and 1pm. Consistent temperature seen from 2 to 6 pm and drop in temperature to late night and early morning. As the context temperature is reducing in January there is a drop in indoor temperature from the evening to late night and early morning.

### **Natural ventilation: Cross ventilation between Living & Bedroom during day & night**

The cross ventilation created the variance in indoor T in the same range between the living & bedroom. RH had a difference of 10 between the living & bedroom through the day this is due to the orientation of living to the east & Bedroom to the west. The east oriented facade get exposure to solar radiation from the early morning hours till afternoon and as the temperature increase the relative humidity drops down. The temperature drop by evening causes the west side have higher relative humidity than east side of the indoors.

### **Conclusion**

The Indoor T & RH at BK living Lab showed benefits in the use of shading with reduced T indoors by 0.5°C achieved in rooms when compared with a non-shaded condition. This difference could be higher in the warmer periods of the year. There is potential to have passive means of comfort with ventilation and lower solar heat gain through the external facing openings. The shading would help in regulating the T at indoors with improved comfort conditions. The SS: RBB also helps in saving energy with lowered loss of energy for cooling. The factors that need to be considered in design along with the solar shading are the Size of exterior facing openings, their exposure to solar radiation, orientation & sun path. The size and volume of the rooms the location of openings: windows and doors and the architectural actions to control the shading, ventilation, privacy and day light.

The night ventilation and cross ventilation between the indoor spaces had the benefit of refreshing the air and reduced CO<sub>2</sub> level capturing the lower T during the night to the indoors and allowing natural free cooling at night. But this needs to have strategies determined based on the varied T conditions at the context to avoid discomfort in seasons when T fall very low and nights are colder. Use of smart technology to monitor T to manage the opening and closing of the opening can allow better regulation of the thermal comfort conditions at indoors. The wind speed and direction, also matter to the air draft and its direction in rooms based on the strategy of opening and closing the windows, its opening size and opening direction. There is potential to have design and operational strategy in buildings for controlling the air draft and exchange between the indoor and outdoors based on the context temperature, relative humidity, wind speed and wind direction. The vegetated in the buildings like the patio (courtyard) at Baitykool creates an opportunity to catch the wind due to its architectural form and proportion and enhance the T & RH conditions of the air draft from the aquaponics wall with vegetation to filter the air and improve and cool down air as it passes the plants and water of the aquaponics system. More experiments are being conducted on this to validate the benefits. The air draft with its velocity adds to the thermal comfort condition at indoors. The user of the space has the choice to control the natural ventilation and air movement based on the opening of windows and doors. There is comfortable climatic condition at the context between 20-25°C and the use of natural ventilation could avoid the use of air conditioner and there by save energy. The January month is good for consideration of natural ventilation and the strategy of night ventilation benefits the reduction in indoor temperature for all rooms during the night

Some of the challenges during the experiments are the varying temperatures and relative humidity on the different days of experiment with its varied effect on the indoor conditions based on the size of rooms, orientation and the comparison between the day of architectural action and the no action (neutral/ reference) day cannot be mapped fully by the measures. More experiment sets are being carried out at varied climatic conditions in for comparison, analysis and development of a model frame work absed on the pattern of variance seen in the other seasons like warm, very hot, very cold, cool. The passive strategies of shading and cooling has benefits on developing an energy balance in building with lowered use of the air conditioning system and creating a sustainable living.

## Notes

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## Development of Visual Analytics for Campus Centralized Emergency Response and Disaster Assistance System

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**Abstract:** It is essential to save lives during emergencies not only in hospitals but also in colleges and universities. Failure to identify risks and take prompt action during catastrophes and emergency situations could result in the loss of life and property for the campus community. This research aims to explore the feasibility of using data analytics to mitigate the risks associated with disasters and emergencies on campus. A prototype of an online reporting system was developed using cloud services to collect relevant data, analyze it, and present the information in an online dashboard for stakeholders to make informed decisions. The study shows that the use of dashboards has a high potential for effectively mitigating risks and identifying appropriate intervention strategies. This research contributes to the ongoing efforts to improve emergency response planning and management in higher education institutions and can be applied to other universities and large community groups to enhance their disaster and emergency response preparedness.

**Keywords:** emergency response system, campus safety, higher education, data analytics

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### Introduction

Some higher education institutions possess specialized physical facilities, making them distinctive. They serve both teaching and research purposes, generate employment and economic benefits within their local and regional communities, and offer essential services like medical care and laboratory functions. In essence, universities operate as self-sufficient communities that provide various amenities, including housing facilities, food services, small businesses (such as retail stores and printing presses), and even hospitals (Ayanian & Weissman, 2002). However, they are also vulnerable to emergencies like natural disasters and man-made crises, which can impact their ability to function effectively such as earthquakes (Koshiba & Nakayama, 2021) and flood (Ke et al., 2023), chemical explosion (Balla et al., 2021) and cyber-attacks (Kassem et al., 2019). In



addition, health emergencies such as pandemics and outbreaks of contagious diseases can also pose significant risks to campus communities (Bokszczanin et al., 2023; Schmitt et al., 2021; Xiong et al., 2020). One of the significant challenges is the need to communicate effectively during emergencies. Higher education institutions may have large and diverse populations, including students, faculty, staff, and visitors, which can make communication challenging. Effective emergency response in higher education requires a multi-faceted approach that includes comprehensive planning, training, and resources (Song et al., 2022). Educational institutions should have clear and regularly reviewed emergency plans in place, as well as robust communication protocols and systems. In addition, there should be adequate resources dedicated to emergency response, including personnel, equipment, funding and technology.

This research aims to explore the feasibility of using data analytics to mitigate the risks associated with disasters and emergencies on campus. To achieve the research aims, this study is guided by the following research questions:

1. What type of campus emergencies and disasters occurred?
2. How significant is an online dashboard for emergency and disaster situations on campus?
3. Which visualization techniques are critical and effective for emergency responses on campus?

## Literature Review

### Campus Emergencies and Disasters

An emergency can be defined as a sudden, unforeseen, and typically dangerous situation that poses an immediate threat to health, life, property, or the environment and necessitates prompt action (Sarwar, 2018). Campus emergencies, ranging from natural disasters to man-made crises, can severely affect the safety and well-being of students, faculty, and staff. Natural disasters like floods, earthquakes, tornadoes, and wildfires can cause significant damage to buildings and infrastructure, leading to transportation disruptions, power outages, and water shortages (Toya & Skidmore, 2007). They can also result in serious injury and loss of life if people are not prepared or evacuated in time. In the context of students, transportation disruptions during floods can have a significant impact on their ability to access food. If food distribution channels are limited or supply chains are disrupted, it can make it difficult for students to purchase affordable and nutritious food. As a result, they may have to resort to eating less nutritious or more expensive food, or even go without food altogether. Furthermore, if transportation disruptions prevent emergency food aid from reaching affected areas, students who are already facing food insecurity may be at an even greater risk of going hungry. This can have a significant impact on their physical and mental health (Othman et al., 2022), as well as their overall wellbeing.

Man-made disasters, such as accidents, acts of terrorism, or violence, can also cause harm to people and property, and immediate emergency response measures may be required (Park, 2011). Examples of such disasters include chemical explosions (Morshidi et al., 2018; Mulcahy et al., 2013), mass shootings (Kowalski et

al., 2021), and cyber-attacks(Ramim & Levy, 1 C.E.). Furthermore, the call for digital transformation of higher education has increased the vulnerability to cyber-attacks as universities become more reliant on technology especially for academic operation. As a result, universities have experienced significant data breaches involving the personal information of students, staff, and alumni. For example, in 2018, a hack of the University of Yale in the United States put the personal information, including social security numbers and addresses, of 119,000 students and staff at risk(Hailey Fuchs, 2018). Such cyberthreats not only disrupt educational processes and create barriers to learning, but are highly potent to cause significant emotional distress and trauma. This can affect their academic performance, mental health, and overall sense of student's wellbeing.

Hybrid disasters, which are a combination of natural and man-made disasters, can have compounded effects and are more complex to respond to. Covid-19 can be considered a type of hybrid disaster because it has both natural and human-made elements. On the one hand, it is caused by a natural virus that originated in animals and spread to humans(A. Zhu et al., 2023). On the other hand, its impact has been intensified by human activities such as international travel(Hohlfeld et al., 2022) and the lack of effective public health measures(Ullah & Harrigan, 2022) in some areas. Furthermore, the pandemic has led to various other disasters, such as economic downturns (Hyman et al., 2021) and social unrest(Warsame & Price, 2021), which are also man-made disasters extending the critical impact on higher education. The pandemic has also created significant mental health challenges for students. The stress and uncertainty of the pandemic, coupled with the social isolation and disruption to routine, have led to an increase in anxiety, depression, and other mental health issues(Bokszczanin et al., 2023). The impact of campus emergencies' events can be severe and long-lasting. Some of the other consequences include:

1. Loss of life and injury: Emergencies can cause injuries and loss of life, particularly if individuals are not properly prepared, treated or evacuated. For example, three students in China die in laboratory explosion (Zhuang Pinghui, 2018).
2. Property damage: Emergencies can cause significant damage to buildings and infrastructure, leading to disruptions in transportation, power outages, and water shortages. For example, Tropical Storm Allison caused 10 million gallons of water inundated the UTHSC-H Medical School basement, resulting in over 1 million gross square feet of space being unusable for several months(Goodwin & Donaho, 2010).
3. Reputation damage: Emergencies can damage the reputation of the institution and negatively impact the enrollment of future students.
4. Legal liabilities: Emergencies can lead to legal liabilities, such as lawsuits from individuals who were harmed or injured during the event.

Higher education institutions should prioritize the safety and wellbeing of their communities, recognizing that human life is priceless and that recovery from injuries can take a significant amount of time. Even though structures and objects can be reconstructed or replaced, the loss of life or the impact of an injury can have a long-lasting effect on the individuals involved and their loved ones. Therefore, it is crucial to invest in

emergency response systems that can provide a swift response to emergency situations on campus.

### **Emergency Response System**

An emergency response system in higher education refers to a comprehensive set of policies, procedures, and resources put in place to address emergency situations on a college or university campus. These systems are designed to provide a rapid response to emergency situations, including natural disasters, medical emergencies, and violent incidents, with the goal of ensuring the safety and security of students, faculty, staff, and visitors. The significance of an emergency response system in higher education cannot be overstated since environments in campuses are dynamic with thousands of people living, learning, and working in close proximity to each other (R. Zhu et al., 2020).

There are several challenges remaining in the emergency response and disaster assistance system. The process of collecting data for emergency response and disaster assistance generates a massive amount of information, including reports, images, videos, and audio that cover various aspects of emergency and disaster situations (Pettet et al., 2022). Unfortunately, the sheer volume of this data often overwhelms emergency agents who lack the necessary tools to filter or refine it for future use. As a result, they may struggle to identify trends or patterns in the data, leading to delays in decision-making or even misinterpretation. In addition to the challenges mentioned earlier, the continued use of conventional and paper-based reporting systems as a primary practice in emergency response and disaster assistance can compound existing issues. Although these approaches are practically workable and less relying on technologies, these methods of data collection and reporting can be time-consuming and prone to errors, further exacerbating the challenges faced by emergency agents, personnel, and victims. This can result in further delays in decision-making and potentially cause critical information to be lost or misinterpreted. There are several issues that can arise in emergency response systems:

1. **Communication failures:** Communication failures between emergency responders and victims or between different agencies can hinder the effectiveness of emergency response efforts.
2. **Resource allocation:** Emergency response efforts require the allocation of resources such as personnel, equipment, and supplies. Inadequate resource allocation can lead to delays or insufficient response efforts.
3. **Inadequate training:** Emergency responders must have adequate training to respond effectively to different types of emergencies. Inadequate training can lead to mistakes and ineffective response efforts.
4. **Coordination difficulties:** Emergency response efforts often involve multiple agencies and organizations, and coordinating their efforts can be challenging. Lack of coordination can result in duplication of efforts or conflicting response strategies.
5. **Limited accessibility:** People with disabilities or limited mobility may have difficulty accessing emergency services or evacuating during emergencies. Emergency response systems must be accessible to all members of the community.

6. Technological limitations: Emergency response systems rely heavily on technology, and technical failures or limitations can hinder their effectiveness. It is essential to have backup systems and contingency plans in place to address technical issues.

It is therefore crucial to develop and adopt modern and efficient systems for data collection, analysis, and reporting to improve emergency response and disaster assistance. To achieve the goal of improving emergency response and disaster assistance, implementing an information system that utilizes data-driven decision making appears to be a promising strategy.

### **Data-driven Emergency Response**

Data-driven emergency response in the campus involves the use of data analytics and real-time information to improve emergency preparedness and response. With the availability of various data sources, such as sensors, social media, and other digital platforms, it is possible to collect and analyze data to detect early warning signs of potential emergencies, track the spread of an ongoing crisis, and inform decision-making during and after the emergency. It has become an increasingly important strategy for improving emergency preparedness and response efforts. According to a report by the United Nations Global Pulse initiative, data-driven decision making can help emergency responders and disaster relief organizations gain real-time situational awareness and make more informed decisions during emergencies (Emmanuel Letouzé, 2012). By leveraging data from a variety of sources, including social media, sensors, and other data streams, emergency response teams can gain insights into the situation on the ground and take actions more quickly and effectively.

One of data-driven emergency response model that frequently adopted in research is Decision-Making Trial and Evaluation Laboratory (DEMATEL). DEMATEL uses a multi-criteria decision-making approach to evaluate different factors and their interrelationships in order to make informed decisions (Gabus & Fontela, 1972). The method involves constructing a matrix of the relationships between different criteria or factors, and then using that matrix to identify the most important factors and the causal relationships between them. Studies has shown the applicability of DEMATEL in the context of emergency management (Song et al., 2022; Zhou et al., 2017). One limitation of DEMATEL is that it relies heavily on the availability and quality of data to construct the interrelationship matrix. The accuracy and usefulness of the final results of a DEMATEL analysis depend on the quality of the data used in the matrix construction. Here are a few specific issues related to data acquisition that may limit the effectiveness of DEMATEL:

1. Incomplete data: If there is missing data for some of the criteria or factors being evaluated, it can be difficult or impossible to construct a complete interrelationship matrix. This can lead to inaccurate or incomplete results.
2. Biased data: The accuracy of the interrelationship matrix depends on the quality and objectivity of the data used to construct it. If the data is biased or incomplete, it can lead to incorrect or incomplete results.

3. Data collection costs: Acquiring and processing data can be a time-consuming and costly process. Collecting and processing data may require significant resources and expertise, which may not always be available.
4. Data complexity: The data used in DEMATEL can be complex and difficult to obtain. In some cases, the data may be proprietary or confidential, making it difficult to access or use in a DEMATEL analysis.

All the issues mentioned are related to data. Whether it is incomplete, biased, costly or complex, the first and foremost step is to make the data available or acquiring data in a cost-effective manner. Therefore, this study proposes a cloud-based with low-code software development approach for developing the emergency response system in campus environment.

## Method

The method for developing the emergency response system in this research is illustrated in Figure 9.

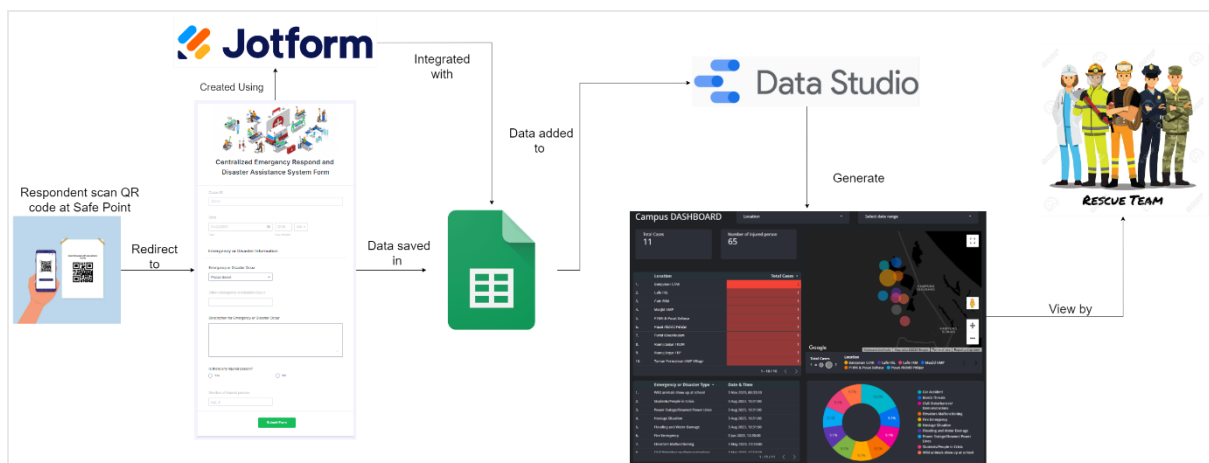


Figure 9: Method for Developing Emergency Response System

### Step 1: Data acquisition with cloud-based form creator

There are various types and service providers that provide cloud-based form creation with low-code approach. In this study, we adopt the service from JotForm. It is an online form builder that allows users to create custom forms for a variety of purposes. The platform offers a wide range of form fields and customization options, making it easy for users to create forms that match their branding and meet their specific needs. Using JotForm to create an emergency report form with closed-ended, open-ended, short-form, and extended-form questions that respondents can fill out on their mobile phones by scanning a QR code at a safe point. The form collects data such as the date, time, location, emergency type, number of people injured, injury condition, and an image related to the emergency incident. The data is stored in JotForm and integrated with Google Sheets.

Step 2: Data visualization with cloud-based dashboard creator

There are many types of software that can be used for creating dashboards. Google Looker Studio is a valuable tool for developing dashboards, which can be used to visualize data collected from various sources, including Google Sheets. For this research, location data was essential, and the longitude and latitude of each location were imported into Google Looker Studio as data sources. To provide a geographic context for the data, a bubble map visualization was used to pinpoint the selected locations on the map. The size of the bubble represents the number of incidents that have occurred at each location, with different colors used to differentiate between locations. Additionally, a table with a heatmap was utilized to display the overall number of occurrences at each location, with lighter colors indicating a higher incidence rate. Figure 4 provides an overview of the dashboard used for this research.

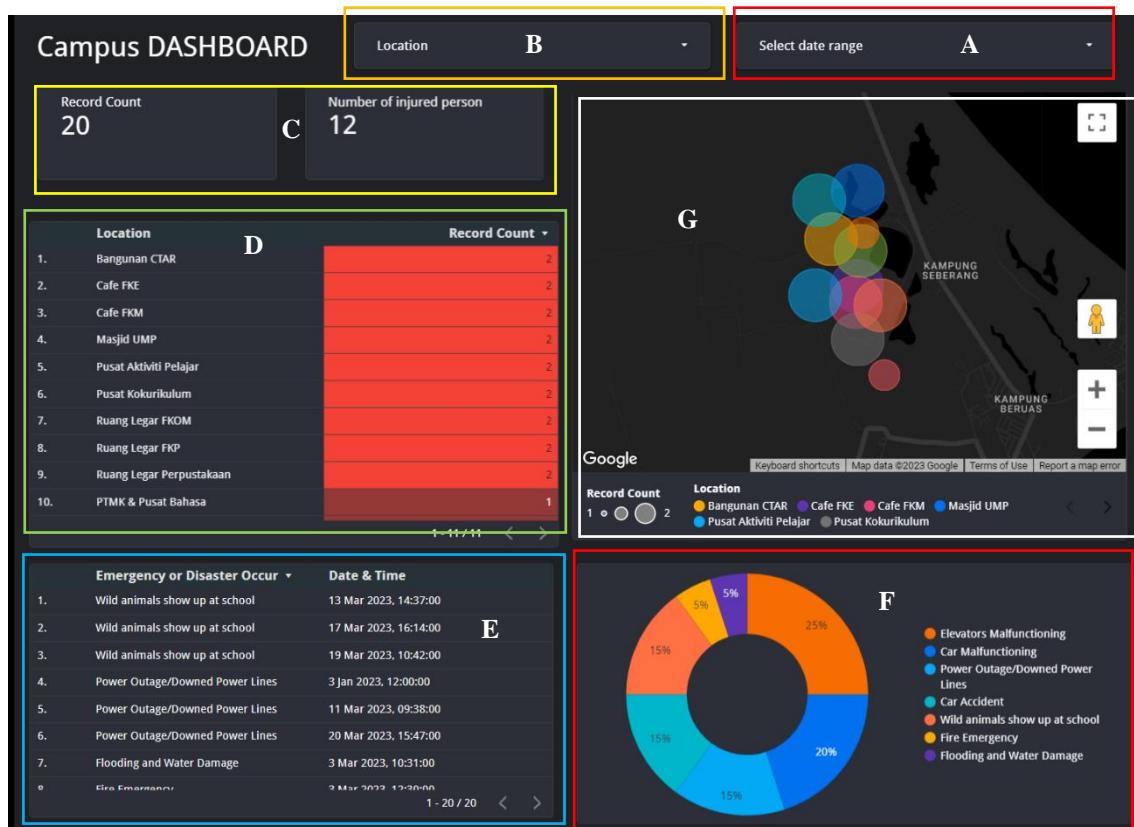


Figure 10: Method for Developing Emergency Response System

Results

The findings from this study are organized based on the research questions as follow: -

1. How significant is an online dashboard for emergency and disaster situations on campus?

An online dashboard for emergency and disaster situations on campus is a significant tool in data-driven emergency response. By utilizing data analytics and real-time information, the dashboard

provides critical information for stakeholders to make informed decisions and take appropriate actions. It offers situational awareness by indicating the level of emergency and urgency for each emergency type and helps identify those who may be affected, enabling emergency responders to deploy resources more effectively and efficiently. Additionally, the dashboard displays the suggested required personnel for the University Health Centre and Emergency Department, as well as the number of available personnel for both departments. Inclusion of the level of emergency and urgency for each emergency type, along with personnel information, can further enhance the overall response to emergency and disaster situations on campus. Therefore, an online dashboard is an essential tool for effective data-driven emergency response on campus.

2. Which visualization techniques are critical and effective for emergency responses on campus?

There are several visualization techniques that emergency responders can use to effectively respond to incidents on campus. Real-time dashboards are one such technique, providing stakeholders with critical information about the incident, such as the level of emergency and urgency, and the number of available personnel for responding to the situation. With real-time updates on the situation, these dashboards can help emergency responders deploy resources more effectively and efficiently. Another critical and effective visualization technique is the bubble map. A bubble map displays data using circles or bubbles of different sizes, colors, and positions on a map to represent specific values. It is an effective tool for visualizing spatial patterns and relationships between data points, such as the location and severity of incidents. By using longitude and latitude coordinates, emergency responders can quickly identify the location of the incident and determine the severity of the situation based on the size and color of the bubble. This visualization technique provides a quick and intuitive way for emergency responders to understand the situation and make informed decisions. Additionally, the bubble map can be used to visualize other relevant data, such as the distribution of emergency resources, to help responders allocate resources effectively. Overall, both the real-time dashboard and bubble map are critical and effective tools for emergency responses on campus.

## Discussion

Based on Figure 10, the dashboard contains a dropdown list, date range control, scorecard, table with heatmap, bubble map, table, and pie chart. The combination of the mention elements can be an effective collection of tools for showing and analyzing data in a dashboard, such that: -

- A. Date range control: Date range control which label with the label A enables users to customize the time period during which data is displayed. This is especially useful for tracking trends over time and assessing data changes across multiple time periods.
- B. Dropdown list: Dropdown list which label with the label B enables users to filter data based on a selected location. This can assist users in focusing on the data that is most pertinent to their needs and make it easier to compare data across regions.

- C. Scorecard: Scorecard which label with the label C gives a succinct total case happen and total number of people injured, allowing users to quickly determine the level of safety on the campus.
- D. Table with heatmap: Table with heatmap which label with the label D shows data in a tabular fashion, with color-coded cells indicating the relative significance or value of each data item. This can help users see trends and patterns in the data more quickly.
- E. Table: Table which label with the label E shows the emergency type, date and time data in a tabular fashion, with rows and columns that facilitate data sorting and filtering.
- F. Pie chart: Pie chart which label with the label F displays the relative proportions of emergency type categories. This can be helpful for rapidly determining the most significant or pertinent categories.
- G. Bubble map: Bubble map which label with the label G displays data spatially, using bubbles or markers to indicate the position and magnitude of cases. This is very effective for illustrating spatial trends in data.

The potential impacts of using a dashboard in emergency and catastrophe situations are significant and can extend to multiple sectors, including:

1. Society: Society 5.0 recognizes the importance of leveraging technology to improve safety, security, and quality of life for all members of society (Deguchi et al., 2020) The use of a dashboard in emergency and disaster response is a prime example of how technology can be used to achieve these goals. By providing the public with real-time updates and accurate information, the dashboard can help to minimize panic and misinformation, while also ensuring that individuals take appropriate safety measures.
2. Government: The use of a dashboard in emergency and catastrophe situations is an example of how digital government can be leveraged to improve the delivery of public services. Digital government refers to the use of digital technologies, such as online platforms and data analytics, to enhance the efficiency, effectiveness, and transparency of government operations (Misuraca et al., 2020).
3. Industry: A dashboard can be an invaluable tool for protecting critical infrastructure and facilities during emergencies or natural disasters. By utilizing data-driven decision-making in emergency response systems, it becomes possible to identify potential threats and deploy necessary resources to secure vital infrastructure and facilities with a preventive management approach for the long term. This approach aligns with the global trend towards the fourth industrial revolution (Duan & Da Xu, 2021).
4. Environment: The efficiency gained from data-driven decision making has a significant impact on the environmental issue. Optimization of resource utilization is possible to be done when there is data available either for real-time action or future scenario planning especially on the logistic and resource planning. This somehow affect directly the environmental in term of carbon emission especially from fires (Wiedinmyer & Neff, 2007).
5. Academia: This study contributes a new insight into the body of knowledge for sustainable higher education itself. Greater attention can be made among scholars and academia on the importance of emergency response systems empowered with data analytics.



## Conclusion

The findings of this study highlight the importance of data-driven decision-making in emergency response and disaster management systems at higher education. By utilizing cloud-based services such as online form creator and online dashboards, universities and communities can gather and analyze data to inform emergency response plans and improve the safety and security of individuals on campus. Furthermore, the study's emphasis on sustainable development goals underscores the need for emergency response systems that prioritize building resilience and preparedness for emergencies scenarios. As such, investing in smart campuses with robust emergency response systems can contribute to achieving these goals, making them an essential resource for decision-makers and stakeholders in emergency management and disaster preparedness. In summary, the link between campus emergencies and emergency response systems is clear. By implementing data-driven decision-making with cloud technologies, universities and communities can improve their emergency response and disaster management systems, ensuring the safety and security of individuals on campus while contributing to sustainable development goals.

## Limitation and Recommendations

While this study offers important insights into emergencies and disasters in higher education, it is also subject to certain limitations. The effectiveness of visual analytics on emergency response and disaster management depends on factors such as the availability of resources and infrastructure, as well as the capacity of stakeholders to implement and use these technologies effectively. For example, the use of smartphone is essential to lodge an emergency report. In certain emergency cases where a person panics or passes out, there is a high possibility the person will be unable to use the technology effectively. As for future research, findings and limitations from this study could provide the way how to explore additional questions related to emergencies and disasters in higher education. Some potential areas for further investigation are:

1. Factors that influence the occurrence of emergency and disaster cases could be examined in future research. For instance, this study revealed a significant incidence of elevator malfunctioning on campus, and further research could explore contributing factors such as mechanical failure or improper maintenance to reduce the frequency of lift malfunctions.
2. The relationship between emergency and disaster cases and their effects on mental health could be investigated in future research. This study did not explore this connection, and additional research could identify successful approaches for delivering psychosocial support and increasing mental health resilience in affected communities.
3. Future research could be conducted to identify effective strategies for improving community readiness and resilience for emergency and disaster situations. Emergency preparedness and resilience are crucial for mitigating the effects of catastrophes and disasters.

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## Study on Potential of Vegetable Wastes as Alternative Media for Probiotics Growth


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**Abstract:** In modern days, agricultural waste such as vegetable waste has been increased tremendously due to rapid increment of population demand. This waste usually ends up being dumped in landfills which will eventually negatively impact the environment and indicate ineffective utilization of resources. Vegetable wastes such as tomatoes and cucumbers were used in this study, and they are rich in nutrients that have significant potential for utilization in the growth of various microorganisms such as probiotics. Thus, the aim of this study was to investigate the potential of vegetable waste as a probiotic culture medium. First, the proximate analysis of the vegetable waste was performed by rapid near-infrared (NIR) spectroscopy. Probiotic *Lactobacillus* spp. were sourced from locally bought yoghurt and cultivated in MRS agar and broth with dried tomato and cucumber powder extracts. The cultures were incubated at 37 °C for 24 h, and the growth of the microorganisms was observed. This study demonstrated that the utilization of tomato and cucumber waste has significant potential as a medium for probiotic cultivation.

**Keywords:** Vegetable waste, Alternative microbiological media, Waste valorization

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## Introduction

With the escalation of the human population, massive amounts of agricultural and food waste are generated worldwide. According to FAO (2019), fruit and vegetable waste (FVW) exhibits the highest wastage rate (40–50%) compared to other food categories. Besides that, the FVW includes rejected fruits/vegetables or fruits/vegetables that are not being marketed due to undesirable appearance. Traditionally, these wastes were disposed of through incineration or field dumping, which have a negative impact on the environment. Such wastes are rich in sugars and nutrients, making them suitable for the industrial production of bioproducts by microorganisms (Rosales et al., 2005). Therefore, it is pivotal that initiatives which utilise these wastes are developed to promote sustainability. Initiatives such as valorization of waste, which transforms waste into economically useful materials, have great potential to solve environmental issues. The valorization of waste into value-added products has become the focal point of numerous researchers in their efforts to reduce waste while simultaneously addressing environmental issues (Chaitanya Reddy et al., 2021; Chilakamarri et al., 2022)

Probiotics is defined as ‘live microorganisms that, when administered in adequate amounts, confer a health benefit on the host’ (Hill et al., 2014). Probiotics has gained significant attention globally for their beneficial effects such as improvement to the gut health, enhancing immune system function, and promoting cardiovascular health (Oniszczyk et al., 2021). Essential nutrients such as carbohydrates, fats, vitamins, proteins or minerals are vital to support the growth of probiotics. It is important to prepare suitable media that are meeting the microbial growth requirement. Different types of media are required in order to isolate and identify certain microbes from a particular sample or environment. However, most of commercially available microbial culture medias are expensive. In order to make the cost of probiotics production more economically feasible, it is beneficial to find and alternative media that are cost-effective (Soccol et al., 2010).

In this study, our main objective is to develop a low-cost culture medium for bacterial growth using rejected tomato and cucumber as the primary source of nutrients. The performance of the newly formulated media with tomato, cucumber or mixture of both was evaluated by comparing the growth of probiotics *Lactobacillus* spp. and *Bacillus subtilis* in both standard nutrient media and formulated agar.

## Method

### Collection and preparation of samples

Rejected vegetables, consisting of tomatoes and cucumbers, were collected from a local farm in Al-Khor, Qatar. The collected samples were transported to the laboratory, washed, and rinsed with distilled water to remove dust and other contaminants. The samples were then dried in an oven at 50 °C for 48 h and ground to a powder using a blender.

### Rapid proximate analysis of vegetable wastes powder

The dried vegetable waste powder were subjected to rapid proximate analysis (Moisture, Fat, Protein, Ash, Fibre, Neutral Detergent Fibre and Acid Insoluble Ash) by using Near Infrared (NIR) Spectroscopy. Carbohydrate was then determined by difference method.

### Preparation of microorganisms

In this study, two different probiotics bacteria were used; *Lactobacillus* spp. and *Bacillus subtilis*. The *Lactobacillus* spp. Were isolated from locally purchased yogurt, grown in deMan, Rogosa and Sharpe (MRS) media and incubated at 37°C for 24 hours. Meanwhile, the *Bacillus subtilis* were obtained from stock culture available in microbiology lab in Qatar Environment and Energy Research Institute. The stock culture were sub-cultured into Luria Bertani (LB) broth and incubated at 37°C for 24 hours.

### Preparation of media and inoculation of microorganisms

1g of dry vegetable waste powder was mixed with 100mL distilled water and let stand for 30 minutes. The mixture then filtered with filter paper and the filtrate were collected. The filtrate was sterilized at 121°C for 20 minutes and used to prepare media with various concentrations of wastes (0%, 25%, 50%, 75%). Once the media is cooled, 1mL of bacterial suspension were inoculated into the prepared media and incubated at 37°C for 24 hours.

### Observation on the bacterial growth in formulated media

After incubation, the turbidity of the samples was measured at 600nm which corresponds to the growth of the bacteria in the formulated media.

## Results

### Proximate content of vegetable waste

Proximate composition generally represents the nutritional quality of product. The proximate composition of dried tomato and cucumber is presented in Table 1.

Table 1. Proximate Content of Dried Vegetable Wastes

Proximate analysis	Cucumber Waste	Tomato Waste
Moisture (%)	1.733	11.9
Fat (%)	4.563	7.9

Protein (%)	16.710	23.4
Ash (%)	27.603	11.0
Fibre (%)	21.380	85.7
Carbohydrate (%)	26.64	45.8

\* Each value represents the average of three replicates

Based on the result tabulated in Table 1, tomato waste indicates a higher percentage in terms of moisture, fat, protein, fibre and carbohydrate content compared to cucumber waste. Meanwhile, the percentage of ash content is higher in cucumber waste as compared to tomato waste.

### Bacterial growth in alternative media

The experimental results revealed that vegetable waste-derived medium effectively supported the growth of probiotics. The optical density measurements showed a significant microbial growth in comparison to control, indicating successful probiotics proliferation.

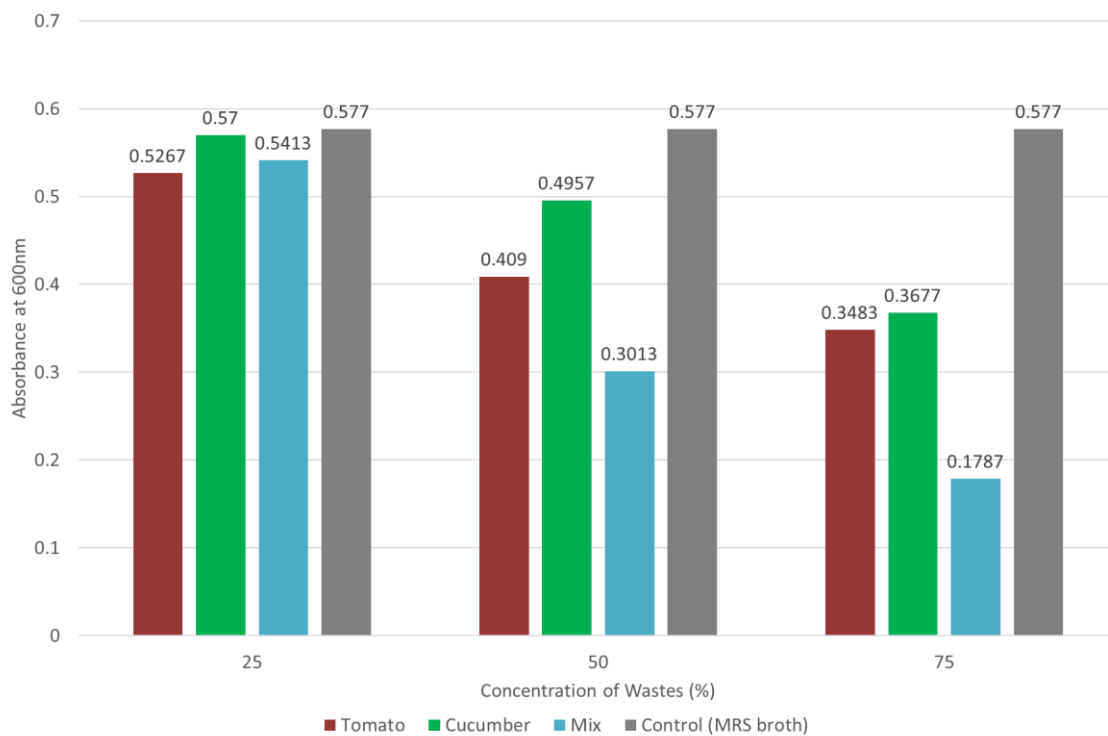


Figure 2. Turbidity measurement of *Lactobacillus* spp. in alternative media

In Figure 2, the absorbance of *Lactobacillus* spp. grown in 25% concentration of cucumber waste is the highest (0.57) among the other media formulations. It also shows comparable growth as compared to the control (*Lactobacillus* spp. grown in MRS broth) with 0.577 absorbance.



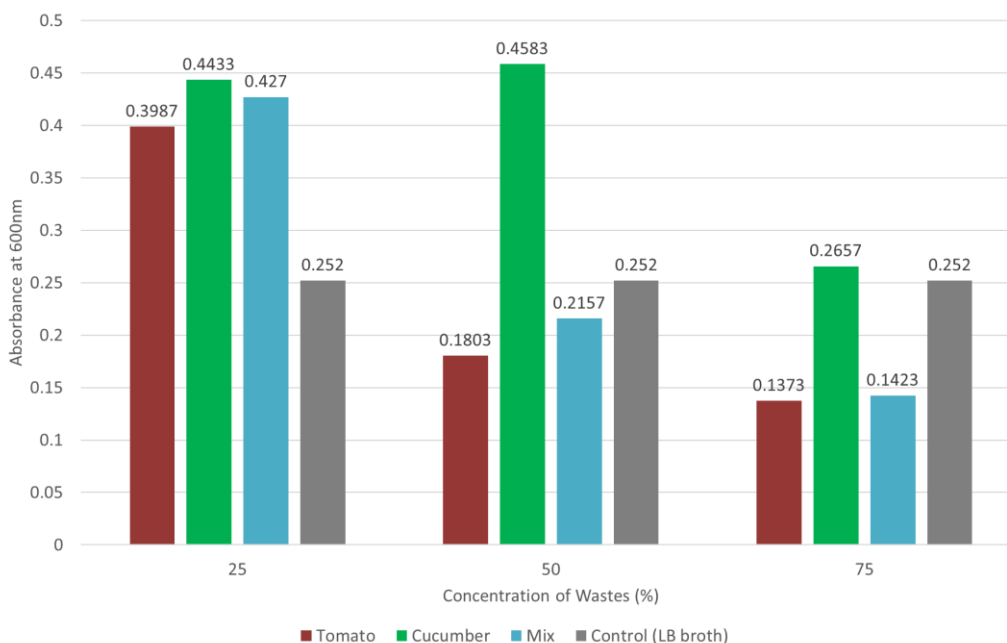


Figure 3. Turbidity measurement of *Bacillus subtilis* in alternative media

In the *Bacillus subtilis* growth diagram (Figure 3), the highest growth occurred in the formulation of 50% cucumber waste media compared to other formulations. These results may occur due to the composition of the 50% cucumber waste media containing nutrients suitable for *Bacillus subtilis* so that the isolate growth becomes optimum.

## Discussion

The results of the proximate analysis revealed that moisture content was higher in tomato waste (11.9%) compared to cucumber waste (1.73%). This could indicate that the cucumber waste will have a relatively longer shelf life due to low water content. Besides that, cucumber waste contains higher ash content (27.6%) as compared to tomato waste, indicating that cucumber waste might have higher mineral content than tomato waste. The minerals are vital as they serve as inorganic co-factors in metabolic processes.

Result showed that investigations on proximate analysis of cucumber revealed that they are rich in carbohydrate, crude ash, crude fibre and followed by protein. In a previous study, it was reported that chemical composition of cucumber are protein in mesocarp 1.68%, in epicarp 3.84% and in endocarp 0.22% while the fat in epicarp is 0.56% and in endocarp is 0.02% (Abulude et al., 2007) which are far lower than reported in this study. The differences might be due to various factors such as nutrients availability, environment and weather during the plant cultivation. Thus, in this research, the proximate analysis of cucumber waste indicates that it can serve as a good source of nutrients with potential application as alternative microbiological media.

A previous reasearch conducted, indicated that MRS medium is the most common used media for *Lactobacillus*

sp cultivation while LB broth is most common media for *Bacillus subtilis* cultivation as it contains optimal growth factors and nutrition (De MAN et al., 1960; Lu et al., 2018). However, its high cost is not economically feasible in industrial-scale processes. In this study, we evaluated potentially low-cost media for *Lactobacillus* spp. production using tomato wastes and cucumber wastes. It was demonstrated that these wastes can potentially be used as a nutrient source for cultivation and fermentation of probiotics. However, further research need to be conducted to optimize the nutrients in the agricultural wastes media to increase the growth rate of probiotics.

## Conclusion

Based on the findings of this study, it is concluded that alternative media supported the growth of both probiotics *Lactobacillus* spp. and *Bacillus subtilis*. Proteins and carbohydrates are very essential nutrients for the growth of any organism and available in the vegetable wastes. The alternative media which can be prepared very easily using different vegetable wastes is rich in nutrient and therefore can be used as an alternative to their commercially available growth media. Alternative media could be used as cheap media for routine experiments in laboratory. Further study on the optimization of the agricultural waste-medium should be conducted to maximize the growth of the probiotics.

## Acknowledgements

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## BT- CNNCAE: A Brain Tumor Cancer Detection Using Hybrid Convolutional Neural Network and Convolutional Autoencoder

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**Abstract:** Aberrant cell growth leads to the development of a brain tumor i.e., when normal cells develop changes or mutations in their DNA, within the brain. It is a serious life-threatening disease which can also be cancerous or become cancerous. The need for early detection of brain tumor is essential for proper treatment. Diagnosis is usually done with the help of Magnetic Resonance Imaging (MRI) images. Machine learning can be used to build systems that automate the diagnosis process. Convolutional neural networks (CNNs) are a category of deep learning approach and one of the methods used for image processing the most frequently. The hybrid model presented in this paper, which combines convolutional neural networks (CNNs) and convolutional auto encoders (CAE), presents a unique method for diagnosing brain tumors. The proposed BT-CNNCAE approach provides acceptable results in the detection of brain tumor. It is evaluated on Br35H-2020 brain tumor dataset that consists of around 3000 MRI images. With only 26,833 parameters, the hybrid model is able to achieve training accuracy of 99.83% and testing accuracy of 97.50%, making it a useful tool for brain tumor identification.

**Keywords:** Cancer, Brain Tumor, convolutional autoencoder, convolutional neural network, MRI images.

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### Introduction

The brain is the most intricate and complex organ in the human body, serving as the nervous system's primary organ. It also plays the role of giving us a sense of awareness of ourselves and our surroundings [2], it is also in charge of directing and governing all body components. Brain Tumor occurs when normal brain cells develop

changes or mutations in their DNA and grow at an uncontrollable rate of growth. As these aberrant cells continues to grow they harm the healthy cells and thus disrupting typical human body functions [3]. Also, brain tumor can be cancerous or they can become cancerous. Brain tumor are usually categorised from grade 1 to grade 4 depending upon various factors that control their growth and spread [28]. Grade 1 and 2 tumors are generally non-cancerous while grade 3 and 4 tumors are malignant [28]. Children can develop brain tumors, but adults of any age can develop them as well. However, older adults tend to develop them more frequently. Cancerous or malignant brain tumors have no known specific aetiology, however it's considered that certain genetic disorders and prior head radiation therapy may enhance the likelihood that one will form. Typically, magnetic resonance imaging (MRI) is used to detect the presence or absence brain tumors instead of CT scans other different techniques because of its non-invasive nature [10,22,23]. MRI produces images of our organs and tissues using magnetic fields [22,23]. Our brain also has a strong magnetic field, which makes MRI an excellent tool for identifying brain illnesses without causing any damage to the brain. The type of brain tumor can be determined by an MRI, albeit a biopsy may occasionally be necessary [29].

The safest way to diagnose brain tumors is through an MRI scan. Machine learning and deep learning models that can automate the diagnosis of brain cancers can be trained using these MRI data. The vast majority of state-of-the-art automated systems are already employing advanced machine learning techniques to recognise and classify brain tumors. Their crucial stage is the feature extraction procedure, which entails these algorithms learning significant elements from the MRI pictures [11]. Dimensionality reduction is another step in the feature extraction process that decreases the amount of duplicated data without sacrificing any of the crucial information from the MRI pictures. To detect brain cancers, machine learning or deep learning models employ the retrieved features as input.

Over the years, deep learning techniques have grown very efficient and accurate in the field of classification problems alongside image processing [9]. Deep learning techniques that work well with image data include Convolutional Neural Networks (CNNs) and Convolutional Auto-encoders (CAEs) [1]. Convolutional Neural Networks are widely used in deep learning because of their efficiency in classifying input images into their respective classes [16], whereas to compress vast or complicated input features into a lower-dimensional space, convolutional auto-encoders can be used [13]. Thus, CAEs ends up aiding in dimensionality reduction. Both of these techniques use neural networks to extract spatial and temporal features from images and produce efficient results.

In order to minimise the amount of training parameters, this research introduces a hybrid CNN and CAE model for detecting brain tumors. Fig 1 shows the brief overview of the proposed BT-CNNCAE approach. While CNN was used to categorise the MRI scans into two groups that indicate the presence and absence of tumors, CAE was used to minimise the dimensionality of the input images, as well as the number of trainable parameters [12]. The remaining sections of the paper are divided into 4 groups. Section 2 reviews the prior research that has been done in this field, and Section 3 describes the suggested strategy and the construction techniques for the proposed BT-CNNCAE model. The outcomes of the suggested model for classifying brain tumors are finally

presented in section 4, while section 5 serves the paper's conclusion.

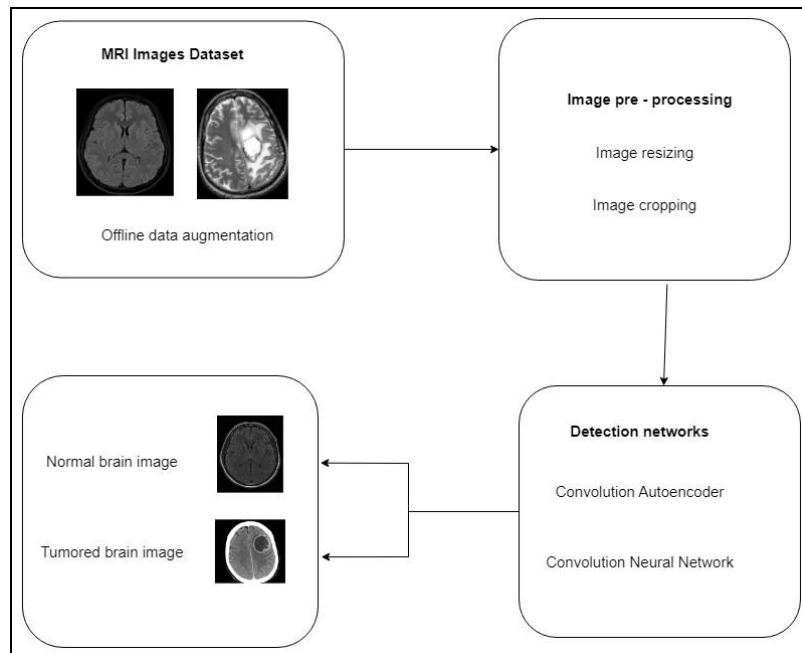


Figure 1: Overview of proposed BT-CNNCAE approach.

## Literature Review

For the purpose of detecting plant diseases, Punam Bedi et al. (2021) [1] suggested a method based on convolutional auto-encoder and convolutional neural network. The approach's major goal was to reduce the number of trainable factors while maintaining accuracy. Their final model was trained using just 9,914 training parameters, and it had a training accuracy and testing accuracy of 99.35% and 98.38%, respectively. M. Yasir et al. (2021) [2] introduced a hybrid model of three different models for both the classification of brain tumor as well as localization of these tumors. In order to classify tumors into the three types of Glioblastoma, Astrocytoma, and Dendroglioma, they employed traditional convolutional neural networks. For tumor localization, they used faster region-based convolutional neural networks and region-based convolutional neural networks. Indu Singh et al. (2022) [3] proposed an approach brain tumor classification and detection using a hybrid CNN model consisting of Multinomial Logistic Regression, Random Forest and Support Vector Machine as classifiers. The model's accuracy was increased by tuning the hyper-parameters of the CNN model with the help of KerasTuner. The proposed model achieved an accuracy of 96.08%. M. Gupta et al. (2021) [4] classified brain tumors using three different CNN models. The first model was based on CNN and it achieved an accuracy of 91.29% while the next CNN model which used data augmentation, achieved a resultant accuracy of 79.79% and the third and final CNN model, using VGG16, achieved 87.27% accuracy in classifying the brain tumors. Syed M. Haider Shah et al. (2021) [5] introduced a CNN model which uses categorical cross-entropy as loss function along with parameter adjustment. The pre-processing phase involved fuzzy based enhancement method to enhance the brain tumor images i.e., MRI scans. The final accuracy achieved by the proposed model was

recorded as 97.60%. The model also classified brain tumors into meningioma, pituitary tumor and glioma tumor and no-tumor. A strategy based on employing a convolution neural network with a grey scale co-occurrence matrix for tumor localization was proposed by Praveen Kumar Ramtekkar et al. in 2020 [6]. The method also included segmenting photos using Kmeans and Otsu thresholding, clustering images using the partial differential equation method, and enhancing images using the multi histogram equalisation method. The model's ultimate objective was to develop an automated system for finding and classifying brain tumors. An automated brain tumor diagnosis method based on FCM (Fuzzy C-Means) and Clustering-based convolution Neural Network (CNN) was developed by L. Jagjeevan Rao et al. in 2020 [7]. The system had a 91 percent accuracy rate. Additionally, they compared the suggested model to K-Nearest Neighbour (KNN) and Back propagation Neural Network (BPNN), coming to the conclusion that CNN provided superior accuracy than these classifiers. Convolution neural networks (CNNs), which are based on data augmentation and picture pre-processing techniques, were proposed by A. M. Hashan et al. (2021) [8] as a means of detecting brain cancers. By identifying sharp features, the dark borders of the photos were removed using image pre-processing techniques. These photos were then normalised to an appropriate scale.

The fact that the above studies while achieved significant accuracy, their techniques were trained on a significant number of trainable parameters. Additionally, training a model having a higher count of trainable parameters needs a long period of training time or a powerful machine. Due to this, a model was designed and it set out to find a way to cut the amount of trainable parameters required to detect brain tumor without significantly lowering classification accuracy. In order to detect brain tumor, a unique hybrid model was thus developed in this study that first uses CAE for dimensionality reduction of the input MRI image and then uses CNN for classification into tumor present or absent. The main finding of this research is that the number of training parameters were significantly reduced by the dimensionality reduction before classification.

## Method

This paper proposes a novel approach for brain tumor detection. The approach consists of building a convolutional-autoencoder (CAE) and convolutional neural network (CNN) based hybrid model. CAE is used to reduce the number of trainable parameters as well as dimensionality. The resultant compressed images are then fed to CNN model which classifies them as tumor and no-tumor.

The method starts by loading the dataset [14], which consists of 3000 MRI scans, and then shuffles and labels the loaded pictures. 80 percent of the dataset was utilised for training, and 20 percent was used for testing i.e., 2400 MRI scans were used for training and 600 scans were used for testing. The trained and tested data were then used as input for the convolutional autoencoder which have two parts.

Convolutional autoencoder primarily comprises of an encoder network followed by a decoder network. The task of encoding the images into smaller dimensions falls on the encoder network. The encoded images are created

by the bottleneck layer, the final layer of the encoder network. The decoder network decodes the encoded images, and the reconstruction layer, the last layer of the decoder network, reconstructs them [1]. This results in significant decrease in redundant features and only relevant features are left for the CNN classifier [17]. The final number of training parameters for the CAE were 29,507. The encoded images were then fed to the CNN model which was designed for final classification of MRI scans as brain tumor present or brain tumor absent.

Four convolutional layers make up the CNN classifier, and each of these convolutional layers is succeeded by a max pooling layer that shrinks the feature map that the convolutional layer's sampling produced i.e., it downsamples the feature map [18]. Convolutional layers employ ReLu as their activation function. The final output is generated by a fully-connected layer that uses sigmoid function succeeded by a dropout layer to handle overfitting. The final number of training parameters for the CNN model were 26,833. Figure 2 describes the flowchart of the proposed methodology.

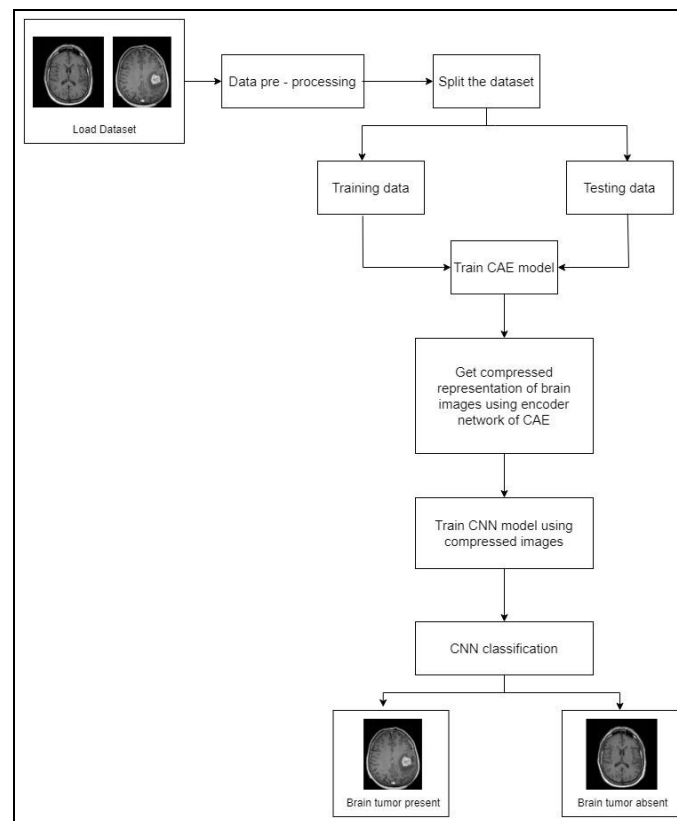


Figure 2: Flow chart of proposed BT-CNNCAE methodology.

### A. Convolutional Autoencoder

A convolutional autoencoder (CAE) is a special case of unsupervised learning model or more precisely self-supervised learning model. It is a neural network that is primarily trained with images. It consists of 2 components i.e., encoder network and decoder network. The last layers in encoder network and decoder network are called bottleneck layer and reconstruction layers respectively. CAE was built using 2 convolutional layers



for both encoder and decoder network. In both the networks, the convolutional layers use ReLu activation function, the equation for which is given below:

$$f(x) = \max(0, x) \quad \dots (1)$$

ReLu is a non-linear function and is one of the most commonly used activation function in case of neural networks. ReLu was used in CAE so that the convolutional layers learn complex relationships from the training data. Encoder networks also uses max pooling layers after every convolutional layer which downsamples the feature map [25]. The mathematical equation which describes the encoder network is given below:

$$X_{e_{i+1}} = f_{e_i}(W_{e_i}^T X_{e_i} + b_{e_i}) \forall i \in 0, 1, \dots, N \quad \dots (2)$$

where,

$X_{e_i}$  denotes the input,  $X_{e_{i+1}}$  denotes the output,  $W_{e_i}$  denotes the weight vector,  $b_{e_i}$  denotes the bias, and  $f_{e_i}$  denotes the activation function that was used in the  $i$ th layer of the Encoder Network [1].

The Decoder network is built similar to encoder network but the layers are structured in reverse order. Also, each convolutional layer is succeeded by an upsampling layer which in contrast to max pooling layer upsamples the feature map. The model in turn produces compressed images with reduced dimensionality as well as significant feature reduction while keeping the relevant features safe. The Decoder network also employed the activation function that was used in Encoder network i.e., ReLu. The mathematical equation that describes the decoder network is given below:

$$X_{d_{i+1}} = f_{d_i}(W_{d_i}^T X_{d_i} + b_{d_i}) \forall i \in 0, 1, \dots, N \quad \dots (3)$$

where,

$X_{d_i}$  denotes the input,  $X_{d_{i+1}}$  denotes the output,  $W_{d_i}$  denotes the weight vector,  $b_{d_i}$  denotes the bias, and  $f_{d_i}$  denotes the activation function that was used in the  $i$ th layer of the Decoder Network.

## B. Convolutional Neural Network

Convolutional Neural Networks (CNNs) are a subset of neural networks that are particularly adept at processing input with a grid-like architecture, such as pictures. The three main parts of CNNs are convolutional layers, pooling layers, and fully connected layers [21]. Convolutional layers handles the computational part, the spatial size of the representations is reduced by pooling layers and finally the fully connected layers consists of full connectivity of all neurons in the preceding and succeeding layer. The fully connected or Dense layer is responsible for final classification. Fig 3 gives the detailed architecture of the hybrid model which consists of encoder network of CAE as well as the complete CNN model.

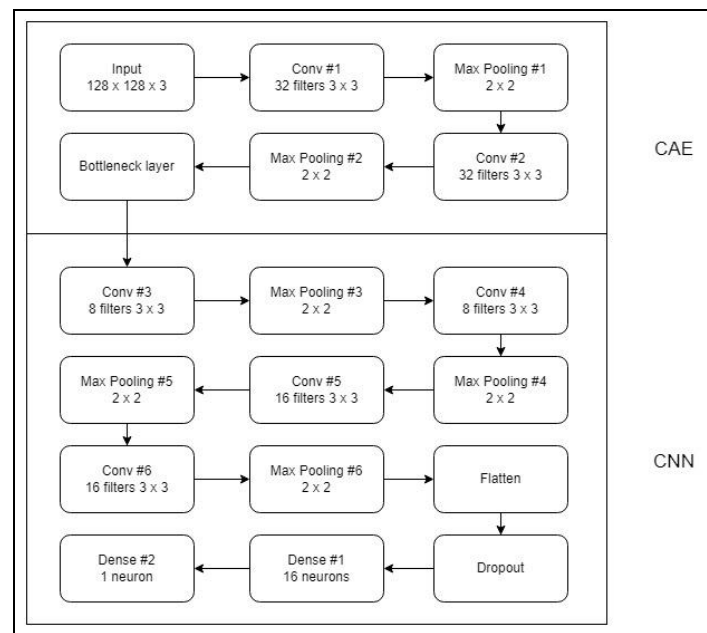


Figure 3: Complete Architecture of the hybrid BT-CNNCAE model.

The CNN model was built using four convolutional layers. Encoded images that were generated by the CAE, were used as input for these convolutional layers which applies a convolution operation i.e., turns a 2D feature matrix into a separate 2D feature matrix and sends the results to the following layers [20]. Each of the convolutional layer uses ReLu activation function and is succeeded up by a max pooling layer which selects a maximum feature from the output of each convolutional layer i.e., it creates a downsampled (pooled) feature map [26]. The downsampled feature map still contains relevant features. This results in reduction in number of trainable parameters which came out to be 7,441 for CNN. Finally, the feature map is flattened into a continuous linear vector via the Flatten layer. A dropout layer is also appended to handle overfitting. The last Dense or fully-connected layer uses sigmoid function and classifies the output. The equation for sigmoid function is given below:

$$S(x) = \frac{1}{1 + e^{-x}} \quad \dots (4)$$

where  $e$  is the Euler's number.

Sigmoid function was used as the problem was a binary classification problem i.e., brain tumor present (interpreted as 1) and brain tumor absent (interpreted as 0).

There were two types of losses involved in this research: training loss and validation loss. How well a deep learning model matches the training set of data is measured by training loss. Training set is used to evaluate model's inaccuracy. It should be emphasised that the training set is a subset of the dataset utilised to train the model initially. On the other side, a statistic known as validation loss was used to evaluate how well a deep learning model performed on the validation set. The section of the dataset designated for model efficacy testing is known as the validation set. Both losses were computed using the Mean Squared Error approach for this

study's purposes, but the focus was subjected on the validation loss only. MSE was calculated by squaring the difference between the model's predicted outputs and the correct output value and averaging it across the entire dataset. The equation for MSE is given below:

$$MSE = \frac{1}{N} \sum_{i=1}^N (y_i - \hat{y}_i)^2 \quad \dots (5)$$

where  $y_i$  depicts the predicted values,  $\hat{y}_i$  depicts the correct (observed) values and  $N$  denotes the total number of values. For implementation purposes, the MSE was implemented with the help of SkLearn library. Finally, the CNN and CAE hybrid model is layered together to give final classification result.

## Results

The proposed approach was evaluated on Br35h-2020 dataset [14]. The dataset consisted of 3000 MRI images with 1500 containing tumor and 1500 not containing tumor. Table I shows the detailed layer-wise construction schema of the proposed BT-CNNCAE model. Various attributes that define the model are shown and their values were chosen after careful observation and experimentation.

Table I. Layer-wise construction schema of the proposed BT-CNNCAE model.

Number	Type of Layer	Input Shape	Filter Count	Filter size	Activation	Padding	Output Shape	Count of training parameters
1	Input layer	128 x 128 x 3	3	-	-	-	128 x 128 x 3	0
2	Conv #1	128 x 128 x 3	32	3 x 3	ReLu	Same	128 x 128 x 32	896
3	MaxPool #1	128 x 128 x 32	32	2 x 2	-	-	64 x 64 x 32	0
3	Conv #2	64 x 64 x 32	32	3 x 3	ReLu	Same	64 x 64 x 32	9248
4	MaxPool #2	64 x 64 x 32	32	2 x 2	-	-	32 x 32 x 32	0
5	Bottleneck Layer	32 x 32 x 32	32	3 x 3	ReLu	Same	32 x 32 x 32	9248
6	Conv #3	32 x 32 x 32	8	3 x 3	ReLu	Same	32 x 32 x 8	2312
7	MaxPool #3	32 x 32 x 8	8	2 x 2	-	-	16 x 16 x 8	0
8	Conv #4	16 x 16 x 8	8	3 x 3	ReLu	Same	16 x 16 x 8	584
9	MaxPool #4	16 x 16 x 8	8	2 x 2	-	-	8 x 8 x 8	0
10	Conv #5	8 x 8 x 8	16	3 x 3	ReLu	Same	8 x 8 x 16	1168
11	MaxPool #5	8 x 8 x 16	16	2 x 2	-	-	4 x 4 x 16	0
12	Conv #6	4 x 4 x 16	16	3 x 3	ReLu	Same	4 x 4 x 16	2320
13	MaxPool #6	4 x 4 x 16	16	2 x 2	-	-	2 x 2 x 16	0
14	Flatten Layer	2 x 2 x 16	-	-	-	-	64	0
15	Dropout Layer	64	-	-	-	-	64	0
16	Dense #1	64	-	-	Linear	-	16	1040
17	Dense #2	16	-	-	Sigmoid	-	1	17
Total number of parameters								26,833

The various hyperparameters of the CNN classifier are displayed in Table II. Adam was chosen as the optimization algorithm for calculating individual adaptive learning rates [19] while binary cross-entropy method

was employed for loss measurement as the problem itself is a binary classification problem. ReLu and sigmoid were used as activation and output activation function respectively. As for the batch size, epochs and no. of convolutional layers hyperparameters, their values were chosen after careful experimentations and observations. In general, all of these parameters were used to train CNN model and were chosen after various combinations to achieve better accuracy and lower the loss.

Table II. Hyperparameters of the CNN classifier.

S. No.	Hyperparameter Used	Field Value
1.	Optimization Algorithm	Adam
2.	Loss	Binary crossentropy
3.	Activation Function	ReLu (Rectified Linear Unit)
4.	Output Activation Function	Sigmoid
5.	Batch size	256
6.	Epochs	100
7.	Number of convolutional layers	4

Fig 4 shows the validation and training accuracy achieved vs Epochs by the proposed hybrid model. The training accuracy reached 99.83% while the validation (testing) accuracy achieved was 97.50%. The testing accuracy was calculated using the below given formula:

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \quad \dots (6)$$

where,

*TP* indicates the True Positive count, *TN* indicates the True Negative count, *FP* indicates the False Positive count and *FN* indicates the False Negative count.

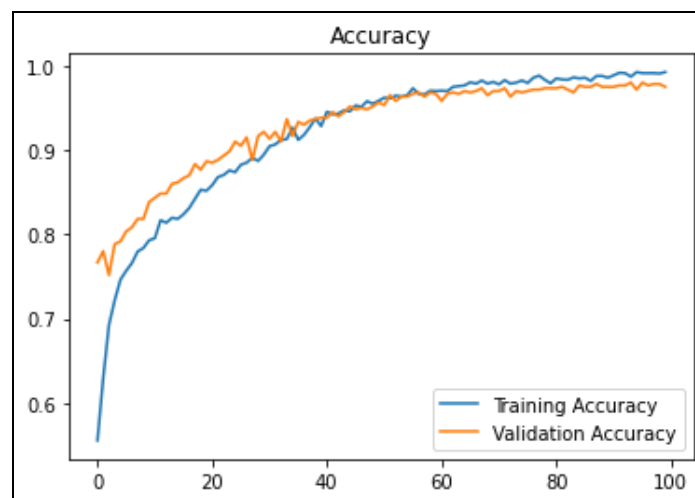


Figure 4. Training vs Validation Accuracy

Figure 5 depicts the validation (testing) and training loss vs Epochs for the hybrid model. The loss was calculated using mean squared error (MSE) method. The validation loss came out to be 0.018 which is well within the acceptable parameters. It can be seen that the loss has significantly decrease. The number of training parameters were also significantly reduced to 26,833.

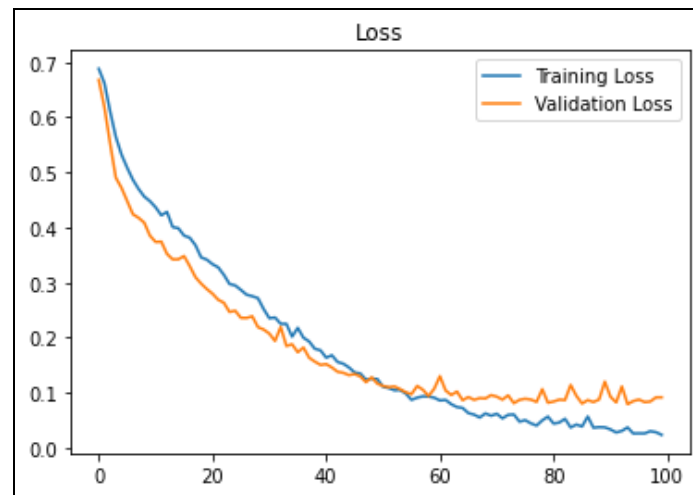


Figure 5. Training vs Validation Loss

The confusion matrix of the CNN model is shown in figure 6. Confusion matrix is a standard measure of performance of any machine learning or deep learning model. It shows all combinations of actual values against predicted values.

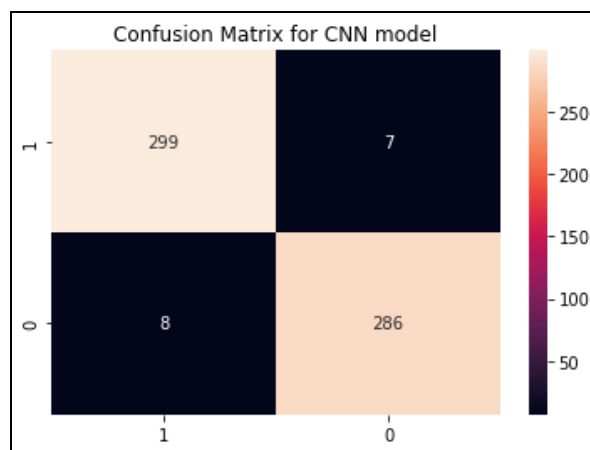


Figure 7. Confusion Matrix for the CNN model

The recall value that can be calculated from confusion matrix came out to be 0.51 while the precision value was observed to be 0.97. The F1-score was calculated as 0.67 which is useful measure when comparing two machine learning models as it measures both recall and precision at the same time. Equations (8), (9) and (10) gives the formulae that were used to calculate the recall, precision and F1-score:

Author(s)	Approach Used	Testing Accuracy	Number of trainable parameters(approximately)
T. Hossain [15]	CNN	97.87%	3.9 million
Muhammad Yasir [2]	Faster R-CNN with AlexNet	89.10%	61 million
Indu Singh [3]	Ensemble learning	96.08%	4.1 million
Syed M. Haider Shah [5]	Fuzzy based enhancement with CNN	97.60%	2.3 million
<b>Proposed BT-CNNCAE model</b>	<b>CNN + CAE</b>	<b>97.50%</b>	<b>26,833</b>

$$\text{Sensitivity (Recall)} = \frac{TP}{TP + FN} \quad \dots (8)$$

$$\text{Precision} = \frac{TP}{TP + FP} \quad \dots (9)$$

$$F1 - \text{Score} = 2 * \frac{\text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}} \quad \dots (10)$$

where,  $TP, TN, FN, FP$  are values that are explained after equation 6.

For calculating the number of trainable parameters of existing research methodologies, the following formula was used:

$$N = ((w * h * d) + 1) * k \quad \dots (11)$$

where  $N$  denotes the number of trainable parameters,  $w$  denotes the shape of width,  $h$  denotes the shape of height,  $d$  denotes the previous layer's filters, and  $k$  accounts for all such filters in the current layer.

It must be noted here that 1 is added in the above formula because of each filter's bias term. Also, the above formula can only be used to calculate the number of trainable parameters in the convolutional layer of the neural network. Finally, the above formula gives an approximate number of trainable parameters for only those methodologies which contained the required metrics as shown in the above formula. The comparison with various approaches is shown in Table III.

Table III. Comparison with existing approaches.

The authors used different datasets and achieved different accuracies as evident from the table. Even though the authors used variations of CNN, it can be seen that the achieved accuracies varied largely based on the preprocessing techniques as well as deep learning techniques chosen. The proposed approach achieved superior accuracy compared to other mentioned approaches.

The above metrics as well as comparison with other existing approaches clearly shows that the proposed BT-CNNCAE approach has achieved desirable results along with reduction in the number of parameters used.

## Conclusion

The proposed BT-CNNCAE approach uses a hybrid model consisting of convolutional auto-encoder (CAE) and convolutional neural network (CNN). The CAE comprised of 2 primary components i.e., encoder network and decoder network with bottleneck layer and reconstruction layer being the last layers of corresponding networks [1]. The training and testing percentages were kept at 80% vs 20% respectively. The images were taken from a public dataset Br35H-2020 [14] which is available at kaggle. The trained and tested data were fed to the CAE and compressed images were generated. The compressed images were used as an input for training CNN model. The CNN model consisting of 4 convolutional layers with each of the convolutional layer preceded by a max pooling layer [27]. The activation function used was ReLu and a dropout layer was also appended to handle overfitting. The fully connected layer used sigmoid function and classifies the final output.

Training accuracy for the hybrid model was 99.83%, and testing accuracy was 97.50%. The loss was calculated using Mean Squared Error method and it came out to be 0.018 which is well within acceptable range. The number of trainable parameters were reduced by the hybrid model to only 26,833. The above results show the proposed BT-CNNCAE model is a viable tool that can be used for the detection of brain tumor cancer.

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## Measurements Of Strains on The Cutting Tooth on A Bucket Wheel Excavator in Coal Mining Process

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**Abstract:** The specific strength of the cutting force for coal and surface rocks, varies to a great degree in the mine quarries. The size and direction of the forces from the cutting teeth also depend on the geometry of the teeth, and the way it is mounted in the bucket of the bucketed wheel. Due to the complexity of the excavation process and the kinematics of the cutting tool, the accurate determination of the forces in the cutting teeth can be realized only through an experimental method in situ, thus the reason of the research in order to conceive and materialize dynamometric teeth identical to the regular cutting teeth, mounted on a dynamometric bucket, and the electrical harness for measuring, transmitting and recording the data into suitable media storage. For the in-situ experiments, it has been established that the 4 teeth that equip a bucket to be all dynamometric therefore creating a dynamometric bucket, which can be mounted onto excavators of type RS1300. In the paper it has been specified that the dynamometric tooth had the same geometrical parameters and performed in the same conditions as the real teeth.

**Keywords:** Mining, Excavation, Measuring, Cutting tools, In situ experimentation.

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### Introduction

Following the experimental tests of displacement through splintering of the coal and rocks from the surface of the Oltenia mine fields, on samples taken from different areas of the field, measurements and records of tangent, normal, and lateral forces have been taken on a set of model teeth fitted with a tension dynamometer.

Through the processing of the recorded data, a varied range of specific forces for cutting of coal and surface rocks are obtained, from which it has been determined the maximum threshold forces of the teeth of the buckets wheel excavators working on different quarries. Knowing the forces which act on the cutting teeth, we conceived three types of teeth with improved characteristics over the ones used until now for three different ranges of the specific cutting strengths.

The specific strength of cutting of coal and of surface rocks from the mine quarries, vary in the mining field, Figure 1.



Figure.1 RS 1300 Excavator type in the mining field

For this reason, the splintering forces on the cutting teeth also have significant variations in the mining fields. The size and direction of the forces from the cutting teeth also depend on the geometry of the teeth, their placement and the direction of mounting in the bucket of the bucketed wheel, Figure 2.



Figure. 2: Dynamometric bucket mounted onto RS1300 excavator type

Due to the complexity of the excavation process and of kinematics of the cutting tool, the accurate determination of the forces in the cutting teeth can be realized only through an experimental method in situ, reason for which the research has been conducted in order to conceive and realize dynamometric teeth identical to the regular cutting teeth, forming an assembly considered as a dynamometric bucket, and the electrical harness for measuring, transmitting and recording the data into locations established previously and suited for, Figure 3.

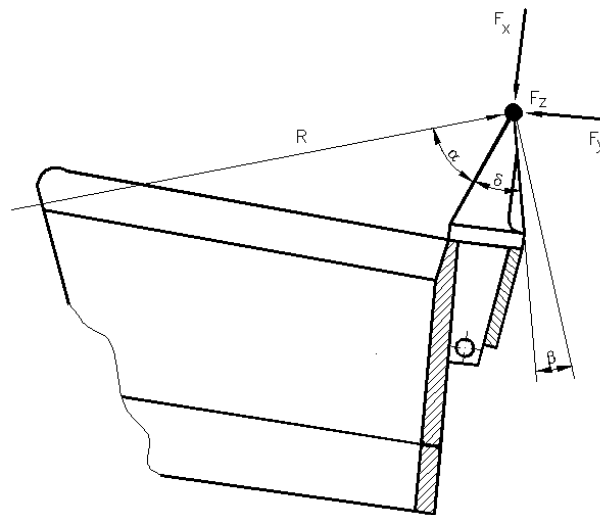


Figure. 3:  $\alpha=55^\circ$ ;  $\beta=7^\circ$ ;  $\delta=28^\circ$ ;  $R=11000\text{mm}$

## Method

### Presentation of the conceived dynamometric tooth

Table 1 presents the geometrical parameters of the three types of teeth.

Table 1.

No	Geometrical parameters (Symbol)	Tooth type		
		I	II	III
1.	Clearance angle ( $\alpha$ )	$52^\circ$	$47^\circ$	$55^\circ$
2.	Seating angle ( $\beta$ )	$7^\circ$	$7^\circ$	$7^\circ$
3.	Sharpening angle ( $\delta$ )	$31^\circ$	$36^\circ$	$31^\circ$
4.	Cutting angle ( $\gamma$ )	$38^\circ$	$43^\circ$	$35^\circ$
5.	Lateral longitudinal angle ( $\zeta$ )	$5^\circ$	$5^\circ$	$5^\circ$
6.	lateral transversal angle( $\theta$ )	$3^\circ$	$3^\circ$	$3^\circ$
7.	Width of the cutting edge of the tooth (b)	120 mm	120 mm	120 mm
8.	Inclinal angle of the seating surface ( $\varphi$ )	$13^\circ$	$15^\circ$	$13^\circ$

Because the measured information is represented by the specific displacements from the application points of the transducers onto the teeth, the relations between them and the components of the resulting points have been

established for each tooth (normal, lateral, tangent).

Figure 4 presents the fastening of the tooth onto the bucket of the bucketed wheel excavator used in quarries Jilț, Roșia and Husnicioara.

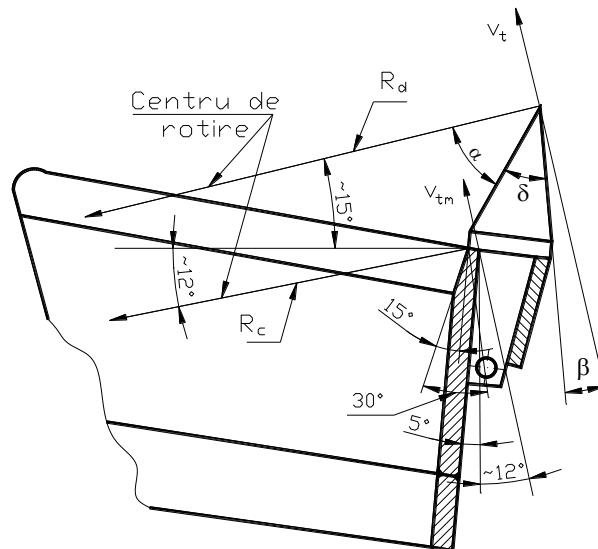


Figure 4. The fastening of the teeth into the bucket

Figure 5 presents the sketch and the geometrical parameters for the teeth type I and II. Type II has the smaller clearance angle. An acute sharpening angle is recommended for cutting coal with higher specific strength ( $A = 800...1200 \text{ N/cm}$ ), from the Oltețu and Peșteana quarries.

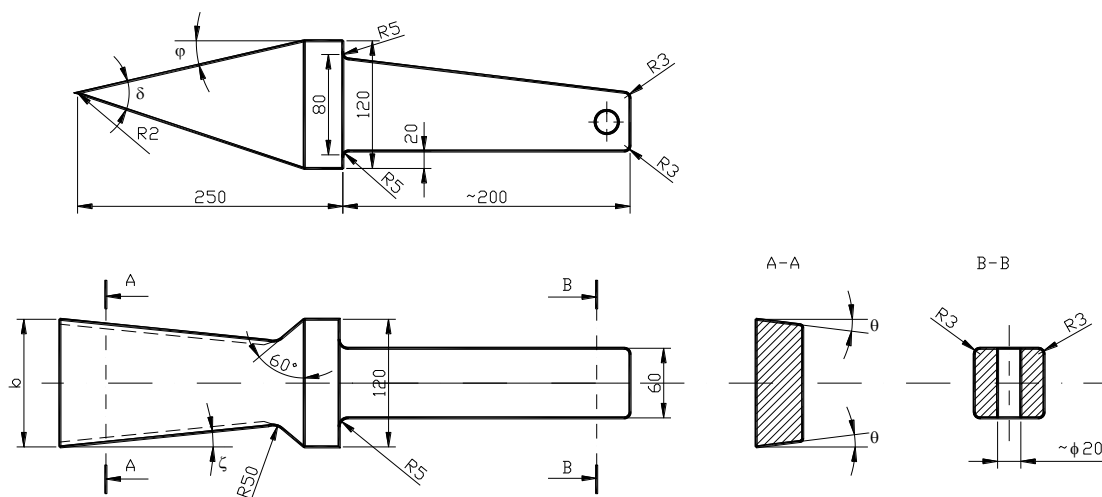


Figure 5. The sketch and the geometrical parameters for the teeth type I and II

Figure 6 presents the shape and geometrical characteristics of the type III, which can cover the entire range of specific cutting strength.

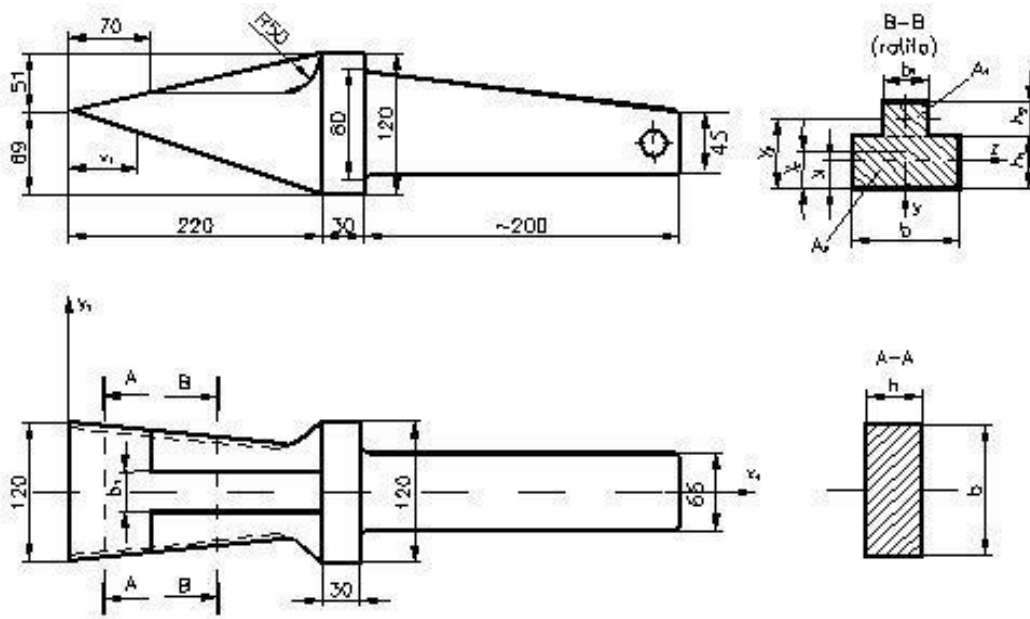


Figure 6. The sketch and the geometrical parameters for the teeth type III

Figure 7 presents the conceived tooth for the research, which is supposed to cover efficiently the displacement of the entire range of specific cutting strengths for the coal and rocks in the Romanian quarries.



Figure. 7

In order to realize the tooth as a dynamometric one there has been provided the placing on the two sides of the tooth's tail (in the free area between the active side and the support that holds it), at a distance of  $l=264\text{mm}$  from the edge, of three electro-resistive transducers. In figure 8 it is presented the dynamometric tooth with the places in which the three transducers are applied SG1 SG2 SG3 and a has been produced a canal in the length of the tooth in order to provide for the electrical conductors from the transducers to the electrical sketch, which will be protected with plates. From here the conductors will be shielded onto the bucket, and the bucketed wheel to the transmission system of the measured data.



Figure. 8: Strain gauges bonded on the dynamometric tooth

**Relations between the forces which act on the tooth and the specific displacements from the measuring points.**

To establish the program to gather and modify the data obtained from the measurements it is necessary to establish the relations between the forces  $F_x$ ,  $F_y$ ,  $F_z$  with random values, which act onto the dynamometric tooth in the splintering process, his geometrical parameters and the specific linear displacements from the placing points of the SG onto the dynamometric tooth.

Specific deformations for the forces  $F_x$ ,  $F_y$ ,  $F_z$ , applied to the center of the edge of the tooth and the geometrical cross section in which the three SG are applied, figure 9, the following relations are obtained:

$$F_x = E \frac{(\varepsilon_2 y_3 - \varepsilon_3 y_2) + \frac{(\varepsilon_1 - \varepsilon_2)(z_2 y_3 - z_3 y_2)}{z_2 - z_1}}{y_3 \left(-\frac{1}{A} + \frac{e_1 y_1}{I_z}\right) + y_2 \left(\frac{1}{A} + \frac{e_2 z_3}{I_y}\right)}$$

$$F_y = \frac{EI_z}{ly_3} \left[ \varepsilon_2 + \frac{(\varepsilon_1 - \varepsilon_2)z_2}{z_2 - z_1} - \frac{(\varepsilon_2 y_3 - \varepsilon_3 y_2) + \frac{(\varepsilon_1 - \varepsilon_2)(z_2 y_3 - z_3 y_2)}{z_1 - z_2}}{y_3 \left(-\frac{1}{A} + \frac{e_1 y_1}{I_z}\right) + y_2 \left(\frac{1}{A} + \frac{e_2 z_3}{I_y}\right)} \right]$$

$$F_z = EI_y \frac{\varepsilon_1 - \varepsilon_2}{l(z_2 - z_1)}$$

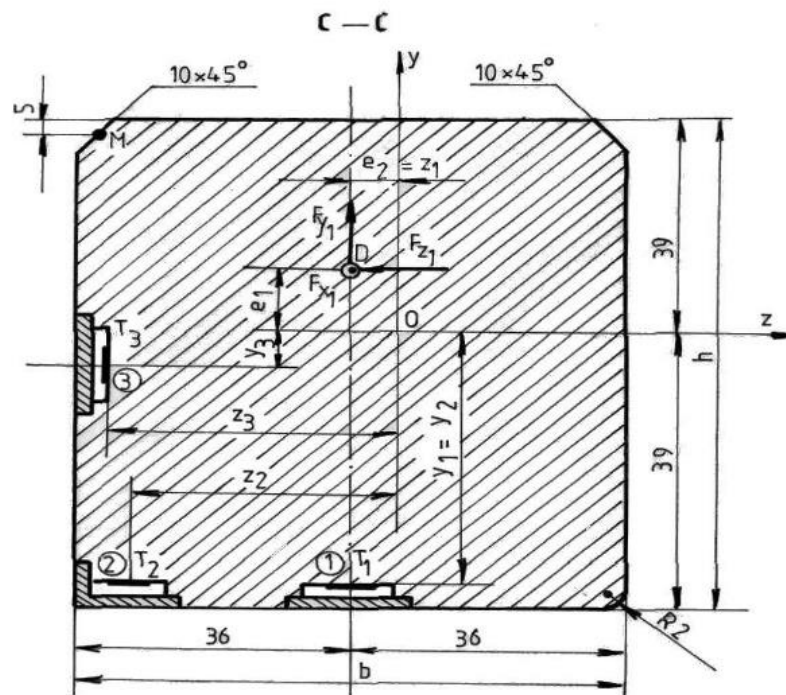


Figure 9: A cross section through the tail of the sample tooth in which the SG are applied

From tests done in laboratory conditions, doing splintering with a machine coal samples and rocks taken from certain areas of the mine fields in Oltenia with different etalon teeth mounted on a dynamometer conceived especially for these tests, there have been determined the cutting characteristics from which it resulted using similar ways for the splintering forces these maximum values:  $F_x=60\text{kN}$ ,  $F_y=18\text{kN}$  și  $F_z=10\text{kN}$ . With these forces there have been determined the values of the stress and there is a base for the design of the tooth further analyzed in this paper.

From the decomposition of these forces depending on the tooth it yields:

$$F_{y1} = F_x \cos 52^\circ - F_y \cos 38^\circ = 2,275 \cdot 10^4 \text{N}; \quad F_{x1} = F_x \sin 52^\circ - F_y \sin 38^\circ = 5,87 \cdot 10^4 \text{N};$$

$F_{z1} = 10 \cdot 10^4 \text{N}$ . With these forces there has been determined the strain state to the type III, which is more supple in design. These forces represent the results of specific loads which have a random distribution on the active sides of the tooth and in a covering, calculation have been considered applied to the type of the teeth.

From the analytical calculations and with the help of the finite element method, in the most stressed point of the section to place the SG1, SG2 and SG3 it has been obtained the strain  $\sigma_M = 248 \text{ N/mm}^2$ , figure 10, resulting in this section of the dynamometric tooth (which is the most stressed). For the dynamometric tooth it has been suggested the material 41MoCr11, which has an increased mechanical strength ( $\sigma_{02} = 750 \text{ N/mm}^2$ ), but also a high resistance to wear. A safety coefficient of  $c = \sigma_{02}/\sigma_M = 3$ .



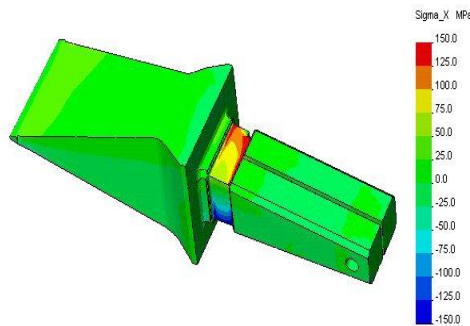


Figure. 10: Stress in the SG direction calculated with finite element method

Geometrical values of the section where are placed the SG, presented in figure 9 are:  $y_1=-29\text{mm}$ ;  $y_2=-29\text{mm}$ ;  $y_3=-0,21\text{mm}$ ;  $e_1=3\text{mm}$ ;  $e_2=-3\text{mm}$ ;  $e_3=3\text{mm}$ ;  $z_1=-29,15\text{mm}$ ;  $z_2=-29,15\text{mm}$ ;  $z_3=-32\text{mm}$ ;  $A=5315\text{mm}^2$ ;  $I_z=2515547\text{mm}^2$ ;  $I_y=2188730\text{mm}^2$ .

The expression of the maximum stress from a current section of the teeth on the range  $y_1 \in [0;70]\text{mm}$ , and from the axis stress and bending is:

$$\sigma = -10^4 \left( \frac{5,836}{65,448x_1 - 0,0934x_1^2} + \frac{2,275x_1}{5,949x_1^2 - 0,00866x_1^3} + \frac{10^4}{1308x_1 - 3,799x_1^2 - 0,00276x_1^3} \right)$$

in which  $x_1$  is introduced in mm and yields the strain in  $\text{N/mm}^2$ .

In Figure 11 it is represented the variation chart of the strain for  $x = 0..70$  mm, in the most stressed points of the active side of the tooth, from which it results that close to the edge there are high values for the strain. This is because in the calculations the tooth was considered perfectly sharp, whereas in reality it's tip is rounded with a ray of 2,5 mm.

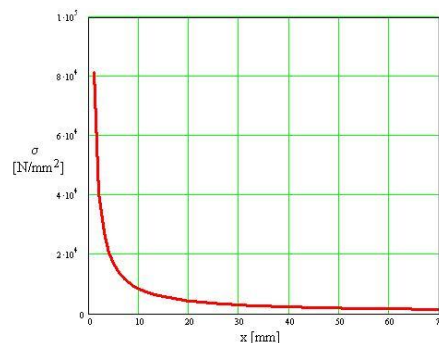


Figure.11 Max strain variation chart for  $x \in [0; 70]$  mm

The complex shape of the tooth for  $x_1 \in [70..220]$  mm, has imposed the determination of stress in the most stressed points along  $x_1$ , and it yielded the variation chart for the maximum strain from figure 12. the values of the max strain from the most stressed points of this range have been obtained with the help of:

$$\sigma = -10^4 \left( \frac{5,837}{A} + \frac{5,836 \cdot e}{W_{z1}} + \frac{2,275 \cdot x_1}{W_{z1}} + \frac{x_1}{W_{y1}} \right),$$

In which A,  $W_{z1}$  și  $W_{y1}$  are the area and the strength modules in the considered points, and e is the eccentric of

the force  $F_{x1}$  with the center of the sections.

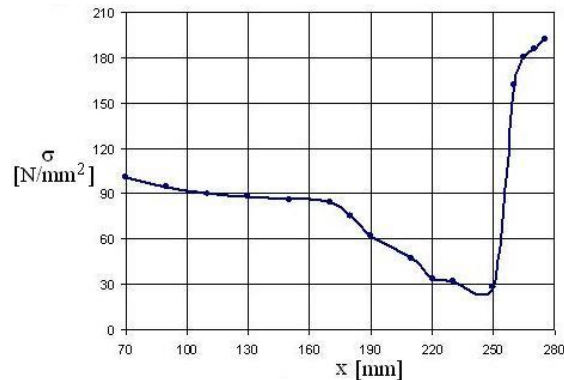


Figure 12. Max strain variation chart for  $x \in [70; 275]$  mm

In figure 12 it is also presented the variation of strain for  $x = 220...250$  mm, for  $x = 220...230$  of the active side with a square section  $120 \times 120$  mm<sup>2</sup> and on the handle of the tooth until the section that enters the cell ( $x = 250...275$  mm), on which the section has been considered constant and rectangular by  $66 \times 66,5$  mm<sup>2</sup>.

The leap variation of strain from 28,39 N/mm<sup>2</sup> to 162,43 N/mm<sup>2</sup>, in the section with  $x = 250$  mm is due to the leap in section of the tooth, from the active side to the handle of the tooth (which is fixed into the bucket). In the leap section of the tooth's dimensions, it is realized a coefficient of concentration of strain  $\beta_k \approx 2$ , resulting in this section a maximum strain of  $\sigma \text{ N/mm}^2_{max}$  and a safety coefficient  $c = 2,3$ .

On the tooth strain gauges are installed on 3 points, requiring 6 strain gages in all, type 3/120 LY-11 HBM, interconnected in half bridges. In this way it is possible to determine by measuring the bending deformations in 3 points. This configuration makes it possible to compensate for temperature.

### Calibration

Calibration was carried out in the laboratory, where the tooth was subjected to a series of defined loads, figure 13.



Figure. 13: Dynamometric tooth calibration in laboratory

The diagram in figure 14 shows some typical laboratory test results. They represent the development of force during a test for 3 directions,  $F_x$ ,  $F_y$ ,  $F_z$ .

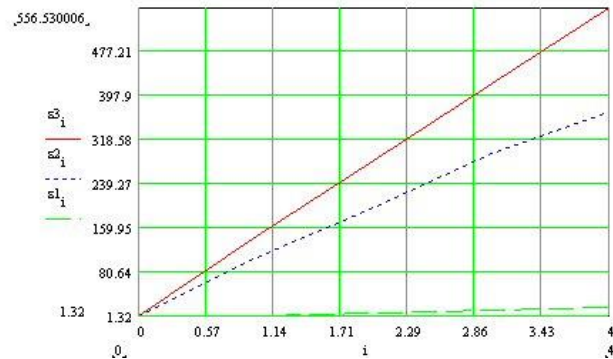


Figure.14 Measurement signals obtaining during calibration the tooth

The measurement data was used in the appropriate transfer matrix, where good linearity and reproducibility were observed.

For the maximum values of the forces  $F_x$   $F_y$   $F_z$  on their acting simultaneously onto the teeth are obtained the maximum values for the specific displacements in points 1, 2 and 3:  $\epsilon_1=508,989 \cdot 10^{-6}$ ;  $\epsilon_2=345.293 \cdot 10^{-6}$ ;  $\epsilon_3=-227.674 \cdot 10^{-6}$ .

During the splintering process, the relations between the forces  $F_x$   $F_y$   $F_z$  changes continuously, the resultant force to these forces being a spinning vector, with an application point in the center of the tooth. For this reason, the specific displacement  $\epsilon_i$  from the  $i$  point ( $i=1,2,3$ ) can vary from 0 to  $\epsilon_i$  max. Therefore, for  $F_{x1} = F_{z1} = 0$  it is obtained  $\epsilon_{1max}=512,723 \cdot 10^{-6}$ , for  $F_{z1} = 0$  results  $\epsilon_{2max}=512,723 \cdot 10^{-6}$ , and for  $F_{y1} = 0$  it is obtained  $\epsilon_{3max}=239,043 \cdot 10^{-6}$ .

**In situ test apparatus**



Figure.15

In figure 15 there is presented the electrical measuring and transmitting installation for acquisition and storage of the data from the stress from the teeth of the dynamometric bucket, which we includes: electro-resistive transducers mounted on the teeth; tensometric amplifier, autonomous source, converting circuit tension-frequency, data acquisition system and computer.

## Conclusion

For the in-situ experimentations, it has been established that the 4 teeth that equip a bucket to be all dynamometric therefore creating a dynamometric bucket, which can be mounted onto excavators of type RS1300. In the paper it has also been established that the dynamometric tooth to have the same geometrical parameters and to work in the same conditions as the real teeth. Following the analysis of the bucketed wheels and the way that the teeth is fixed into the holders it has resulted that the electro-resistive transducers should be placed onto the tail of the tooth, in the free area between the tooth's shoulder and it's holder, in places covered with metallic plates to protect from mechanical hits, and environmental factors. This placement also has the advantage of a placing and a good protection of the electrical conductors which tie the transducers to the tensometric bridge which will be placed onto the rotor of the bucketed wheel near the axel.

From the numerical calculation using the finite element method, on an simultaneous application of forces  $F_x$   $F_y$   $F_z$  onto the dynamometric tooth there have resulted the specific displacements  $\varepsilon_1=0,00047$ ;  $\varepsilon_2=0,0003$  and  $\varepsilon_3=-0,00022$ , which are practically equal to those that resulted from the classical calculations.

This paper presented two transducers with six degrees of freedom, suitable for measuring the forces and moments that a skier transfers to the skis. The first transducer was fully test-ed in the laboratory, during calibration and during skiing trials under real load conditions. The second new and independently developed transducer was designed to increase compactness, safety, precision and sensitivity in relation to the 3 loads.

At the same time satisfactory decoupling effects were achieved in three ways:

1. Mechanically by means of the HBM strain gages which are optimally tuned to the geometry and stresses of the sprung elements.
2. Electrically due to wiring the strain gages in a special way to compensate for unwanted signals.
3. Mathematically by computing the cali-bration matrix.

The individual sensors in the new load cell were fully calibrated. A global calibration then has to be carried out in the laboratory, during which forces and moments are simul-taneously applied to the whole configuration along the x, y and z axes. Skiing trials can then be carried out under real load conditions.

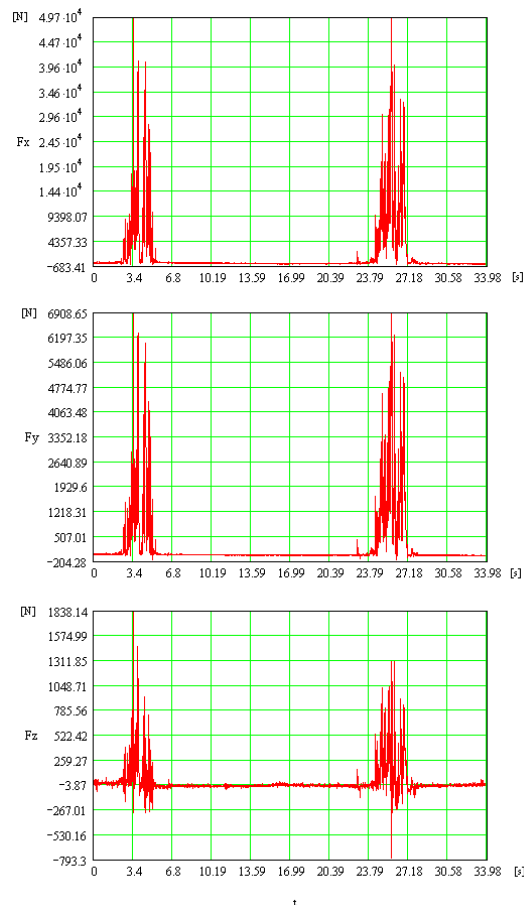


Figure 11. Measured forces in cutting process

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## Environmental Strategies of Industrial Parks in Russia

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**Abstract:** The concept of eco-industrial parks is based on the idea of reducing ecological footprint by replacing toxic materials, using carbon dioxide absorption technologies, integrated waste treatment, reusing materials and maximizing energy efficiency in the design and construction of industrial facilities. This concept has not yet become widespread in Russia, but now industrial parks and technology parks are developing in the country. The purpose of this study is to analyze the environmental aspects of the design and operation of industrial parks and technology parks (technoparks). The distribution of Russian technoparks and industrial parks by types, kinds and regions of the country was examined. The work analyzed more than 1000 official websites of industrial parks and technology parks in Russia, which are at different stages of development and identified a few cases of technoparks and industrial parks that have implemented an environmental policy and environmental management system. As a result of the study, it was concluded that the concept of an eco-industrial park has not yet been applied in Russia; only 1% of industrial parks in the country have a clearly defined environmental policy. However, this situation can be changed by introducing a system of voluntary certification of eco-industrial parks, which may include the requirements, like Chinese, Italian and other national IEP standards.

**Keywords:** industrial park, technopark, eco-industrial park, environmental policy, environmental standards

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### Introduction

Since the first industrial revolution in the middle of the 18th century, industrial manufacturing has greatly contributed to the development of labor productivity and created material benefits for people. However, the excessive development of industrial production has also brought a number of environmental problems, such as the depletion of water and soil resources, a sharp decline in biological diversity, and global climate change. Since the widespread acceptance of the concept of sustainable development, a new form of organization of production based on the principles of the circular economy, namely, eco-industrial parks, gained great popularity around the world (Fuentes Barrera, Gabarrell i Durany, Rieradevall Pons & Guerrero Erazo, 2021;

Huang et al., 2019). Eco-industrial parks are created and successfully operate both in economically developed (for example, USA, Germany) and in developing countries (India, China). The main goal of the eco-industrial park is to improve the economic performance of participating companies while minimizing their impact on the environment (Castiglione & Alfieri, 2020). The most important elements are the interaction between the enterprises-residents of the park, the local community, and the natural environment. The concept of eco-industrial parks (EIP) provides for the development of industrial symbiosis and the introduction of industrial environmental innovations (Geng & Hengxin, 2009; (Chebykina, 2018; Talantsev V.I. & Smirnova N.K., 2016; Hu, Tian & Chen, 2021; Tudor, Adam & Bates, 2007). Due to the creation of the EIP, the issues of increasing the energy efficiency of the national economy, reducing its negative impact on the environment, and rational consumption of resources are being comprehensively resolved.

In recent years in Russia there has been a rapid development of industrial parks (IP) and technology parks (TP), but the concept of eco-industrial parks has not yet become widespread. This study therefore set out to analyze the environmental programs and policies of Russian industrial parks and technology park and assessment their strategies from the point of view of their compliance with the principles of the circular economy.

## Method

This investigation uses frequency analysis and the multiple case study methods. Data for this study were collected using the register of industrial parks in Russia, developed by Terra Business & Industrial (TBI Group), engaged in the selection of land plots with infrastructure and premises in industrial parks, agroclusters and technology parks of the Russian Federation (Analytics, 2022). At the first stage of the study, the distribution of Russian technology park and industrial parks by types, kinds and regions of the country was analyzed. At the second stage of the study, an analysis of their official websites was carried out for all operating technoparks and industrial parks. If the park's website presented its environmental policy or strategy, a content analysis of these documents was carried out to determine if they presented any information on the use of the principles of the circular economy. If the park's website did not present its environmental policy, the entire content of the site was analyzed. If the park did not have an official website, any materials on its operation presented in the media were analyzed.

## Results

### Distribution of Russian industrial parks by types and kinds

According to TBI Group, in June of 2022, 950 industrial parks and 310 technoparks were registered in Russia. The largest number of both industrial and technology parks are located in Moscow, the Moscow region, the Republic of Tatarstan and St. Petersburg (fig 1-2).



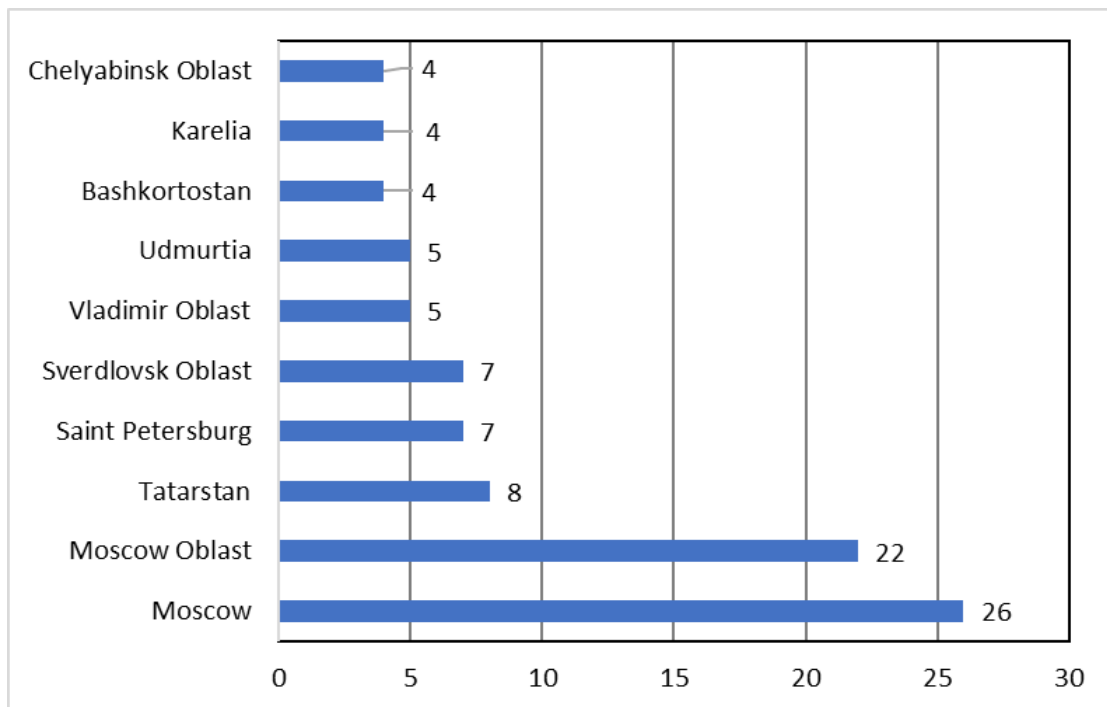


Figure 1. Number of technoparks in the leading regions.

Source: compiled by the authors based on the data <https://russiaindustrialpark.ru/analytics>

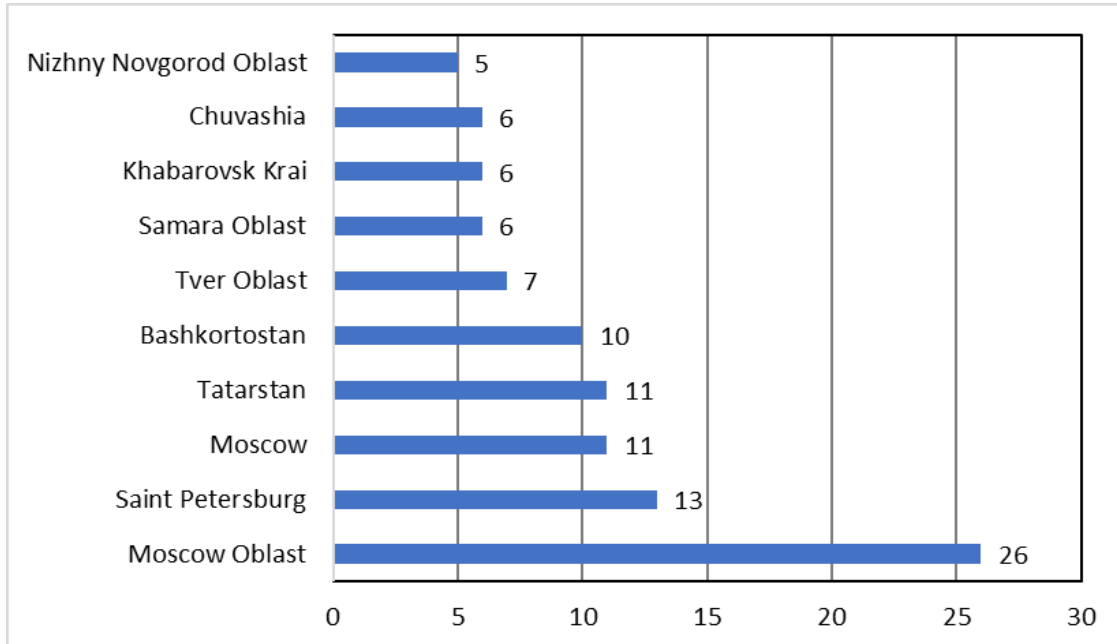


Figure 2. Number of industrial parks in leading regions.

Source: compiled by the authors based on the data <https://russiaindustrialpark.ru/analytics>

We did not notice any significant difference between Russian industrial parks and technology parks either in terms of product innovation or in the principles of organization and operation. However, in terms of ownership the predominant type of TP is state-owned, and the predominant type of IP is private (fig.3).

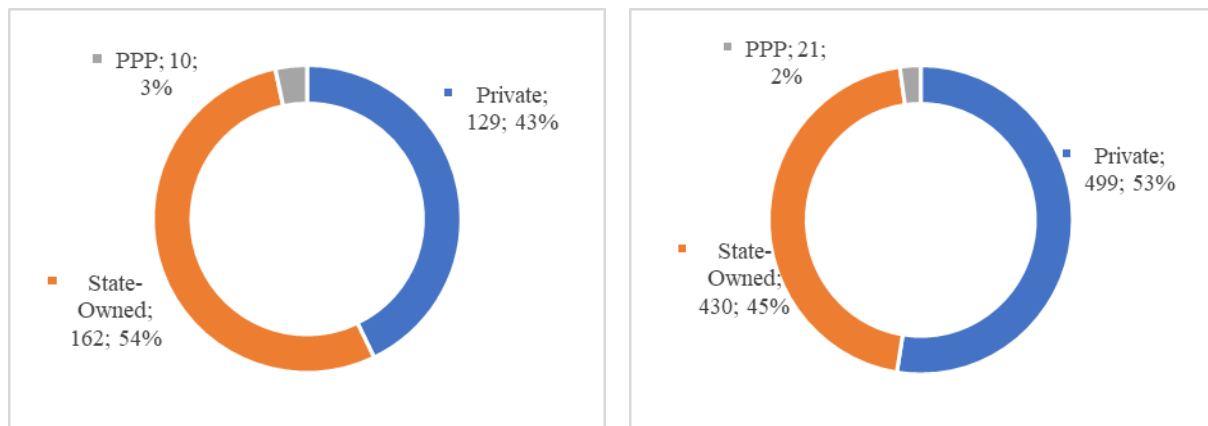


Figure 3. Distribution of techno parks (left) and industrial parks (right) by form of ownership.

Source: compiled by the authors based on the data <https://russiaindustrialpark.ru/analytics>

Analyzing the distribution of technoparks and industrial parks by status (operating / being constructed / projected / intentions), it can be noted that the largest number of parks is under construction (fig.4).

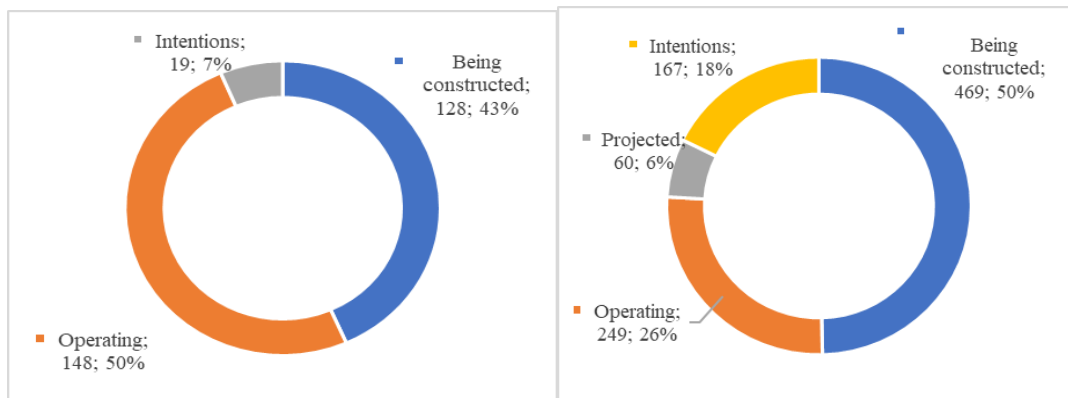


Figure 4. Distribution of techno parks (left) and industrial parks (right) by status.

Source: compiled by the authors based on the data <https://russiaindustrialpark.ru/analytics>

Currently, the largest number of operating technology parks is located in Moscow City (26), Moscow region (22), Republic of Tatarstan (8), St. Petersburg (7), Sverdlovsk region (7), Vladimir region (5), Udmurt Republic (5), the Republic of Bashkortostan (4), the Republic of Karelia (4) and Chelyabinsk Region (4). Most of parks under construction are in Moscow City (28), Moscow region (8), Novosibirsk region (7), Sverdlovsk region (6), Kaliningrad region (5), Republic of Tatarstan (5), Voronezh region (4), Lipetsk region (4), Astrakhan region (3) and Penza region (3). Most of planned techno parks are in the Republic of Buryatia (4), St. Petersburg (3), Astrakhan region (1), Orenburg region (1), Republic of Ingushetia (1), Ryazan region (1), Tomsk region (1), Chechen Republic (1), Khabarovsk Territory (1), and Yugra region (1).

As for industrial parks, the largest number of operating industrial parks is located in the Moscow region (26), St. Petersburg (13), Moscow City (11), the Republic of Tatarstan (11), the Republic of Bashkortostan (10), the Tver

region (7), Samara region (6), Khabarovsk region (6), Chuvash Republic (6), and Nizhny Novgorod region (5). Most of parks under construction are in Moscow Region (26), Ulyanovsk region (14), Chelyabinsk region (13), Republic of Tatarstan (11), Yugra region (11), Ryazan region (10), Udmurt Republic (10), Kurgan region (9), Rostov region (9), and Yaroslavl region (9). Most of the designed industrial parks are in the Moscow region (26), the Republic of Tatarstan (11), the Vladimir region (6), the Leningrad region (4), the Astrakhan region (3), the Vologda region (2), the Kirov region (2), the Oryol region (2), Perm region (2), and Primorsky region (2). Most of the planned parks (intention) are in Moscow Region (26), Republic of Crimea (11), Republic of Tatarstan (11), Kursk Region (5), Orenburg Region (5), Irkutsk region (4), Krasnodar region (4), Leningrad region (4), Republic of Bashkortostan (4), and Republic of Dagestan (4).

The distribution of technoparks and industrial parks by type (Brownfield or Greenfield) is shown in fig. 5.

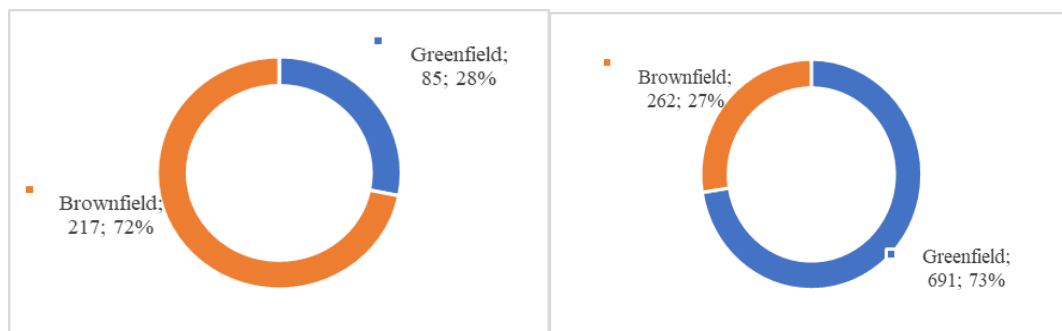


Figure 5. Distribution of techno parks (left) and industrial parks (right) by Brownfield and Greenfield types.

Source: compiled by the authors based on the data <https://russiaindustrialpark.ru/analytics>

Note that a "greenfield" is a type of industrial site, which means that a potential consumer receives an undeveloped territory with communications, potential administrative approvals, and the possibility of building industrially oriented facilities. This type of site implies minimal investment on the part of the IP organizer and the most flexible possible structure of use for the consumer. Greenfield IP is one of the most acceptable ways to organize an industrial park, as it already has a modern infrastructure and communications, which makes it possible to significantly increase production at the lowest cost and to ensure compliance with environmental requirements (Huang et al., 2019; Castiglione & Alfieri, 2020; Tudor, Adam & Bates, 2007). Creating an industrial park from scratch allows you to apply the standards of eco-industrial parks (such as, for example, Chinese standards HJ/T273-2006, HJ/T274-2006, HJ/T275-2006, HJ/T274-2009 and HJ/T274-2012 or Italian Criteria for defining the environmental performance of Areas productive ecologically equipped—EEPA) at a very early stage of planning (Huang et al., 2019; Tessitore, Daddi & Iraldo, 2015). However, the creation of greenfield-type industrial parks requires large investments. In this regard, the territorial location of such parks gravitates towards the presence of the nearest objects of transport and engineering infrastructure. From ecological point of view, it can be not the best location at all (Fernández & Ruiz, 2009).

The second type of the site is “brownfield”. It is a property complex that was previously used for industrial purposes, for example, the territory of old factories, logistics facilities. Brownfield has several disadvantages. Some of which are worn-out infrastructure or lack of specialized facilities to produce new products. But these disadvantages can be depleted with proper management. Often, "brownfields" are created by entrepreneurs who do not have a significant budget. These executives seek to apply innovation in the economy and attract investment by leveraging connectivity to infrastructure and logistics facilities (Castiglione & Alfieri, 2020; Geng & Hengxin, 2009; Tudor, Adam & Bates, 2007). The transformation of an existing industrial park into an eco-industrial one is a complex process that requires serious efforts in scoping EIP interventions, society awareness raising, developing policy support and park management structure, upscaling resource efficiency and industrial synergies (Susur, Hidalgo & Chiaroni, 2019; UNIDO, 2022).

Therefore, generally in greenfield industrial parks the development and industrialization of the region takes place in accordance with a well-defined concept, including the reduction of environmental impact. Brownfield development is the revitalization of an existing industrial complex with the reduction of environmental impact as one of the objectives. Hence, it can be expected that for Russia, as a country with a still poorly developed practice of developing eco-industrial parks, greenfield parks will have a more advanced environmental policy.

### **Eco-policies of Russian technology parks and industrial parks**

After analyzing the websites of acting 148 technology park and 249 industrial parks for interest in preserving and reducing harm to the environment, we can identify only a few cases of technoparks and industrial parks that have implemented an environmental policy and environmental management system.

First example will be technopark Morinsis-Agat (Moscow City, private, brownfield), which industrial activities are related with the negative impact on the environment. Therefore, the goals of JSC Concern Morinsis-Agat in the field of environmental protection are the basis for setting long-term strategic. These goals are:

- minimization of the specific negative technogenic impact on the environment;
- involvement of all personnel in activities to reduce environmental risks, the implantation of an environmental management system and performance indicators in the field of environmental protection;
- implementation of environmental certification of products;
- conducting and stimulating scientific research aimed at improving energy efficiency, reducing the negative impact on the environment and environmental risks;
- enhancement of the environmental education system;
- staff motivation to use the creative potential of each employee in the matter of resource saving and reducing environmental risks;
- active interaction with civil society bodies interested in the environmental protection.

The environmental policy of IP “Morinsis-Agat” covers the following areas:

- impact on atmospheric air;
- protection of water resources;
- waste management;
- environmental management system;
- energy saving and industrial sanitation.

The second example of ecologically-oriented IP is KuibyshevAzot (Samara Region, brownfield, private). One of the main elements of the development strategy of this IP is the preservation and protection of the environment, reducing the technogenic load on it and reducing resource consumption. IP conducts continuous comprehensive work in accordance with the goals defined by the "Policy of PJSC "KuibyshevAzot" in the field of quality, ecology, labor protection and industrial safety". For this, low-waste, energy- and resource-saving technologies are being introduced, equipment is being improved and existing production facilities are being reconstructed. Each project of the enterprise at all stages, from development to implementation, is carried out considering the environmental component.

To achieve sustainable high results of the company, the management assumes the following obligations:

- accord with legislative, regulatory and other applicable requirements in the field of product quality and safety, industrial and labor safety, health and environmental protection;
- constantly improve the management system and confirm its compliance with the requirements of international standards in the field of quality, industrial and labor safety, health protection and the environment;
- ensure safe working conditions to prevent occupational injuries and damage to health;
- take the necessary measures to eliminate dangers and reduce risks that can affect the quality and safety of products that threaten the health and safety of workers, visitors, and the population living nearby as well as the environment;
- prevent pollution of the environment, ensuring the management of environmental aspects in accordance with established standards, conducting environmental monitoring, identifying and preventing potential emergencies;
- carry out technical re-equipment of production, introduce resource-saving, low-waste, and waste-free technologies, rationally use natural resources, interact with stakeholders on environmental issues.

The third example is industrial park LLC PSK "Atlant-Park" (Moscow region, greenfield, private). Since its formation his IP has paid considerable attention to environmental care in the construction and operation of warehouse facilities. LLC PSK "Atlant-Park" is actively implementing resource-saving technologies in the field of energy supply, heat, and water supply of warehouses, which allows us not only to significantly save resources. The practical component of the comprehensive work to reduce the negative impact on the environment is regular monitoring and control of the environmental situation on the territory of the complex and within the sanitary protection zone. The most important part of the environmental policy of PSC "Atlant-Park"

is assistance in the implementation of infrastructure and social projects with a significant environmental component.

The Stankomash Industrial Park (Chelyabinsk Region, brownfield, private), Zhigulevskaya Dolina Technoparks (Samara Region, brownfield, state-owned) and TOTACHI DGT Technopark (Tver Region, greenfield, private) also announce a set of measures to reduce the negative impact on the environment. These industrial clusters are making the transition to waste-free and low-waste technologies and industries, and are also engaged in the greening of industrial production, which includes:

- improvement of technological processes and development of new equipment with a lower level of emissions of impurities and wastes into the environment;
- carrying out ecological expertise of all types of industries and industrial products;
- replacement of non-recyclable waste with recyclable.

As an example of the transformation of an already existing industrial park into an eco-industrial park, we can point out the development strategy for an eco-industrial park of clean technologies International Consortium "St. Petersburg Cluster of Clean Technologies for urban environment". The main objectives of this strategy are:

- 1) to create, based on the experience of the Nordic countries and the EU countries, the first in Russia interregional eco-industrial clean technology park based on industrial symbiosis as eco and energy efficiency demonstration zone;
- 2) create a public-private partnership and attract investment for implementation industrial symbiosis for economic and environmental benefits through exchange of resources that increase the efficiency of companies - residents of the eco-industrial park. At the same time, contribute to their resilience to external impacts, where the smart specialization of one park resident company is its secondary resource (waste) becomes a primary resource for other park resident companies (raw material).

As the first practical experience in the implementation of the Sustainable Development Goals one of the companies-residents of IP (Tireman group LLC), became a project partner for "Baltic Industrial Symbiosis (BIS) / Baltic Industrial Symbiosis" Programs

cross-border cooperation between Russia and the EU. It created Living Laboratory on the territory of the park, which is a place for popularization and practical testing of the ideas of industrial symbiosis as eco and energy efficiency demonstration zone. Living Laboratory has identified 15 new possibilities for industrial symbiosis among the companies of IP.

In addition to the cases discussed above, it is possible to give several examples of industrial parks, in the name of which the term eco is used. However, the use of this term does not always mean following the strategy and principles of an eco-industrial park. So, for example, the industrial park "Ecobaltic" (Kaliningrad region, greenfield, private) only follows the established norms of environmental legislation, providing high-quality wastewater treatment for pharmaceutical enterprises located on its territory. This IP does not use any principles or standards for the operation of eco-industrial parks.

## Discussion and Policy Applications

Therefore, as we see from our analysis that environmental aspects are not yet a priority for most industrial parks and technology parks in Russia. The concept of an eco-industrial park has not yet been implemented in a full-value format at any Russian industrial complex. In our opinion, this situation can be changed by introducing a system of voluntary certification of eco-industrial parks.

Currently, Russia has a voluntary certification system for industrial parks, the requirements of which are established by national standard GOST R 56301-2014 "Industrial parks. Requirements". Based on this, it is necessary that local authorities, when developing policies or planning industrial parks, consider the environmental performance around industrial parks. Besides high economic benefits, they should also pay attention to environmental protection and the quality of local life, support industrial parks, and create an innovative atmosphere to enhance the environmental technology of the industry. In addition, to saving energy resources, all industrial parks can actively participate in the renewable energy integration plan, improve their environmental performance, and promote the transition from an industrial park to an eco-industrial park.

Similar to Chinese, Italian and other national IEP standards, the voluntary certification system for eco-industrial parks in Russia may include the following requirements:

1. Infrastructure for sustainable mobility: special materials, such as sound-absorbing asphalt, must be used for road construction. There should be a hierarchy of traffic, walking and cycling to reduce the environmental impact of traffic and improve safety.
2. Greening the area: the certain share (for example, 70%) of the roads should be planted with tall trees; hedges and trees in parking lots.
3. Underground facilities, such as electrical grids, telecommunications networks, etc. should be built to facilitate IEP maintenance.
4. Communication networks: the area should have advanced telecommunication systems.
5. Green lighting of public areas: 50% of electricity for lighting public roads and parking spaces must come from renewable sources.
6. Landscape integration: buildings and premises in this area should be integrated into the natural landscape.
7. Collecting and reusing rainwater: collection of at least 50% of rainwater that has fallen on impervious surfaces (e.g., roofs, streets, etc.). At least 80% of the collected water must be reused in industrial facilities, for domestic use, in the fire extinguishing system or for irrigating green spaces. A dual water distribution system is to be implemented in the area: one for drinking water and the other for collecting rainwater.
8. Separate sewer systems: the sewerage system of the area should include industrial sewage pipelines and contaminated rainwater pipelines; domestic wastewater pipelines, uncontaminated rainwater pipelines.
9. Industrial water treatment: the industrial wastewater treatment system must have a single treatment system and one discharge.
10. Use of renewable energy sources for industry applications.

11. Advanced logistics measures: the development and implementation of a sustainable transportation management system within the framework of the EIP requires accounting and effective management of both human and material flows (Bunjongsiri, 2017). Companies are generally interested in three types of material flows, i.e., incoming (raw materials and components), outgoing (finished products and waste to be disposed of on a park site), and internal (by-products and waste processed by other companies of EIP). In order to organize these flows and make them more efficient and sustainable, various initiatives can be implemented, such as the creation of a shared transport management system.
12. Energy management and monitoring: an energy manager should be appointed in the region to monitor energy consumption and coordinate energy conservation and the expansion of renewable energy sources.
13. Waste area management: it includes a) waste management plan; b) full or partial recycling of materials used and produced in this zone; c) a list of general suppliers of waste transportation and disposal selected based on environmental requirements.
14. Emergency response plan: a plan that illustrates how companies should respond and what actions should be taken outside the industrial area.
15. Sustainable management of green spaces: green spaces are managed in terms of biodiversity protection, landscape conservation and carbon sequestration.
16. Sustainable construction site management: plan to minimize the environmental impact of construction site operation. The plan should identify all operations that may lead to critical environmental impacts and highlight the respective responsibilities and modes of operation for addressing environmental issues associated with the operation of the facility. Design, build and operate buildings in accordance with LEED and other green building standards.
17. Green procurement: green procurement is the procurement of "goods, services and works with a reduced environmental impact throughout their entire life cycle". The introduction of green procurement practices stimulates the development of green suppliers, this is the basis for the management of green supply chains.
18. Compliance with environmental requirements: compliance with national and regional laws and regulations on emission and pollution control, waste management and other environmental matters. In addition to these responsibilities, companies can voluntarily adhere to the ISO14001 standard.
19. Product liability: ensuring responsibility for the product requires paying attention to all phases of the product life cycle: an effective efficient design, including selection of materials and suppliers, quality of manufacturing processes, including inventory management and transportation, safety of use and environmentally friendly disposal. This includes additional activities such as providing clear labels and precise instructions for use, as well as responsible advertising. All these activities are aimed at improving the health and safety of consumers and reducing the gap between their expectations and the true performance of products. The above aspects refer to individual products and are usually considered at the level of one company. Participation in the EIP allows companies to work more effectively towards harmonizing their program product and responsibility goals (Liu et al., 2018), which in turn is key to exploiting the strong link between firms' commitment to achieving environmental efficiency and their sustainable success (Elabras Veiga & Magrini, 2009).
20. Eco-industrial park design according to the UNIDO International Framework Program.



## Conclusion

Summing up the results of the study, we can conclude that environmental aspects are not yet a priority for most industrial (technology) parks in Russia. The concept of an eco-industrial park has not yet been implemented in a full-value format at any Russian industrial complex. Only about 1% of Russian technoparks and industrial parks have a clearly formulated environmental policy. Nevertheless, a significant part of Russian technology park and industrial parks specialize in resource- and energy-saving technologies, which makes it possible to expect the growth of the circular economy 2.0 in Russia in the near future (Ratner, Gomonov, Lazanyuk & Revinova, 2021).

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## Water Symbolics: Fresh, Salty and Sour Waters in The Azores

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**Abstract:** This paper aims to understand the symbolic representations and social uses of different types of waters on the island of São Miguel in the Azores. In this research, the authors discuss some of these differences in a specific socio-spatial context, the island of São Miguel, the island with the largest territorial dimension of the Azores, corresponding to about one third of the total area of the Azores archipelago. This island accounts for more than half of the Azorean population, has the highest economic activity and presents some of the main “eruptive centers” of the Azores: the volcanoes of Furnas, Fogo and Sete Cidades. To attain this goal, the authors analyzed, through participant and non-participant observation, the social representations of waters in the Azores through three symbolic analytical frameworks: fresh waters, salty waters and sour waters. In this study of symbolic water, the following categories resulted from the sociological analysis: sweet waters (the images of water that tends to be drinkable), salty waters (the allegories related to the sea) and sour waters (the allegories related to those waters that come from volcanic phenomena). This proves that the element of water itself can be understood differently, and that the social context in which individuals live is very relevant in helping to understand these different significations.

**Keywords:** Water, Symbolic of Water, Social Representations, Azores.

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### Introduction

This article aims to understand the symbolic representations and social uses of the various types of water on the island of São Miguel, the Azores. The starting point of this research is composed by representations, which translate the way in which society thinks of itself in its relationships with the objects that affect it. These representations regard categories of thought through which, in a given society, its reality is produced and expressed. The classical sociologist Émile Durkheim considered that these categories are not given a *priori* and

are not universal in the awareness but emerge linked to social phenomena, transforming themselves in social phenomena susceptible of observation and interpretation.

Social representations are cognitive evaluations, forms of practical knowledge about social objects, which organize behaviors and communication, allowing us to understand how individuals think, feel and create reality. Any object is likely to have different social representations as “a form of socially shared and produced knowledge that has a practical purpose, adding to the construction of a common reality for a social group” (Jodelet, 2001, cit. in Polli & Camargo, 2015, p. 1312), which also has profound implications in the individuals’ practices by ascribing meaning to reality, thus contributing to their own identity (Almeida, 1990; Polli & Camargo, 2015; Schulz & Ioris, 2017). It follows that individual or group behavior is not only determined by the objective characteristics of the situation in which people find themselves but also by the representation they have of the situation or a given object” (Polli & Kuhnen, 2013, p. 111). In a more direct way, and as Martins (2013) states,

There is always a symbolic intentionality embodied in the code of socially desirable resources. This means that a natural resource cannot be reduced to its economic dimension even for those who observe it as such; it is also a symbolic resource that embodies cultural signs, thus occupying a position in the hierarchical set of symbolic exchanges. Naturally, due to its position in this hierarchical set, its political and economic dimensions take on particular significance for distinct societies and social groups (p. 126).

It is in this analytical context that representations of water(s) will be studied (Peña-Ramos et al., 2021; Angelakis et al., 2021; Amores, 2008; Taylor & Sonnenfeld, 2017; Noga & Wolbring, 2013; Qian, 2018; Durán-Sánchez et al., 2018; Hellberg, 2017). Water is a fundamental element in human existence at the physical but also spiritual and even social levels (Behailu et al., 2016; Amores, 2008). Strang (2011) advocates that “Because of the centrality of water in all aspects of human life, visual, textual and other representations of water are useful in articulating the cosmological beliefs and values – and the concomitant practices – that compose societies’ broader relationships with the material world” (p. 213). For instance, different social representations about water and even its use and management may emerge or be present, for example, in a logic of conflict over the control of water resources (Peña-Ramos et al., 2021), or of preservation of water as an essential resource for healthy life (Polli & Kuhnen, 2013; Polli et al., 2009; Biagi & Ferro, 2011; Hellberg, 2017; Agra, 2017; Strang, 2011).

The very look and valuation of water are reshaping to some extent. For example, Hannigan (2017) shows the valuation of the oceans currently in dimensions such as a source of resources, having geostrategic importance and as an ecological ecosystem to be increasingly researched. Or water as an element promoting tourism as a source of leisure is on a crescendo and takes on high relevance in economic activity (Kwon et al., 2017; Park et al., 2017; Castel-Branco, & Albergaria, 2017). In an excellent example of various representations of water by artists and scientists, Macagno (1992, 1993, 1994) argues that

The difference lies not so much on quality versus quantity as in the approach and in the goals. In art, when it is figurative, description seems to be the essential feature, while analysis and synthesis

characterize science while, for technology, prediction and function are typical (Macagno, 1993, p. 26).

There are, therefore, many different and very rich views and symbols that can be held about water (Bruni, 1993; Noga & Wolbring, 2013), which are sometimes even ambivalent as they reflect different life stories, as well as social conditions and expectations (Amores, 2008; Hellberg, 2017). Table 2 presents an example of representations of water according to a literature review (Espitia-Torres & Naranjo-Monto, 2020).

Table 1. Social representations of water according to social actors and their definition

Name	Definition
Naturalist	Water must be kept in sanctuaries, without humans. Emphasis on physic-chemistry, without considering socioeconomic aspects.
Globalizing	The interactions between society and nature are key to the survival of human beings, in harmony with the environment, considering it as a source of survival.
Utilitarian anthropocentric	We must take advantage of water, its goods and services.
Anthropocentric agreed	We must take advantage of water, recognizing the impacts on the environment. Evidence of environmental knowledge in general.
Cultural anthropocentric	Emphasis on environmental education, respect, solidarity, love and quality of the environment.
Community	Conservationist, water use regulation and integrated management in cultural practices. Emphasis on organic, spiritual and social nature that regulates environmental cycles, ecological balance and landscape aesthetics. Distrust of the State and the private sector. Evidence of participatory processes.
Privatisation	Water is a private resource with environmental services subject to market rules, oriented towards industry and the household. There is no ecosystem or ecological relationships between the city, the water and the territory. They concession water exploitation.
Hybrid	Integrate the Community Social Representation and Privatization with a pro-environmentalist discourse to interact with other actors and impose their representation. Without references to the private appropriation of the environment, they promote a green image.
Global ecological, aesthetic and identity	Assign water aesthetic and identity values, which is social heritage, abundant and affordable but limited, which generates environmental uncertainty. Perception of interdependence between man and environment.
Fragmented and Functional	Assign the use of water functional and ethical values, demonstrated in the utilitarianism linked to domestic water and in the discourses against inequalities (social fractures) in access to water. They propose solving short-term needs.
Monistic or	Water gives life and is integrated into nature (Cosmogony). It has spiritual forces

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Organic that must be acknowledged and respected.

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Source: Produced from Espitia-Torres & Naranjo-Monto, 2020, p. 120.

To understand the different social representations that can be expressed in different cognitive evaluations and socially differentiated views of the same real object – water –, this paper seeks to be a contribution on this situation in São Miguel Island, the Azores, Portugal.

## Methods

This article aims to understand the symbolic representations and social uses of the various types of water on the island of São Miguel, the Azores. To achieve this objective, an ethnographic analysis was favored, aiming to understand the meaning and the meanings that actors ascribe their practices. The ethnographic observation procedures followed focused on participant observation and non-directive, informal interviews conducted on the basis of the interests and contexts of the actors observed. Participant observation implies insertion into the social world of the actors to be studied, to observe “from the inside” what it means to be an actor in that world and describe what one sees, hears and infers (Vieira, 1998; Esteves, 1998).

There were several moments in which the researchers triangulated the information they collected, with fruitful moments of discussion in their presentation and interpretation, bearing in mind that the ultimate aim of observation is to find a sociological meaning for the data collected, to classify and analyze it (Peretz, 1998). This study of the symbolic of water resulted in the following categories (Bardin, 1995) of sociological analysis: sweet waters (the social images of water that tends to be drinkable), salt waters (the social images associated with the sea) and sour waters (the social images related to those waters that come from volcanic phenomena).

## Presentation of results and discussion: the waters in São Miguel

### The island of São Miguel, in the Azores

The Azores are a Portuguese autonomous region composed of nine islands located approximately halfway between the American and European continents in the North Atlantic Ocean. The archipelago of the Azores is located between latitudes 36°45' to 39°43' North and longitudes 24°45' to 31°7' West of Greenwich and comprises nine islands and several islets, which extend for about 600 km, in an approximate direction NW-SE. The islands of the Azores are divided into three groups: the Western Group, consisting of the islands of Flores and Corvo; the Central Group (Faial, Pico, São Jorge, Graciosa and Terceira); and the Eastern Group (São Miguel and Santa Maria). The island of São Miguel is the largest island of the archipelago, with an area of 744.6 Km<sup>2</sup>, a length of around 64 km and a width of 16 km. This island, with the largest territorial dimension of the Azores, corresponding to about one third of the total area of the Azores archipelago, is where more than half of the Azorean population lives, has the highest economic activity and presents some of the main “eruptive centers” of the Azores: the volcanoes of Furnas, Fogo and Sete Cidades (Ferreira, 2008). This unique

characteristic of the physical geography of the Azores is present in the nature of the rocks “with hues ranging from black to red, and in the forms of relief, in which the volcanic cones of all sizes, craters and calderas, often occupied by lagoons, stand out” (Ferreira, 2008, p. 21). The location and geography of the Azores islands are elements that condition the Azoreans’ way of being and their own representations. As Vitorino Nemésio stated, “geography, for us, is worth as much as history” (Nemésio, 1932, cit. in Matos et al., 2008, p. 12).

The volcanic origin of the Azores explains the occurrence of numerous mineral water springs, predominantly gas-carbonic and/or thermal, which denote a high variability of chemical types and magnitude of mineralization, particularly on the island of São Miguel, but also on the islands of Terceira, Graciosa, São Jorge, Faial, Pico and Flores (Cruz et al., 2014). Azorean waters are of meteoric origin, acquiring different characteristics through their interaction with volcanic rocks and seawater (Cruz et al., 2014). The mineral waters of the Azores are grouped into four groups: groups 1 and 2 are composed of gas-carbonated (sparkling) waters originating from high altitude aquifers and include (1) cold acidic waters (with pH between 4.7 and 6.3 and temperatures below 27°C); (2) thermal waters, which can be acidic or neutral (varying temperature between 27°C and 75.2°C and pH between 4.7 to 7.2); and (3) boiling basic waters (with temperatures between 92.2°C and 93.2°C and pH between 7.75 and 8.73). Group 3 is composed of sulfuric waters and is therefore acidic (pH between 2.02 and 2.27). Group 4 is characterized by highly mineralized waters, mostly containing sodium chloride, as they come from aquifers near the sea and are the result of groundwater and seawater mixing. The waters are, in general, supersaturated in quartz and amorphous silicon due to the interaction with rocks of a volcanic origin and are relatively rich in alkali metals (mainly sodium) and poor in alkaline-earth metals (such as calcium and magnesium) (Cruz & França, 2006; Cruz et al., 2010, Cruz et al., 2014; Antunes, 2019).

The hydrogeological resources of the island of São Miguel are very significant, and, similarly to the remaining islands of the archipelago of the Azores, there is a high density of natural mineral water springs. In 2013, 1,100 springs and 26 boreholes were mapped on this island, distributed over six bodies of water: Sete Cidades, Ponta Delgada-Fenais da Luz, Água de Pau, Furnas – Povoação, Achada and Nordeste-Faial da Terra (Cruz et al., 2014). The influence of the active volcanic environment is denoted by the occurrence of a high number of mineral waters, many of them thermal, especially in the water bodies Furnas – Povoação, Água de Pau and Sete Cidades, whose predominant facies are sodium bicarbonate and sodium chloride (Cruz et al., 2014). Hydro-mineral resources are susceptible to various uses, namely, therapeutic, industrial uses for bottling, in the course of the prospection of geothermal resources with the study of the characteristics of these fluids, or within the scope of monitoring programs of volcanic activity with the performance of periodic observations (Cruz et al., 2014).

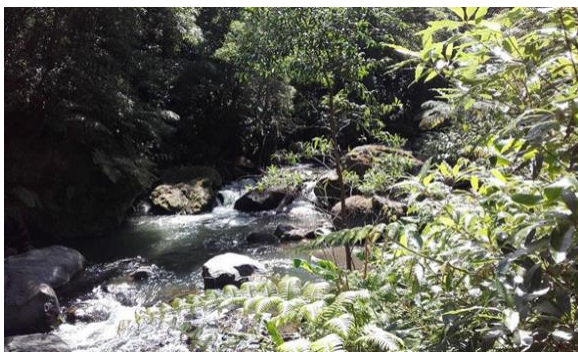
### **Symbolic representations and social uses of water**

In the analysis of symbolic representations and the social uses of the various types of water, it is important to focus on the relations of interdependence between the “human” social actors, which classify and ascribe meanings to the various types of water and use them in different ways, and the “non-human” social actors,

namely the sea, the streams, the lakes, the ponds, the *furnas*, the boilers, endowed with a specific capital: a set of accumulated and lasting physical and material resources that shape the practices and representations (Machado, 1996).

### *Freshwater*

The central elements of the representations about freshwater express the idea that this type of water is a component essential to life, indispensable to survival, which is associated with the conservation of health and needs to be preserved. Freshwater is essentially human water, while saltwater is perceived as being inhuman water, insofar as it does not fulfil what seems to be the first requirement of water, which is to serve man (Margarido, 2008). In their speeches on freshwater, the actors highlighted the vital importance of this type of water in various areas and activities: domestic – food, hygiene, cleaning, watering of vegetable gardens; agriculture; livestock – water supply for animals and in the maintenance of landscapes; and services – hospitality, catering, hospitality (Leandro, & Silva, 2015). Another relevant aspect in these speeches relates to the quality of the water and the risks of its contamination, namely by the use of pesticides, animal waste and the “infiltration” of salty and sour water. The strong link between tourism, leisure and freshwater is another very relevant aspect in the speeches of various actors (Castel-Branco, & Albergaria, 2017) (Figures 1 and 2).



Figures 1 and 2. *Salto do Cabrito* (São Miguel island) – Nature and Tourism  
(Photos by Ana Isabel Santos)

If fear marks the symbolic representations of the sea and shapes the experiences of those who “live from the sea”, only rarely does freshwater manage to provoke identical fear, and when this happens, it is due to the fact that freshwaters adopt a maritime behavior: this is what happens when rivers “look like a sea”, i.e., when the extension and the violence of the waters break with the normal and expected behavior of freshwaters (Margarido, 2008, p. 74).

### *Salty water*

The central elements of the representations of salty waters, the maritime waters (Bentz, et al, 2015; Dias, 2012), show distinct but interdependent social images of the sea: and image of fear (top of fear in the Western



imagination, fear of monsters and mermaids, fear of shipwrecks); preventive and therapeutic image (therapy of body and soul: rationalization of the energies of body and spirit; correction of the ills of urban civilization, while respecting the imperatives of intimacy); hedonistic image (place of adventure and seduction; place of consumption and illusory evasion) (Pereira, 2012; Henriques, 2012). Another central element of the representations highlights the idea that the islanders develop an enchantment in relation to the sea that surrounds them, simultaneously as a constraining element but also as an element that makes it possible to leave the islands and head for the desired destination: North America.

In the imaginary related to the sea, for the inhabitants of the island of São Miguel, the sea is also seen as a source of subsistence, which was at the origin of several fishing communities. The sea is also considered an element that allows travel and emigration, and São Miguel, as well as all the islands of the archipelago of the Azores, has recorded high emigration throughout its history (Ferreira, 2008). Leisure, recreation and tourism related to the sea are very present, for example, on the beaches of the island and some gardens of São Miguel. The Azores is an emerging destination for marine wildlife tourism, with diving and whale watching being the main activities.

### *Sour waters*

The designation of sour water is associated with several springs of sparkling mineral water, generally highly carbonated. For the observed actors, the characteristics that distinguish mineral water from “normal” tap water are the presence of mineral salts and gases, temperature, taste, being natural, medicinal uses, quality, digestive properties and the fact that they “emerge” in springs (Pereira, 2015).

The association of sour waters with the prevention and treatment of some diseases arises as a central element in the representations and justifications of the therapeutic uses of these waters (Rezio, 2008) . *Água Azeda do Rebentão*, a water with a high gas-carbonate content, is used topically to treat “dandruff” and ingested to treat digestive problems. *Água da Prata* is used by the local population for eye problems. *Água Santa* and *Água do Caldeirão* are associated with the treatment of respiratory problems. *Água Santa* is traditionally indicated for upper respiratory tract infections, while *Água do Caldeirão* is mixed with honey to treat flu-like conditions and coughs. *Água do Padre José* is indicated for treating cholesterol and digestive diseases. *Água do Torno* is a very mineralized water and is used to prevent hair loss. *Poça da Silvina* has a very mineralized iron water, and is used by the population for dermatological diseases of the lower limbs. *Água da Morangueira* is considered therapeutic for liver and kidney diseases. At Ponta da Ferraria, in the parish of Ginetes, a hot spring flows into a natural pool connected to the sea. The salt thermal water combined with the presence of sulfur helps in the treatment of rheumatism and neuritis (Antunes, 2019).

Other central elements of the representations about sour waters express the idea that this type of mineral water is associated with hygiene, consumption to prevent illnesses, bathing, commercial and leisure activities, and the production of hydroelectric power. *Caldeira Velha*, located on the slope of *Vulcão do Fogo*, consists of three

thermal pools and is used mainly for leisure purposes, being managed by the local municipality that allows free access to the residents. *Furnas* thermal springs, integrated into the *Furnas Boutique Hotel*, characterized by bicarbonate, fluoride and sodium water, are mainly used for treating rheumatism, dermatologic diseases and respiratory, digestive and circulatory system diseases. Currently, it functions as a simple spa, with hydrotherapy services, and the local natural mineral water is confined to the swimming pool, whirlpool, sauna and Turkish bath (Antunes, 2019). For example, the *Terra Nostra* Garden Hotel is endowed with a large thermal water pool inserted in a centennial botanical garden (Antunes, 2019).

In the social visibility of sour waters, the high importance of the bottling industry of carbonated mineral water is highlighted. The bottling of this type of mineral water is an activity with a significant relative weight in the economic structure of the island of São Miguel. Bottling has always been the result of concessions, and examples are *Água da Serra do Trigo*, *Água de Alcântara*, *Água da Helena*, in the parish of Furnas, and *Água das Lombadas*, in the municipality of Ribeira Grande (Freire, 2013). In 2013, *Água da Serra do Trigo* was the only one of the aforementioned emergences to be operated under the name *Magnificat*. It was exploited by an entity of the *Renova* group, the same that exploited the *Gloria Patri* spring, also located in Furnas (Freire, 2013).

Hydropower is essentially characterized by the use of watercourses whose potential energy (associated with the height of the fall and the flow) can be transformed into mechanical energy through hydraulic turbines and, in turn, into electrical energy through alternators coupled to the same (EDA Renováveis, 2018). The hydroelectric power plant of *Salto do Cabrito*, located in Ribeira Grande, in São Miguel, was put into service in 2006 and is equipped with a Pelton turbine with an installed power of 670 kVA.



Figures 3 and 4. *Salto do Cabrito* (São Miguel island) – Hydroelectric Power Plant  
(Photos by Ana Isabel Santos)

**Conclusion**

The aim of this paper was to understand the symbolic representations and social uses of the different types of waters on the island of São Miguel, Azores. A typological analysis was developed favoring the following types: fresh waters (the social images of water tending to be drinkable), salt waters (the social images associated with

the sea) and sour waters (the social images related to those waters that come from volcanic phenomena). The central elements of the representations about freshwater express the idea that freshwater is essentially human water; this type of water is a pivotal component for life, indispensable to survival, which is associated with health conservation and needs to be preserved.

The central elements of the representations of the salty waters, i.e., the maritime waters, highlight distinct but interdependent social images of the sea: an image of fear, a preventive and therapeutic image, an hedonistic image. Other central elements of the representations highlight, on the one hand, the idea that the islanders develop an enchantment in relation to the sea that surrounds them, simultaneously as a constraining element and as an element that makes it possible to go to a desired destination; on the other hand, the sea is perceived as a source of subsistence. The association of sour waters with the prevention and treatment of certain diseases emerges as a central element in the symbolic representations and therapeutic uses of these waters. Other central elements of the representations of sour waters express the idea that this type of mineral water is associated with hygiene, consumption to prevent diseases, bathing, commercial and leisure activities, and the production of hydroelectric power.

Water is not only a resource that keeps us alive but also contributes to people's lifestyles, perceptions of themselves and their place in society. The notion of basic water is related to social hierarchies in several interrelated ways. What is understood to be basic functions of water services is relative to what people are used to, according to their socioeconomic status. This is one factor that makes inequalities and social hierarchies that have been sustained after the democratic transition to appear 'natural' (Hellberg, 2017, p. 76).

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# An In-Depth Review on Parkinson Disease Identification Using Deep Learning


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**Abstract:** Parkinson's disease is a tragedy for retirees because it causes the nervous framework to deteriorate and, as a consequence, the participant's maneuverability. The application's precise involvement in Parkinson's disease significantly increases the chances of preventing it from worsening. The framework can circumvent this by gathering exact data from the individual or by supplying certain sample handwritten patterns, such as spirals or waves. This review article looked at a collection of appropriate publications as a solution. The research demonstrates that the computer vision architecture is the final answer for revealing the Parkinson disease probability by studying the sufferer's hand-drawn image. As a response, relevant papers have been studied in attempt to create an effective recognition system that employs the Region of Interest model to recognize the fuzzy pattern of patients' symptoms. The spiral shapes and accompanying discrepancies are caught using the CNN and Decision Making procedures in the Classification models. Future editions of this study will go through the approach in greater detail.

**Keywords:** CNN, Decision Making, Parkinson's disease, Classification

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## Introduction

The phenomena of modernization, as well as subsequent improvements in the medical sector, have culminated in a vastly enhanced standard of living for the average human. Biomedical progress has also contributed to the overall incremental improvement in human longevity. This has been a boon to society as a whole, because individuals can now survive much extended, happier, and pain-free lives. This appears to have undermined the well-being of the rapidly increasing demographic of senior citizens. These folks are suffering with challenges that were not as common when the expected lifetime was much shorter. Several older residents suffer from

extremely rare illnesses that are exclusively present in the aging population.

Parkinson's disease is a well-known ailment. It is a persistent neurological condition that is steadily increasing in prevalence amongst some of the elderly. This illness is marked by a drop in dopaminergic concentration in the body, a neurotransmitter which actively encourages interaction and cooperation. Reduced stability and the onset of uncontrollable muscle convulsions are symptoms of dopaminergic insufficiency. This is extremely inconvenient, and it may increase the elderly patient's risk of incidents and injury. A failure in the cortex central nervous system, particularly the ganglia area, is the most common cause of dopamine insufficiency, which impairs comprehension.

Parkinson's disease is a cortex deteriorating illness that affect the wellbeing of countless of retirees throughout the globe. Due to the obvious variability of Parkinson's disease, manifestations might proceed independently from one individual to the next. Individuals with Parkinson's disease may have convulsions, which occur mostly during rest. Shaking in the hands, muscular stiffness, and mobility and equilibrium issues are all possibilities. Parkinson's disease indicators may be divided into two categories: movement-related or motor functions and non-movement-related or non-motor complaints. Individuals with non-symptoms are actually significantly impacted than those with movement disorders. Anxiety, sleep behavior abnormalities, impairment of odor, and cognitive decline are examples of non-motor manifestations.

Since there are no true guidelines for assessing the neurodegeneration, diagnosing Parkinson's disease is very difficult. Parkinson's disease, on the other hand, can be identified using a range of behavioral and diagnostic characteristics. The freezing gait evaluation and speech synthesis tests are among the techniques that deal with mobility and involuntary movements. The doctors also employ a spiral approach to look for recurrent spasms, which show up as a jagged line inside the spirals. On some of these types of tests, medical specialists perform extensive manual calculations. This type of evaluation takes a long time and requires a lot of work from the experts. Qualitative categorization also bears the risk of introducing human error into an otherwise possibly fatal prediction. As a consequence, there is a need for a methodology that can be used to evaluate and diagnose Parkinson's disease utilizing computer image and machine intelligence approaches.

There seems to be a set of different classifiers that have already been discovered as producing the best and most reliable evaluation of Parkinson's disease in an individual. As input data, the spiral-containing photographs are delivered into the software. The Region of Interest approach is used to isolate the important part of a photograph that will be used for recognition. The region of interest is one of the most prominent methods for identifying the related region that is necessary for an appropriate inspection of the approach. This is used in conjunction with Convolutional Neural Networks and Decision-Making technologies to boost the effectiveness of Parkinson's disease identification techniques, which will then be detailed in future research publications.

This literature survey paper segregates the section 2 for the evaluation of the past work in the configuration of a literature survey, and finally, section 3 provides the conclusion and the future work.



## Related Works

S. K. Khare et al. 2021 demonstrate an automated, accurate, and resilient PDCNN model depending on EEG signals. The EEG waves are utilized to generate the SPWVD graphs. Using two open-source EEG datasets, the SPWVD plots in conjunction with CNN produced the best PD detection performance. Using two PD benchmark datasets, the suggested technique has an accuracy of 99.73 percent, 100 percent, and 99.93 percent in automatically recognizing PDSF, PDSO, and PD classes. By decreasing the cross-term interference of time and frequency, the SPWVD can extract more representative and hidden information. The SPWVD plots aid in capturing spatial and temporal features at the same time, making it extremely distinct in distinguishing PD and HC participants. The presented prototype is portable and may be utilized in real-time Parkinson's disease diagnosis utilizing EEG data.

M. Rumman et al. introduced a framework that approached the problem of identifying PD from a different perspective than previous methods. DaTSPECT pictures were processed in this research to detect the putamen and caudate region, which is the region of interest (ROI) for this investigation, and the area of these sections was discovered. Subjects with Parkinson's disease have smaller putamen and caudate area than those who do not have Parkinson's disease (Rumman, et al., 2021). An artificial neural network (ANN) was utilized to classify Parkinson's disease and healthy control. When placed in an unknown comparable setting with previously supplied knowledge, ANN has a remarkable capacity to discern patterns and extract meaning from those patterns. The discovered results are quite relevant to real-life scenarios. A model with more datasets can provide even more consistent accuracy. More data may be used to train the ANN, making it more efficient in categorization.

K. H. Leung et al. present a deep-learning-based strategy that included both imaging and non-imaging clinical variables and has shown substantial promise for predicting prognosis in Parkinson's disease patients. This study examined longitudinal clinical data from 198 Parkinson's disease patients, including DAT-SPECT pictures and clinical assessments. The DAT-SPECT pictures were preprocessed by choosing a continuous segment of 21 image slices from each image with the greatest relative intensity in the transaxial direction as the center slice (Leung, et al., 2021). The photos were then zero-padded, yielding  $128 \times 128 \times 21$  images for both years 0 and 1. Given the availability of a heterogeneous longitudinal dataset, the authors created numerous deep-learning-dependent algorithms with varying input data. The first technique exclusively makes use of data from DAT-SPECT pictures. The second technique exclusively employs data from non-imaging clinical characteristics. Finally, both imaging and non-imaging methods are provided for the final technique.

A new design for deep neural networks GS-RNN is introduced by K. Hu et al. that processes spatial-temporal data in the form of dynamic graph sequences. The basic elements of GS-RNNs are graph RNN cells and vertex-wise RNN cells, which simulate both structural and temporal graph patterns concurrently. GS-RNNs may be utilized to construct vision-dependent FoG findings as a fine-grained sequential modeling job in this case (Hu, et al., 2021). Extensive experimental findings on an in-house dataset, which contains the highest number of

patients in the literature of video-based PD gait analysis, show that the suggested GSRNN designs outperform the competition. Furthermore, by localizing the important vertices of a FoG film, the graph representation of anatomic joints gives an understandable interpretation of the detection findings, which is useful for clinical evaluations in practice.

Depending on DCGAN, SN, and feature matching, a Spectrogram Deep Convolutional Generative Adversarial Network (S-DCGAN) was presented by Z. -J. Xu et al. The model is utilized to recognize voiceprints. This model can create high-resolution spectrograms for sample augmentation by better capturing the spectrogram's textural properties. The addition of the SN technique enhances training stability when compared to DCGAN (Xu, et al., 2021). The feature matching approach increases the image quality and, in the end, produces a high-resolution spectrogram. The experimental results reveal that voiceprint recognition accuracy improves in a small sample of PD patients, and it is better than some of the most advanced technologies.

To categorize MRI patches of Parkinson's disease and healthy patterns, P. M. Shah et al. developed a bespoke CAD-based CNN design. The introduced network with three convolutional layers efficiently learns patterns from training samples of the benchmark PPMI dataset, resulting in enhanced accuracy. The findings demonstrate that the introduced network is capable of autonomously learning correct Parkinson's disease traits. During the testing, the authors discovered that the little dataset was a key issue, causing the CNN model to overfit (Shah, et al., 2021). They were able to overcome the overfitting problem by using suitable network architecture and dropout layers.

Y. Zhang et al. 2021 offer an approach for developing high-accuracy and low-latency FoG prediction models depending on impaired gait patterns. The authors expected that step-to-step impaired gait parameters such as cadence, symmetry, and variability are more relevant in FoG prediction than traditional FoG detection features and need shorter segmentation windows. Therefore, utilizing the compromised gait parameters, the authors were able to anticipate the imminent FoG with greater accuracy and reduced latency. They also anticipated that the duration of individualized pre-FoG phases was positively connected with illness conditions, which they utilize as the foundation for an FoG prediction model that is more accurate than unified labeling.

Depending on premotor indicators (i.e., Rapid Eye Movement (REM), sleep Behaviour Disorder (RBD), and olfactory loss) W. Wang et al. suggested a deep learning model to automatically differentiate normal persons and patients afflicted by PD (Wang, et al., 2021). The suggested deep learning model demonstrated strong detection capability, with an accuracy of 96.45 percent. This is mostly owing to the deep learning model's favorable capabilities in learning linear and nonlinear features from PD data without the requirement for hand-crafted feature extraction. The results reveal that the developed deep learning model outperforms the twelve examined machine learning models in distinguishing normal persons from Parkinson's disease patients.

Using EEG data acquired from individuals with Parkinson's disease and FOG, Z. Cao et al. explored the brain dynamics of FOG and intentional pausing events. The experimental outcome showed that FOG episodes were

related to aberrant EEG dynamics and that intentional halting could be distinguished from FOG events. The data reveal that freezing episodes are linked with considerably enhanced theta and alpha band power throughout the central and occipital regions when the transition to the freezing phase is compared to the freezing period itself. Furthermore, when compared to the FOG period, the EEG power reduced dramatically during the voluntary halting interval (Cao, et al., 2021). Their findings shed new light on the fast transition dynamics that underpin the phenomena of FOG and may pave the way for therapeutic prediction and mitigation of freezing episodes in sensitive patients.

L. Zahid et al. present the Alexnet model for deep feature extraction and finding of PD which provided a basic acoustic features-based strategy and also explored a pre-trained convolution neural network architecture. The authors employed transfer learning-based categorization for a fair comparison (Zahid, et al., 2021). The suggested approaches are evaluated using Parkinson's disease speech recordings from the PC-GITA dataset. The outcome suggests that the strategy depends on deep characteristics yielded superior outcomes.

CNN and CNN-BLSTM are two deep learning-based learning models suggested by C. Taleb et al. for end-to-end time series categorization. To cipher time series into pictures for the CNN framework, two distinct frameworks were proposed: Gramian angular field images and spectrogram images. The benefit of employing spectrogram pictures is that they compute local short-term information that occurs in non-stationary online handwritten signals before normalization, whereas the other two algorithms normalize the time series into a fixed dimension image without extracting local information (Taleb, et al., 2021). The fresh time series are utilized directly by the CNN-BLSTM framework, with no need to transform them into pictures. This method has been tested to confirm the relevance of taking into account local information before integrating on a temporal scale.

A. H. Neehal et al. developed a novel technique by evaluating resting-state fMRI image data. Each voxel represents a time series data point that is utilized to calculate in the time-frequency domain (Neehal, et al., 2021). STFT is employed in this method to obtain the signal's localized frequency information. The output of the STFT function yields a frequency vector and a time vector, which are then utilized to categories the data using the SVM classifier. The SVM classifier predicted the early phases with the highest accuracy. The authors were able to execute feature extraction for the targeted objective of recognizing early stages of PD since they used data from early-stage PD patients.

A. S. Alharthi et al. show how to utilize a deep convolutional neural network (DCNN) to analyze GRF data from Parkinson's patients. This extends the author's prior work which was confined to a DCNN's classification performance on GRF data using LSTM and statistical analysis. The idea is that they may use spatiotemporal gait GRF signals to categorize individuals as healthy or PD patients, and relate key known events in the gait cycle to cognitive decline owing to PD severity (Alharthi, et al., 2021). To their knowledge, this is the first time the LRP method has been utilized to analyze spatiotemporal gait GRF data in Parkinson's disease. They also use perturbation noise and LRP relevance scores to validate the approaches for how successful the obtained

classification result is.

## Conclusion

Parkinson's disease is one of the most disabling neurodegenerative conditions. There is no recognized cause for the onset of this illness that is commonly seen in the elderly. The illness is related to cognitive impairment and a change in the physicochemical properties of both the brain's neurons. The disorder is seldom recognized in its initial phases since the symptoms are modest and infrequent, rendering it difficult to detect and assess. As a consequence, the goal of this study is to develop a suitable method for identifying Parkinson's disease in patients that could be used to make an accurate assessment on their own. To give a benchmark analysis of the different approaches for Parkinson's disease identification, this review paper drew on a number of academic articles. This has being observed that the majority of the techniques include flaws. Convolutional Neural Network as well as Decision Making are therefore appropriate candidates for neural networks which will be extended in additional investigation to eliminate these inconsistencies and provide a dependable Parkinson's disease diagnosis technique.

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## Literacy Parameters of Hijamah Services for Practitioners and Users

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**Abstract:** This paper delves into the significance of literacy in the context of *hijamah*, an ancient method of healing that has been increasingly adopted in recent years. Despite the growing popularity of *hijamah*, there is a lack of clarity regarding the literacy levels of both practitioners and users. To address this gap, this study undertakes a review of existing literature on *hijamah* literacy. The findings of the study reveal that while there are important components related to *hijamah* literacy scattered throughout various sources, there is also a missing comprehensive assessment of *hijamah* literacy. This lack of clarity could have implications for the quality of *hijamah* services provided and received, as well as potential risks associated with the practice. The study concludes that the findings could aid policy makers in developing new guidelines for *hijamah* literacy, with the aim of improving education and training for practitioners and promoting safer practices for the public. However, the study also highlights the need for further research in this area to gain a more in-depth understanding of *hijamah* literacy and its impact on the *hijamah* industry.

**Keywords:** Literacy, Hijamah, Assessment

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### Introduction

*Hijamah* remains popular today particularly among Muslims; it is indicated for both healthy patients and those suffering from ailments. It is a cupping therapy which is simple, effective, and economic alternative medicine to treat chronic aches and pains with minimal side effects when compared to the present use of drugs with relatively higher side-effects (Al-luhaidan & Prarthana, 2020). The therapy has been used since the time of Prophet Muhammad (ﷺ), whereby its wet cupping type is considered the original form of *hijamah*; in fact, the terms *hijamah* and *faṣḍu* were used interchangeably (Asar A.K., 2022). This *hijamah* wet cupping is the bloodletting technique involves cupping, puncturing and cupping (CPC) method. Cups are applied through vacuum, skin is lacerated, the cups are repositioned and the blood is drawn so that the morbid substances are evacuated (Al-luhaidan & Prarthana, 2020). However, despite its long history of use, the practice of *hijamah* is largely unregulated, and there is a lack of standardized literacy parameters for both practitioners and users. Lack

of regulation and standardization in hijamah practice can result in practitioners with varying levels of knowledge, training, and experience, which can affect the quality and safety of treatment (Aboushanab & AlSanad, 2018). Therefore, the aim of this paper is to identify and explore the necessary literacy parameters for the safe and effective delivery of hijamah service.

## Literature Review

The document Traditional and Complementary Medicine Blueprint 2018-2027 Health Care (TCMBP) (Ministry of Health, 2017) is a strategic plan developed by the Ministry of Health Malaysia to guide the integration and development of traditional and complementary medicine in the country's health care system. It outlines the vision, mission, goals, and strategies for the promotion, regulation, and utilization of Traditional and Complimentary Medicines (T&CM) to provide holistic and comprehensive health care to the Malaysian population. The blueprint acknowledges the historical and cultural significance of T&CM in Malaysia, and highlights the potential benefits of integrating T&CM into mainstream health care to improve patient outcomes and enhance health care delivery.

The document highlights 17 challenges faced by the T&CM industry, they are categorised into four (4) areas: 1- practice, 2- education and training, 3- medicinal materials and products, and 4- research. In response to these challenges, six general directions were tailored to address the challenges. The document further proposes 22 strategies and 52 action plans that are aligned with these general directions. It will cover an implementation period of 10 years and an interim review will be conducted after 5 years. The four (4) areas highlighted in the ministry document are as follows:

- 1- **Practice.** This area aims to establish a regulatory framework for T&CM practice, including registration, licensing, and standardization of T&CM services, products, and practitioners. It emphasizes the need for evidence-based practice and research in T&CM, and the development of guidelines and protocols for T&CM integration in health care settings.
- 2- **Education and Training.** This area aims to strengthen the education and training of T&CM practitioners, as well as mainstream health care professionals, to ensure competent and qualified T&CM services. It highlights the importance of research and innovation in T&CM, and the need for interprofessional collaboration among health care providers.
- 3- **Medicinal materials and products.** This area aims to enhance the availability, accessibility, and affordability of T&CM services to the population. It emphasizes the need for a patient-centered approach in T&CM practice, and the integration of T&CM into primary health care, hospitals, and other health care settings. It also encourages the development of evidence-based clinical practice guidelines for T&CM conditions.
- 4- **Research.** This area aims to promote the growth and sustainability of the T&CM industry in Malaysia, including the cultivation of medicinal plants, production of herbal products, and export of T&CM services. It highlights the importance of entrepreneurship and innovation in the T&CM industry, and the need for quality assurance and market surveillance to ensure consumer safety.

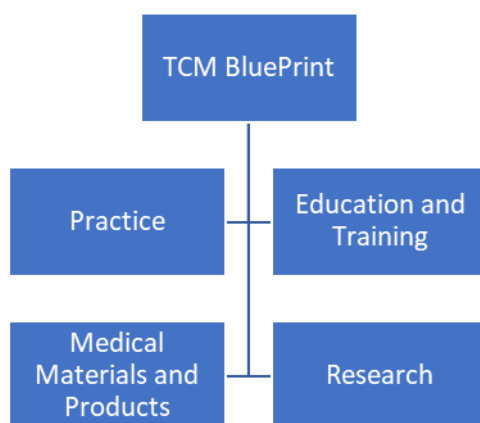


Figure 1. TCMBP Four Main Areas

For the purpose of this paper, researchers focus on the second area which obviously related to literacy of *hijāmah* therapy, it is “Education and Training”. Generally, the literacy parameters are divided into two types of literacy, they are:

- 1- Literacy parameters of *hijāmah* practitioners.
- 2- Literacy parameters of *hijāmah* users.

### Literacy Parameters of *Hijāmah* Practitioners

In general, practitioners of *hijāmah* must possess a strong knowledge base about this cupping therapy, teoritically and practically. They also must be able to recognize contraindications and complications associated with the therapy and have the necessary skills to manage them. Additionally, the practitioners must possess the necessary communication and professionalism skills to effectively communicate with clients. Finally, they should also have a clear understanding of Islāmic guidelines about this prophetic medicine. Hence, the details of the literacy parameters for *hijāmah* practitioners could be summarized as follows:

1. **Knowledge of *hijāmah* therapy.** *Hijāmah* therapy, also known as cupping therapy, is an ancient form of alternative medicine that has been practiced for centuries in various cultures around the world. This therapy does have two main types of cupping: wet and dried cuppings. As with any form of therapy, it is essential for practitioners to have a deep understanding of the therapy's history, theory, and practice to provide safe and effective treatment to their clients. To be a proficient practitioner, one must have knowledge of the traditional and modern techniques used in the therapy, as well as the indications, contraindications, benefits, and risks associated with the therapy. Understanding the underlying principles of *hijāmah* therapy and its effects on the body's systems, including the circulatory, immune, and nervous systems, is crucial to tailor the therapy to the individual's needs. The practitioner should be able to identify the appropriate locations for cup placement (Aboushanab & AlSanad, 2018), which can vary based on the patient's age, sex, body composition, and medical history. Additionally, they must be familiar with the different types of cups used in the therapy and how to properly sterilize and maintain them to prevent the spread of infections. Furthermore, practitioners must be aware of the potential risks



associated with the therapy, such as infection, bruising, and the risk of transferring bloodborne pathogens. The risk of infection can be minimized by ensuring that the skin is clean and disinfected before cup placement. Practitioners must also use disposable or sterilized needles when performing the procedure to avoid the transfer of bloodborne pathogens.

By possessing a thorough knowledge of *hijāmah* therapy, practitioners can provide safe and effective treatment to their clients. This knowledge enables them to tailor their techniques to meet individual needs and address any concerns or complications that may arise during the therapy. Practitioners can educate their clients on the benefits and risks of the therapy and help them make informed decisions regarding their health. Therefore, it is crucial for practitioners to continually update their knowledge of *hijāmah* therapy and stay up to date with the latest research and best practices in the field.

- Anatomy and physiology.** To perform *hijāmah* therapy accurately, practitioners should not only have a comprehensive understanding of the therapy itself, but also possess a solid understanding of human anatomy and physiology, especially the musculoskeletal and circulatory systems. This knowledge is necessary to ensure that the cups are placed correctly during the therapy, which can reduce the risk of complications. Practitioners need to have a detailed understanding of the location and function of various muscles and bones in the body, as well as the path of major blood vessels and nerves. This knowledge enables them to identify the best placement of cups for maximum therapeutic benefit and avoid sensitive or vulnerable areas of the body. Moreover, practitioners must be familiar with the circulatory system and the role it plays in the body's overall health. They should have knowledge of the different types of blood vessels, their functions, and how the therapy affects blood flow and circulation. By understanding the circulatory system, practitioners can assess how the therapy affects blood flow and circulation, then adjusting their techniques accordingly to promote healthy blood flow. Accurate placement of cups during the therapy can also help to improve circulation, enhance oxygen and nutrient delivery to tissues, and facilitate the removal of waste products from the body (Setyawan, Hikmah, Oktavianto, & Yanuar Saifudin, 2022)(Mohamed, Zhang, & Jan, 2023).

By possessing a solid understanding of human anatomy and physiology, practitioners can ensure safe and effective placement of cups during *hijāmah* therapy and minimize the risk of complications. This is obviously can be achieved by formal certification from related body.

- Infection control and hygiene.** Infection control is an essential aspect of any healthcare practice, including *hijāmah* therapy. Standard precautions are on the assumption that any patient may potentially be infected with organisms that are transmissible; therefore, standard precautions apply to all patients, in all settings (Edmond & Wenzel, 2015). The essential elements of standard precautions are hand hygiene, personal protective equipment (gowns, gloves, masks, and eye protection), and safe needle practices. *Hijāmah* practitioners must adhere to strict infection control practices to minimize and prevent the risk of infection, they must also practice the high standard of hygiene.

Hijamah practitioners must thoroughly wash their hands before and after each session with soap and water, or an alcohol-based hand sanitizer. They should also thoroughly wash their hands before and after each session with soap and water, or an alcohol-based hand sanitizer. The use of personal protective equipment (PPE) such as gloves, masks, and eye protection are basic hygiene process to minimize the risk of exposure to pathogens. Infection control and hygiene are used interchangeably, some authors refer hygiene as sanitation(Purnama & Susanna, 2020). Hygiene protocols also include disposable cups, using clean and sterilized equipment for each user. The equipment used in the therapy, including the lancets, blades, and other tools, should be cleaned, and sterilized using appropriate methods before and after each use.

Therefore, the practitioners should be well-versed in infection control and hygiene protocols to ensure safe and effective the therapy. In fact, Infection Prevention and Control (IPC) is one of the first topics introduced in nursing programs, yet its main tenets are often lost or forgotten(Dar, 2021).

4. **Communication.** Effective communication between healthcare practitioners and patients is crucial in ensuring positive health outcomes. Theory of person-centeredness is still in its ascendancy(Klancnik Gruden, Turk, McCormack, & Stiglic, 2021). In the field of healthcare, practitioners must be equipped with the skills to communicate appropriately with their clients. This includes assessing their medical history, explaining the therapy, and ensuring their comfort during the procedure. Effective communication skills have been linked to better health outcomes for patients(Street, Makoul, Arora, & Epstein, 2009). Practitioners must be able to communicate complex medical information in a way that patients can understand and be able to answer any questions they may have. Additionally, effective communication involves showing empathy and building trust with patients. In fact, patients who perceived their healthcare practitioner as empathetic were more likely to follow their medical advice and report better health outcomes(Stewart et al., 2000).

Thus, it is essential for healthcare practitioners to not only possess technical expertise but also have effective communication skills to ensure that their patients receive the best possible care.

5. **Professionalism.** In the healthcare profession, professionalism is crucial for ensuring the delivery of safe and effective care. It enhances doctor-patient relationships and advances patient-centric care(Tay et al., 2020). Practitioners must maintain a high level of professionalism, which includes ethical standards and comply to local regulations and guidelines. Ethical standards are critical in maintaining the trust of patients and the public. Practitioners must adhere to ethical principles such as confidentiality, informed consent, and non-maleficence to ensure that they are providing care that is in the best interest of their patients. Technological innovation has been the prime driver of educational transformation nowadays(Sinclair, Kable, & Levett-Jones, 2015); hence, continuing education with the help of technology is also an important aspect of professionalism, as it allows practitioners to stay up-

to-date with the latest advances in their field.

Islāmic guidelines also play a crucial role in the practice of ḥijāmāh because this traditional Islāmic therapy is associated with the prophetic medicine. Practitioners of ḥijāmāh should understand and adhere to Islāmic principles such as sincere intention, invocations, modesty, and respect. Since, a truly Islāmic society should comprise of women who join the working forces(Asar AK & Bouhedda, 2016), gender separation also should be diligently observed during ḥijāmāh; this gender separation is the controversial issue debated by many. In short, male and female patients should be treated in separate spaces to maintain modesty and uphold Islamic teachings on gender interactions. It is not a requirement for a practitioner to be a *mahram* to the female patient; if there is an urgent need to get treatment, then the female patient can get that treatment. However, it must be based on the guidelines that have been explained by Muslim jurists to guard against the occurrence of *zinā*, or *fitnah* that may arise in society. One of the guidelines is to have her husband, guardian, or other trusted woman with the female patient when she receives treatment from the trusted practitioner(Asar A.K., 2022).

### Literacy Parameters of Hijamah Users

In general, users of ḥijāmāh must also possess a certain level of literacy parameters to ensure their safety and efficacy of the therapy. The parameters are as follows:

1. **Knowledge of ḥijāmāh.** Users seeking ḥijāmāh therapy should also have a basic understanding of the treatment, including how it works, potential benefits, and risks. However, users should be aware of the potential risks associated with the therapy, such as infection, bleeding, and skin irritation; if necessary, users should also seek medical advice before undergoing the therapy. Currently, cupping therapy is used for health promotion, prophylaxis, and treatment of a variety of diseases around the world(Qureshi et al., 2017). Ḥijāmāh is thought to improve overall health and well-being; the suction created by the cups can stimulate the flow of blood and other fluids in the body which may help to remove toxins and other harmful substances. This can lead to improved circulation, which can help to reduce pain and inflammation, as well as boost the immune system(HijamaPoints.com, n.d.). A basic understanding of the therapy can help users make informed decisions about their healthcare and ensure that they are receiving safe and effective care.
2. **Medical history.** Providing a comprehensive medical history is a critical aspect of receiving safe and effective healthcare. Users seeking medical treatment, including ḥijāmāh therapy, should inform their practitioner of any underlying medical conditions, allergies, or medications they are taking that may affect the therapy's safety and effectiveness. With the help of digital tools nowadays, medical histories can be collected easily. A detailed medical history can help ḥijāmāh practitioners to facilitate treatment planning, reduce documentation work, and improve care(Albrink et al., 2022). This includes any

chronic conditions such as diabetes or hypertension, as well as any medications or supplements that the user is taking. A detailed medical history of users is an essential component of the healthcare provider's role and can improve the user's experience by reducing the risk of complications and increasing the effectiveness of the treatment.

3. **Hygiene.** Hygiene is a critical aspect of any medical treatment including *hijāmah* therapy; whereby hand hygiene remains as one of the most effective methods for reducing infections (Hillier, 2020). Hand hygiene compliance of health care personnel has been an ongoing challenge (Moore, Robbins, Quinn, & Arbogast, 2021). Users seeking *hijāmah* therapy should ensure that the practitioner uses disposable cups, clean and sterilized equipment and follows proper hygiene practices, particularly the hand hygiene to minimize the risk of infection. Poor hygiene practices can lead to the transmission of infectious diseases and other complications. Users can also take steps to ensure their own hygiene, such as showering before the treatment, wearing clean and comfortable clothing, and avoiding the therapy if they have any open wounds or infections. Maintaining proper hygiene practices can improve the effectiveness of the treatment and minimize the risk of complications.
4. **Communication.** Effective communication is essential in any healthcare setting, including *hijāmah* therapy. Users seeking this therapy should be able to communicate effectively with their practitioner, especially regarding their level of discomfort during the treatment. In fact, patient-centered communication may improve patient satisfaction, reduce malpractice rates, and decrease diagnostic testing expenses (Wang, Lavender, Hoque, Brophy, & Kautz, 2021). Medical narrative that starts from adequately listening to the patient's story contributes to comprehensive medical training, and offers the patient the opportunity to be treated in an empathic and humanized environment (Miranda-Bastidas, 2020). It is important for the user to communicate any discomfort or pain they may be experiencing during the treatment, as this can help the practitioner adjust the treatment to minimize discomfort and improve the user's experience. Users should also inform the practitioner of any concerns or questions they may have about the therapy, including its potential benefits and risks. Hence, effective communication can improve the user's experience and satisfaction with the treatment, as well as ensure that their needs are met.
5. **Aftercare.** Aftercare is a critical aspect of any medical treatment, including *hijāmah* therapy. Users seeking *hijāmah* therapy should follow the practitioner's aftercare instructions to ensure optimal recovery and minimize the risk of complications. Following aftercare instructions can improve the user's recovery and reduce the risk of infection and other complications. A follow-up call by practitioners is useful for reinforcing aftercare instructions, follow-up referrals, and problem-patient identification (Shesser, Smith, Adams, Walls, & Paxton, 1986). Users may also be advised to rest, eat a healthy diet, and drink plenty of fluids to aid in the healing process. Additionally, the practitioner may prescribe medications or supplements to promote healing and reduce discomfort. It is important for the user to follow the aftercare instructions carefully and contact the practitioner if they experience any

unexpected symptoms or complications.

### Literacy Framework for Hijamah

Based on the previous discussion and available literature, we propose a framework for the literacy of hijamah services for practitioners and users.

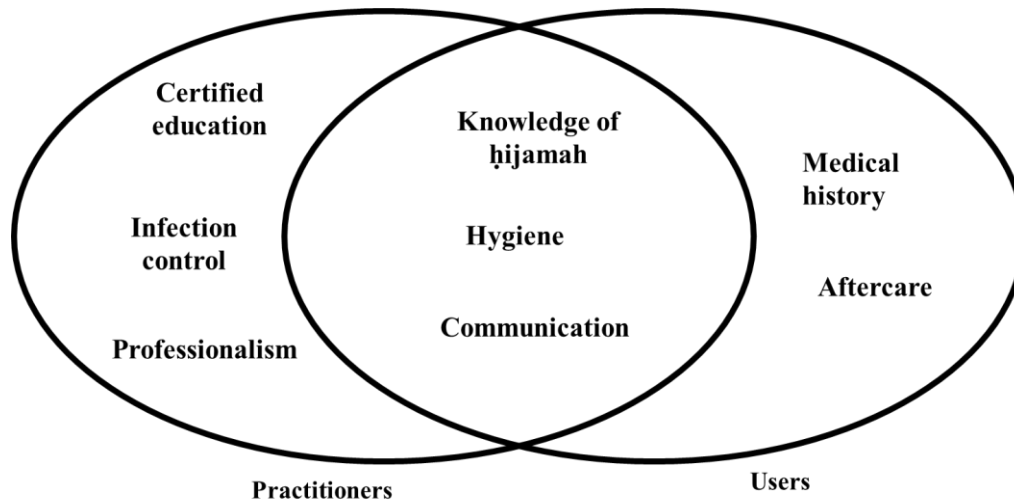


Figure 2. Literacy Framework for Hijamah

The details of the framework are as follows:

- 1- **Knowledge of hijamah therapy:** Practitioners and users should have a basic understanding of what hijamah therapy is, how it works, and its potential benefits and risks.
- 2- **Certified education.** Hijamah practitioners should have a certified education and training in hijamah therapy, whereby a solid understanding of the anatomy and physiology of the human body is a must. The practitioners should be trained in proper hygiene practices, and the use of clean and sterilized equipment to minimize the risk of infection. They are also should have a clear understanding of Islāmic guidelines since hijamah therapy is the prophetic medical therapy which being practiced by many Muslims as sunnah.
- 3- **Infection control and hygiene.** Infection control and hygiene practices are critical to be understood by both hijamah practitioners and users in ensuring a safe and effective therapeutic experience. By adhering to rigorous personal hygiene, maintaining a clean treatment environment, practicing appropriate instrument sterilization, and following infection prevention measures, the risk of cross-contamination and infection transmission can be significantly reduced. It is vital for both practitioners and users to stay updated on current guidelines and recommendations to ensure the highest standards of infection control are consistently maintained during hijamah therapy.

- 4- **Communication:** Practitioners and users should be able to communicate effectively with each other. Effective communication between healthcare practitioners and patients is crucial in ensuring positive health outcomes.
- 5- **Professionalism.** Professionalism and adherence to Islamic guidelines are integral to the practice of *hijāmah*. Upholding ethical conducts and integrating Islamic principles are essential for practitioners and users alike. By maintaining professionalism and following Islamic teachings, *hijāmah* practitioners can provide a holistic approach to therapy that incorporates physical, emotional, and spiritual well-being, ensuring a positive and fulfilling experience for all parties involved.
- 6- **Medical history:** Users should inform their practitioner of any underlying medical conditions, allergies, or medications they are taking that may affect the therapy's safety and effectiveness.
- 7- **Aftercare:** Users should follow the practitioner's aftercare instructions to ensure optimal recovery and minimize the risk of complications.

### **Limitation**

Some limitations of this review deserve to be mentioned, one of them is only full text articles in English and Malay published in peer-reviewed journals were included in the review, which may have excluded some relevant articles which further limited the number of studies included.

### **Conclusion**

The lack of standardized literacy parameters for *hijāmah* services can lead to ineffective treatment, adverse events, and serious health risks. By adhering to these literacy parameters, practitioners can provide high-quality care, and users can make informed decisions about their health and well-being. This proposed framework may serve as the standardization in the practice of *hijāmah*. It may improve the quality and safety of *hijāmah* therapy. It paves the way for *hijāmah* awareness and its acceptance as a viable alternative healthcare option.

### **Recommendations**

Based on the findings of this research, there should be a standardization of practice in the field of *hijāmah*. This standardization includes the development of a code of ethics for *hijāmah* practitioners which complies with Islamic ethical guidelines. Regular training and assessment of practitioners; monitoring of their practice by regulatory bodies, and collaboration with healthcare professionals are also a must nowadays. Finally, there is a need for public education on the benefits and risks of *hijāmah*, as well as the ethical guidelines that practitioners

should follow. This can be achieved through public awareness campaigns, educational programs, and the dissemination of information through traditional and social media platforms.

## Acknowledgements

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# Recognition and Detection of Traffic Signs Using Convolutional Neural Network

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**Abstract:** Recognition and detection of traffic signs have been one of the most important factors and a very crucial aspect for autonomous vehicles and also in the Driver assistance system. If a proper and accurate recognition and detection system is not installed in a vehicle, the information present in signs will not be interpreted correctly and hence it can result in the loss of human life. The need for a good detection system is very important. One of the Deep Learning approaches, an improved convolutional neural network(CNNs) in conjunction with Image Preprocessing Techniques presents a unique solution to recognize and detect traffic signs with state-of-the-art results for building a better Advanced Driver Assistance System (ADAS). The proposed model is evaluated on German Traffic Sign Recognition Benchmark(GTSRB) traffic sign dataset and fine-tuned to capture the minute and fine details and features present in different classes of the traffic sign. which contains in total, more than 52000 traffic sign images. With the enormous size of data, the model was able to achieve testing accuracy of 97.76% and validation accuracy of 99.71% therefore, making the model a useful part of the advanced driver assistance system.

**Keywords:** GTSRB, Convolutional Neural Network, ADAS, Traffic Sign Recognition, Traffic Sign Detection

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## Introduction

Deep Learning has been currently one of the most progressive fields from the subset of the machine learning when it comes to identify and classify any image (Treebupachatsakul & Poomrittigul, 2019), recognition of imprints (Rahul, et al., 2020), summarizing text (Shand & Rahul, 2022), and related to its representation. The

progress in the field of the deep learning is directly relates to the progress made in the autonomous vehicle industry (Balasundaram, et al., 2021). For any instance we can see that Deep Learning is so intensely used in when it comes to the semantic division of an image (Chen, et al, 2018)., locating any kind of arrangement made (Berriel, et al., 2017), in the course assessment of the heading of a vehicle which is known to everyone.one of the key benefit of deep One of the key benefits of deep learning is its ability to handle unstructured data, such as images,

audio, and text. Much progress has been made in areas including speech recognition (Wang, 2020), computer vision, and natural language processing as a result of this. In addition to its advantages, Deep Learning also has certain disadvantages as it necessitates costly annotation, a sizable well-balanced data collection, and a high computing cost during training. Despite these challenges, deep learning is a rapidly growing field and and provides many prospects.

The proposed research project is concerned with traffic sign detection. This project seeks to aid autonomous vehicles in safely navigating roadways by giving drivers real-time information about traffic signs. A single traffic sign can convey a great deal of information to the people. It is necessary to develop a dependable automatic traffic sign detection system. Since there are some traffic signs that are uncommon and rarely encountered in everyday driving situations, A dataset with practically all the traffic signs information is needed to achieve this task efficiently. For the current model, we have used German Traffic Sign Recognition Benchmark (Houben, et al., 2021) for the training purpose. The following name of the dataset is due the image being captured on the German Street.

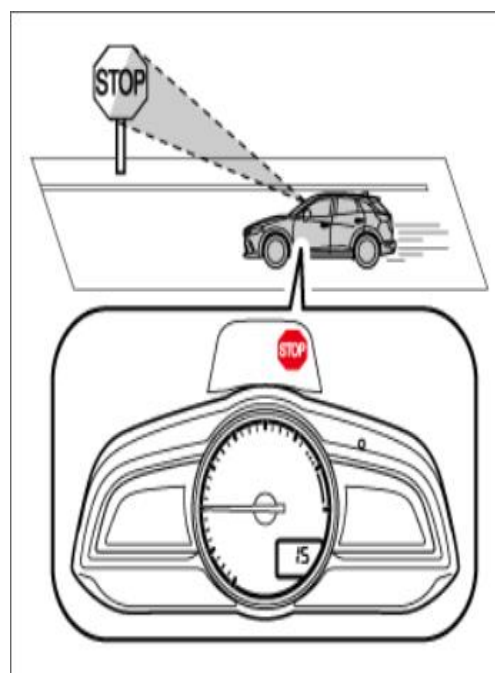


Fig 1.TSR Model

## Convolutional Neural Network

A CNN (Convolutional Neural Network) is a supervised learning method that requires both training data and target yield data. These are categorized using their marks to provide a scholarly framework for future information research. The architecture of a ConvNet was inspired by the organisation of the Visual Cortex and is similar to the connectivity network of neurons present in the human brain. Individual neurons are only excited in the Receptive field, a limited region of the visual field. There are several overlapping fields like this that make up the total visual field. A CNN (Convolutional Neural Network) typically consists of three layers: Convolutional layer, pooling layer and a dense, completely integrated network. The Information image is applied to the convolutional layer using  $m$  times of  $n \times n$  channels to create a component map. The maximum pool layer, which is mostly used for dimensionality reduction, takes the element map after that, and selects just its best features from the component map. Finally, all of the highlights are smoothed and delivered as a contribution to the fully integrated thick neural structure, which learns the loads using back propagation. The convolutional neural network only looks at a single section or window of the information picture at a time. Every time, the convolutional layer will produce a component map for each portion. The feature extraction is not done manually in the convolutional neural network (Hao & Maoguo, 2017).

Highlight extraction is done in the pooling layer by removing the excess highlights and taking only the primary highlights for that area. Therefore, by using CNNs, we may avoid having to do a separate component extraction process. Compared to other comparative characterization calculations, CNNs require less pre-preparing. Traditional MLP (Multi-Layer Perceptron) calculations provide the necessary precision for image recognition, but because the hubs are tightly coupled, they suffer from the effects of dimensionality and cannot be scaled to high goal images. CNNs use the spatial relationship of a picture to get over the problems MLP presents. An illustration of a neighborhood network between neighboring neuron layers is used to complete this. When compared to other approaches, CNNs end up being better at a variety of tasks, including video analysis, natural language processing (Raul, et al., 2021), and many more. CNN has the essential advantage over its forerunners in that it can autonomously determine the distinctive traits of each class and can identify key properties without manual intervention. CNN can also be combined with other machine learning-based algorithms or modified further like hybrid wavelet CNN with WCO (Monika, 2022). In summary, CNNs are an effective technique for processing image data and have produced cutting-edge outcomes on a variety of visual recognition tasks and offer several advantages over traditional computer vision methods, such as automatic feature extraction and robustness to variations in the input data.

## Literature Review

When the work related to recognition and detection of the traffic signs started all it could recognize the signs

using the features such as shapes and colors and that too was not so efficient in its functioning. Sign recognition is basically based on extracting the specific features which are generally represented through some traffic sign patterns (Sun, et al., 2021). Since it is a broad field of study the most recent development related to it can be analysed from the survey by Møgelmoose et al. 2021. There are certain problems related to color fading or the changes in the illumination, the deformation are some of unresolved problems (Lim, et al., 2017).

The most important part that plays role in recognition of signs is to find the required information and then extract it from the image and label the sign present in the image correctly (Wang, 2018). Sermanet et al. 2011 for traffic sign recognition proposed a multi scale CNN framework on GTSRB (Houben, et al., 2021). Yuga hatolkar et al. 2018 a model is proposed for recognition of the traffic signs where the optimizer modules act been carried by the fuzzy classification module for the results which are obtained by CNN. Chiu et al. 2021 in his research proposed a framework which is based on CNN that uses a two-stage approach for the traffic sign detection consisting of region proposal and classification. Luo et al. 2017 made a proposal of a novel method classifying and detecting the the signs based on multi task CNN framework doing both the task simultaneously. Zhang, et al., 2020 made use of knowledge distillation along with the CNN for calculating the accuracy which came out to 70% due to the pruning a model These studies highlight the importance of architecture design, data preprocessing, and data augmentation in achieving high accuracy and robustness in traffic sign recognition and detection.

With advancement ongoing the works done in this field of DL and NN are producing results with good accuracy and efficiency which can be significant for the future of the work done in this field. Those results encourage future development and the research work being carried in improving models' artificial intelligence. inspired from the work done in deep learning and developing a good traffic sign recognition system we aimed at developing an effective model for the traffic sign recognition with using the using the multilayer architecture of Convolutional Neural Network.

## **Methodology**

### **Dataset**

In this paper for the training validation and testing purpose a large size of dataset was required for which we used GTSRB (Houben, et al., 2021). dataset. The name of the dataset is due the image being captured on the German Street.

The dataset used contains images containing different signs present of the road which can be divided into 43 classes and in total having 51,839 images Each class of image contains images with different resolution clarity so as we were able to train the model better.

Out of the total images from all classes in the dataset for purpose of the training the images are 31367 in

number, for the validation purpose are 7482 and the left one which are 12630 for the testing purposes.

### Data pre-processing

Before passing the image, the dimensions were checked, the dimensions varied in a very dynamic range of  $16 \times 16 \times 3$  to  $128 \times 128 \times 3$ . To enhance the efficiency of the model the images were preprocessed without distorting much of the information. The images were preprocessed and their dimensions were changed to  $(32 \times 32 \times 3)$ . The image is further treated for noise reduction by gaussian blur and then with max-min scaling.

### Implementation

In this study for the recognition, classification and identification of the traffic signs and signals a CNN model is used. The filter size number being used and the proper number of epochs decided to be used in the model were subject to the experimental tries and were deciding on the basis of it. They were also chosen considering the experimental cost. The image of input size  $(32 \times 32 \times 3)$  is firstly passed on the first Conv2D layer with kernel size of  $(5 \times 5)$  and total 32 filters. A dot product is done with the input image when the kernel was slid over the input image and the output matrix is formed which is basically the resultant of this dot product. The layer's output is further passed to another similar layer but with 64 filters to make algorithm learn through back propagation. Regarding the activation function (Hatoikar, et al., 2018), in each layer the activation function used is ReLU and except in the last layer where Softmax function is used. From each layer the output produced is passed from the activation function where ReLU activation function gives 0 for values less than zero and decided about the output that will be shipped to the next layer's neuron. The result is further passed to the pooling layer (Bera, et al., 2020), which is basically used when the feature map is to be further reduced as it might be needed to give better result as moving further in the algorithm. NN model are prone to overfitting and to reduce that the dropout layer is used which randomly deactivates a certain percentage of neurons in a layer during each iteration.

The output from the previous layer is passed to the dropout layer. For choosing the most efficient dropout layer, we tested our code randomly between 20% to 50% and got best result around 25%. The dropout layer's output is further sent to the flatten layer as an input. The flatten layer in a neural network serves as a bridge between convolutional layers and fully connected layers by transforming pooled feature maps into a flattened, one-dimensional vector. This allows for the introduction of non-linear properties into the model through the non-linear dense layers, and enables efficient processing of the feature maps.

We compared our model with different optimizers (Zaheer, et al., 2019) and finally decided to use Adam Optimizer considering comparison graph. Adam optimizer was able to achieve higher accuracy in comparison to other optimizers that we have used. It reduces the computational cost and training cost was also lower than the other optimizers.

Layer (type)	Output Shape
conv2d (Conv2D)	(None, 28, 28, 32)
conv2d_1 (Conv2D)	(None, 24, 24, 64)
max_pooling2d (MaxPooling2D)	(None, 12, 12, 64)
dropout (Dropout)	(None, 12, 12, 64)
conv2d_2 (Conv2D)	(None, 10, 10, 64)
conv2d_3 (Conv2D)	(None, 8, 8, 64)
average_pooling2d (AveragePooling2D)	(None, 4, 4, 64)
dropout_1 (Dropout)	(None, 4, 4, 64)
flatten (Flatten)	(None, 1024)
dense (Dense)	(None, 256)
dropout_2 (Dropout)	(None, 256)
dense_1 (Dense)	(None, 43)

Fig 2. CNN model architecture

## Experimental Results

In this study the images in the dataset were preprocessed to 32X32X3 dimensions from which we observed that the preprocessing done on the images helps in improving the accuracy of the model.

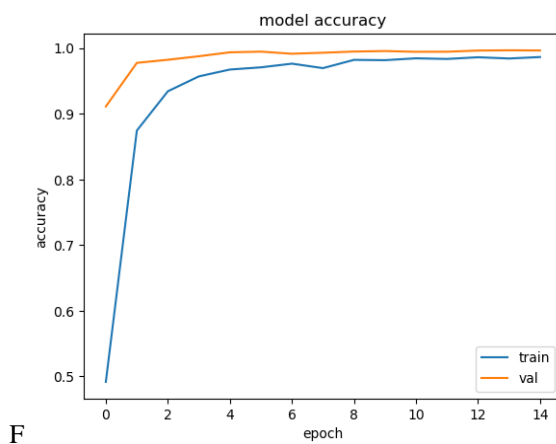
We trained our model on GTSRB dataset and used Adam optimizer which gives the most promising results than the other optimizers used and also it reduced the training cost and computational cost of the model. We used max pooling layer (MaxPool2D) with first conv2d layer set and next time average pooling layer which gave us better results than using either one of them. Next to use the dropout layer we got better accuracy while using the dropout layer who's with value of 25%. The model has 2 convolutional layers with ReLu activation function whose result is passed through the max pooling layer and dropout layer and then a similar one repeated before passing through the flatten layer with only difference using the average pooling layer instead of max pooling layer giving us better results.

The results in the table comparing the results of using max pooling layer, average pooling layer and combination

of both max and average pooling layer.

Table 1. showing the performance using different pooling layers

Performance Measures	MaxPool2D layer (%)	AveragePooling2D layer (%)	Combination (MaxPool 2D and AveragePooling 2D layer) (%)
Training Accuracy	95.65	98.64	98.7
Validation Accuracy	99.03	99.71	99.64
Testing Accuracy	95.81	97.26	97.45



F

ig 3. Training vs validation (accuracy)

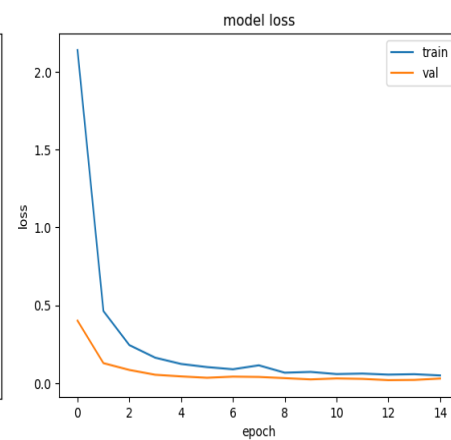


Fig 4. Training vs Validation (Loss)

The approach in this paper working over 15 epochs with a batch size of 128 shows good results for recognition of the traffic signs with a training accuracy of 98.7% , validation accuracy 99.64% and the testing accuracy of 97.458432304038 %. The variation in the accuracy and loss with epochs is shown in the figure below

### Conclusion and Future Work

In this paper, a recognition system for traffic signs has been proposed with results, testing accuracy 97.458432304038 % on the GTSRB [2] dataset which consists of traffic signs images among 43 classes and these images were randomly divided for training and validation. Images were preprocessed before the passing to the CNN framework so as to reduce the computational cost which further supported by the use of Adam optimizer.

The models in terms of its performance have better when compared to other models. Since the model having a good efficiency and, it can recognize images at a good rate. The performance can further be optimised in the future with making the algorithm error-free or with much less error and improved accuracy also the implementation of real-time working of the model for detection and recognition can also be done.

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## The Influence of The Aging Process on The Physico-Chemical Composition and Organosensory Characteristics of The Alcoholic Distillate Produced from The Black Shesh Variety

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**Abstract:** The non-aromatic variety Black Shesh is an autochthonous Albanian cultivar spread throughout the Albanian territory mainly used for wine production. The study is focused on a certain amount of the Black Shesh variety, which was subjected to controlled vinification at a temperature of 18-20°C, without the presence of SO<sub>2</sub> in the presence of 3 gr/l of selected yeast *S. cerevisiae*. Then the fermented mass is subjected to the process of fractional distillation, single distillation is performed, the obtained distillate is subjected to aging in oak wood for 1, 2 and 3 years. The aim of the study is to identify the physico-chemical and organosensory characteristics of this alcoholic distillate before and after aging for 1, 2, 3 years. The analyzes were carried out according to the methods OIV-MA-AS312-01A, OIV-MA-AS313-01; REG-CE 2870/2000. Referring to CE Regulation no. 110/2008, point 3, article 1, alcoholic distillate stored in oak wood has changes in its physical and chemical composition. The results show that the change in the physico-chemical composition is observed in the third year of aging and mainly in the reduction of the methanol content, which decreases by 3.05 gr/l a,a; in the increase of high alcohols up to 4 gr/l a,a; increase of furfural in the amount of 0.22 gr/l a,a; increase of acetic aldehyde in the amount of 1.75 gr/l a,a; ethyl acetate increases to the amount of 3.8 mg %ml a.a. The organosensory evaluation of the aged distillate shows an improvement in the aromatic picture even though the initial aromatic intensity of the distillate is negligible, the sweet taste is easily discernible, the color changes from transparent white to the shade of honey, these come as a result of the hydrolysis of lignin and wood hemicellulose. The distillate does not lose its clarity during aging in oak wood.

**Keywords:** Black Shesh, Alcoholic Distillate, Ageing Process.

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### Introduction

Fresh grape distillates are colorless with alcoholic notes in the taste and their aromatic phase is characterized by the aromas of flowers, fruits, herbs, depending on the grape cultivar used.(Cortés, et al. 2009). Alcoholic distillates consist in a number of volatile compounds responsible for their aroma and taste, mainly formed

during fermentation, distillation and aging. These components are generally fusel alcohols, fatty acids, esters responsible for the organoleptic qualities when they are present in relatively large quantities, up to 3 gr/lit. (Fitzgerald, G., et.al. 2000). The secondary compounds with higher amounts present in alcoholic distillates are fusel alcohols and fatty acid esters, together with acetaldehyde and its acetal with ethanol (MacNamara, K., et.al. 2005) Acetaldehyde as a toxic metabolite that is originating from fermented raw materials, can increase during ageing process due to the oxidation of ethanol and further oxidation of acetaldehyde can result in the formation of small amounts of acetic acid (Cole, V. C., et.al. 1997) Acetaldehyde concentration in the final distillate is also influenced by the distillation system, the wood and the aging time (Parazzi et al.2008) Methanol is formed by pectinolytic enzymes that cleave the methoxyl group from the pectin present in crushed fruit, the methanol concentration in the final distillate alcohol increases with extraction time (Silva, M. L., et.al 1998). Ethyl acetate at a level of 150-200 mg/lit can add spoilage to wine and distillates, at lower concentrations, ethyl acetate contributes to the fruity properties of wine and distillates, it mainly derives from bacterial spoilage of distillates produced from fermented wine (Silva, M. L., et.al.1999). The taste of aged alcoholic drinks in wood is based on a series of compounds such as: alcohols, esters, lactones, acetals, polyphenols, organic acids, terpenes, etc. The transfer of components from the wood to the distillate, the absorption capacity of the wood surface depends on factors such as: the type of wood and its geographical origin (Singleton VL 1995) the contact surface of the wood with the alcoholic beverage (Castellari M, et.al 2001), the alcohol intensity as well as storage conditions such as: humidity and temperature.

Physico-chemical and organosensory changes are mainly influenced by factors such as: type of wood, thermal treatment, temperature and humidity of the cellar, aging time and initial composition of the distillate. (Caldeira, Iet al 2006.; De Rosso, Met.al 2009.; Prida, A.et.al 2006). Referring to the application (CE regulation 110/2008, no. 3, article 1), the alcoholic distillate point of the drinks in the oak weighs changes in its physical and chemical changes, in different periods of time this in the European challenges of the intensity of the changes we want to receive. The time and type of wood used have an impact on the quality of the aged distillate (Canas et al., 1999; Belchior et al., 2001; Canas et al., 2011). The aging process is a treatment used to improve the organoleptic indicators of alcoholic distillates (Léauté et al. 1998). Practice has shown that other alternatives can be used besides traditional barrels for aging, such as the use of oak wood divided into parts, this turns out to be a fast way of treatment for aging (Puech J.L., et.al.1992). Studies have shown that the physico-chemical and organosensory changes are directly influenced by the type of wood, its storage and thermal treatment. (Viriot et al., 1993; Scalbert, A. et.al.,1988). The taste and aroma compounds of alcoholic beverages are collected in: alcohols, aldehydes, higher alcohols, esters, volatile acids and terpenols. Monoterpenes and ketones are created through the breakdown and rearrangement of various terpenoid compounds (Molina, A.et.al. 2007). Higher alcohols are produced during alcoholic fermentation as a result of the conversion of amino acids in the environment and are important precursors for the formation of esters, which are associated with pleasant aromas. (Clemente-Jimenez et al., 2005). The aim of the study is to identify the physico-chemical and organosensory characteristics of this alcoholic distillate before and after aging for 1, 2, 3 years

## Method

### Alcoholic distillate production and aging conditions.

The cultivar Black Shesh is cultivated in Central Albania in lowland areas with red - muddy soil where lime and DAP- superphosphate is added to improve the quality of the soil. This ecosystem is characterized as part of the Mediterranean climate, the annual temperature is 18°C, the average temperature of the vine vegetation is 16°C, the amount of active temperature 3705°C, the relative humidity 70%. This cultivar is late maturing, the pod is large, medium in length and moderately compressed, the berries are round, medium in size, blue to black in color, with a medium thick shell, 2 to 3 seeds and is a non-aromatic variety. After harvesting, the selected raw material is in good condition, the grapes are subjected to mechanical analysis, determination of acidity, sugar content and then undergo fermentation process at a temperature of 18-20°C, without the presence of SO<sub>2</sub> in the presence of 3 gr/l of selected yeast *S. cerevisiae*. Then the fermented mass is subjected to the process of fractional distillation, single distillation is performed, the obtained distillate is subjected to aging in oak wood for 1, 2 and 3 years. The study aims to identify the physico-chemical and organosensory changes of the distillate after 3 years of aging in the presence of oak wood. In order to identify the quality of the cultivar, analyzes were performed on the samples of:

- Must, Wine and Alcoholic distillates produced from the grape cultivar in 4 different years:
- Samples of Black Shesh alcoholic distillate (year 0), which after fermentation is subjected to fractional distillation. The heart fraction of the distillates is subjected to the preservation process in two forms:
  - a. In hermetically sealed glass container. Distillate stored in glass(temperature 20-25°C and humidity 65%, for 3 years)
  - b. In hermetically sealed glass container in the presence of oak cubes. Distillate stored in oak(temperature 20-25°C and humidity 65%, for 3 years)

Sample of *Quercus robur* wood processed according to point 3 article 1 of CE regulation no. 110/2008 of January 15, 2008. The wood is divided into strips with a thickness of 1cm<sup>2</sup>, which were pre-passed in an oven with dry hot air circulation, it is dried in a ventilated oven at a temperature of 20°C for 12 hours and baked first at a temperature of 70°C for 2 hours and then 80°C for 3 hours and at 85°C for 1 hour, until a light caramel color is obtained. The process is carried out according to the rule set by CE that specified the condition of ageing and consumption (an alcoholic distillate must not be consumed before the second year of aging).

### Analytical method and procedure

The analyzes were performed according to the methods: OIV-MA-AS312-01A, OIV-MA-AS313-01; The GC-FID method is the one provided by the current European regulation REG-CE 2870/2000, and especially paragraph III. Components in alcoholic distillates are determined by direct injection of the alcoholic distillate into a gas chromatographic (GC) system. An appropriate internal standard is added to the alcoholic distillate prior to injection. Components are separated by temperature programming on a suitable column (6ftx2mm i.d,

packed 5%Carbowax 20M in 80 – 100 Carbowax; Gas flow: He, 300-30 ml/min) and detected using a flame ionization detector. The concentration of each component is determined relative to the internal standard by response factors, which are obtained during calibration under the same chromatographic conditions as those of the alcoholic distillate analysis.

The sample is injected directly after injection of the internal standard. The chromatogram obtained represents several decoded points, especially after 24 minutes, not written to present organic acids, especially acetic and butyric acid. The identification of volatile compounds was based on matching the mass spectra of the compounds with the reference mass spectra of the NIST library. The identification of the chromatographic peaks was also confirmed by comparing the retention times with those of the pure compounds. Quantitative analyzes were made using the corresponding response factor in the reference solution, according to the internal standard method. Determinations were made in triplicate. The quantitative evaluation of the analytes is in the extract ion, while the identification is based on the retention time and in comparison with the total ion spectra of the analyte under study and the spectrum of the pure components (fit threshold > 80%). The organosensory assessment is based on the intensity of the descriptive and qualifying parameters (appearance, aroma, taste, aftertaste and general impression) all samples were tasted in tasting glasses, at room temperature and the assessment was made using a structured scale (10, no perception ; 20, very low; 30, low; 40, medium; 50, high and 60, very high intensity).

## Results

The physico-chemical and organosensory composition of the distillates taken into consideration shows significant differences between the samples. The presence and concentration of these compounds is related to the raw material used, the fermentation conditions, the distillation technique used and the aging process.

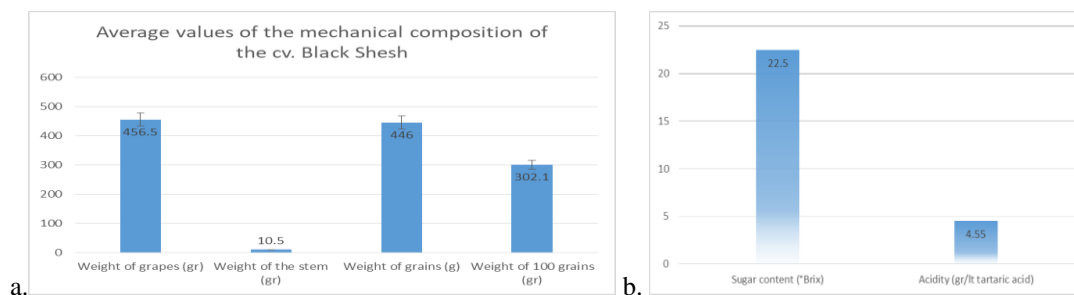


Figure 1. Average values of a. mechanical composition b. physico-chemical indicators of grapes Cv. Black Shesh

From the obtained results we come to the conclusion that: from the harvest to the production of the must, there are no visible changes in the main ingredients: sugar and acidity. The must obtained from the black Shesh cultivar has a high sugar content of 22° Brix (that is converted in 231.5 gr/l) and a low acidity of 4.55 gr/l of tartaric acid.

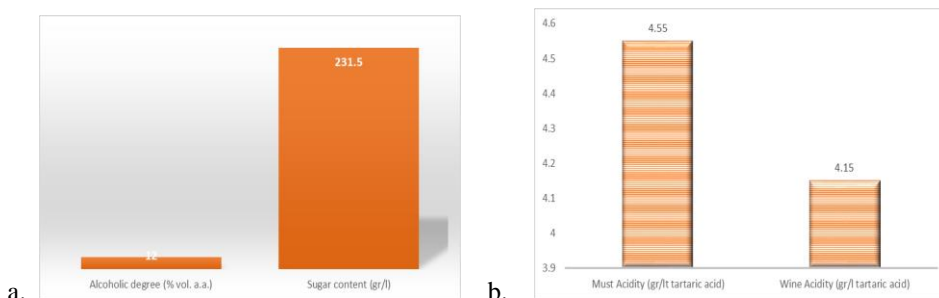


Figure 2. Average values of physico-chemical indicators of Black Shesh grape and wine a. Change of sugar content in alcohol, b. Change of general acidity during alcoholic fermentation.

The alcoholic strength is within the allowed limit for distillates produced from grapes (it must be 9-13% vol alcohol) and wine produced from the cv. Black Shesh is  $12 \pm 0.7\%$  vol alcohol. Performing the alcoholic fermentation at a low temperature and applying a regular fermentation protocol has helped to obtain the maximum alcoholic gradation, but it has also protected the wine from being affected by bacteria, which would increase the acidity.

Table 1. Physico-Chemical indicators of alcoholic distillate samples obtained from cv. Black Shesh and stored in two forms

Nr Indicators	Cv. Black Shesh distillate	B. Distillate (stored in glass)	Sh. B. Sh. (stored in wood)	Distillate in oak EEC Standard
1 Alcoholic degree (% vol. a.a)	$37.11 \pm 0.27$	$36.88 \pm 0.1$	$36.91 \pm 0.01$	37.5–50% vol
2 Methanol (g/hl a.a)	$89.3 \pm 0.57$	$90.025 \pm 0.1$	$86.25 \pm 2.9$	Max. 200 g/hl a.a. 100 % vol. a.
3 High alcohols (g/hl a.a)	$380.25 \pm 1.71$	$365 \pm 1.2$	$384.25 \pm 2.1$	Not more than 600 (gr/hl).
4 Furfurol (mg % ml a.a)	$1.15 \pm 0.06$	$1.19 \pm 0.01$	$1.375 \pm 0.2$	Not more than 5 mg/100 ml a.a
5 Acetaldehyde (mg % ml a.a)	$30.63 \pm 0.75$	$32.125 \pm 0.5$	$32.37 \pm 0.8$	Not more than 150 g/hl.

The alcoholic degree of the samples under study was within the margins established by the corresponding Regulation Council (37.5–50% v/v) even though the cultivar enables obtaining a distillate with a low alcohol content. The methanol content in alcoholic distillates is very important because of its toxicity (according to EEC No 2009/92 article 7, the level of methanol should not be higher than 200gr/hl a.a 100% vol), it's content in the analyzed samples decrease with 3.05 g/ hl a.a. in the aged distillate and have a little increasement with 0,73 g/ hl a.a in the glass stored distillate, this can be attributed to the low pectin content of the raw material employed in

the elaboration of the alcoholic distillate, the great change of methanol is detected in glass stored distillate. The amount of total higher alcohols in the samples analyzed increased with 4 g/hl a.a at the aged distillate and to an decreased with 15, 25 g/hl a.a in the glass stored distillate. These volatile compounds are positively involved in the sensory quality of the distillate, if they are not present in high concentrations. The increasement of the higher alcohols during aging was primarily due to isoamyl alcohol (Parazzi et al. 2008). Furfurol is one of the representatives of the aldehydes that contributes at the aromatic complex of the distillate, it comes as a result of overheating the mass of fermented must grape, is present in the fresh distillate and it increase in the two form of storing, in the aged distillate in Q. robur it increase in 0.22 gr/hl a.a; in glass stored it increase in a lower level with 0.04 gr/hl a.a. Acetaldehyde is part of the group of volatile compounds formed during spontaneous oxidation or mediated by microorganisms during alcoholic fermentation of the raw material. The concentration of acetaldehyde increases to lower levels during aging, which is due to the distillation system of the raw material and the type of wood used (Q. robur). The level of acetaldehyde in the aged samples of Black Shesh increase with 1.7 g/hl a.a. and in the samples stored in glass it increase with 1.49 g/hl a.a. this shows that growth occurs even in the absence of oak wood.

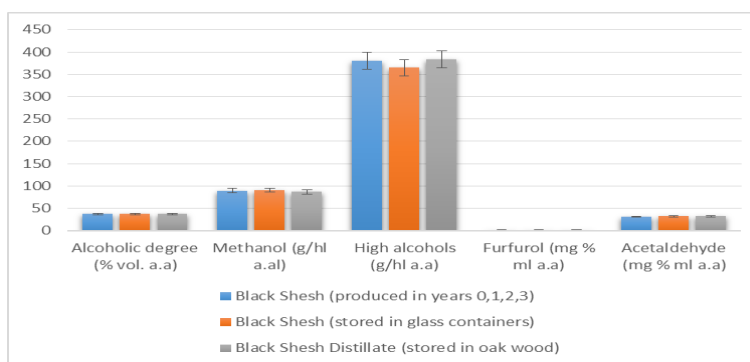


Figure 3. Physico-Chemical indicators of alcoholic distillate samples obtained from cv.Black Shesh and stored in two forms

Table 2. Esters indicators of alcoholic distillate samples obtained from cv. Black Shesh and stored in two forms

Esters	Cv. Black Shesh distillate	Black Shesh (Stored in Glass)	Black Shesh (stored in Oak)
Ethyl acetate (mg % ml a a)	334.75 ± 0.5	333.4 ± 0.9	338.55 ± 0.8
Ethyl caprylate (mg % ml a. a.)	0.735 ± 0.01	0.74 ± 0.01	0.75 ± 0.013
Ethyl Caprat (mg % a. a.)	0.113 ± 0.01	0.01 ± 0.01	0.113 ± 0.01
Ethyl lactate (mg % ml a a)	28.45 ± 0.34	27.4 ± 0.5	29.13 ± 0.9
Ethyl capronate (mg % ml a. a.)	0.535 ± 0.01	0.54 ± 0.01	0.6 ± 0.1

Ethyl acetate turns out to be in the highest amount, it is formed by the secondary metabolism of yeasts during the alcoholic fermentation of grapes. It is known to be a product of acetic acid esterification and thus its concentration increases during the aging process (Onishi, M.J., et al., 1977). A high content of ethyl acetate in

the distillate, above its perception threshold of 180 g/hl a.a., has a negative impact on sensory characteristics and is perceived to have a solvent character (Silva, M.L. et.al 1998). Its content increases during aging with wood in 3.8 mg % ml a.a and decreases slightly during storage in glass in 1.35 mg % ml a.a.

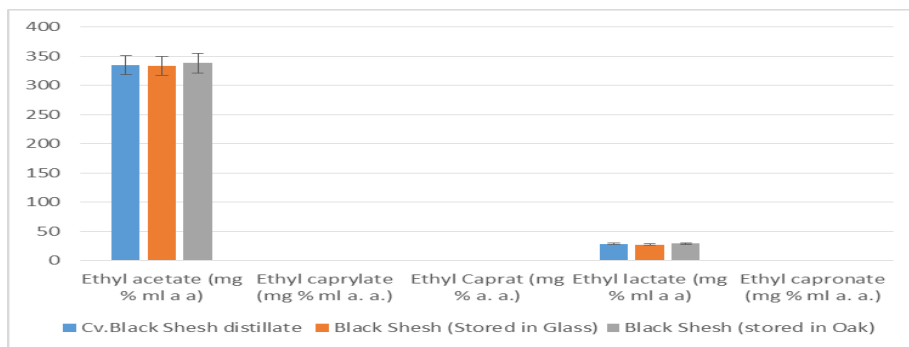


Figure 4. The content of esteres in alcoholic distillates cv. Black Shesh and stored in two forms

Table 3. Average Values of terpenols in alcoholic distillates cv. Black Shesh and stored in two forms

Terpenols	Cv. Black Shesh distillate	Black Shesh (Stored in Glass)	Black Shesh (stored in Oak)
1 $\alpha$ -Terpenols (mg % ml a.a)	n. c<0.05	n. c<0.05	0.05±0
2 Citronellol (mg % ml a.a)	n. c<0.05	n. c<0.05	0.07±0.03
3 Linalool (mg % ml a.a)	n. c<0.05	n. c<0.05	0.08±0.03
4 Nerol (mg % ml a.a)	n. c<0.05	n. c<0.05	0.07 ± 0
5 Geraniol (mg % a.a)	n. c<0.05	n. c<0.05	0.1 ±0.05

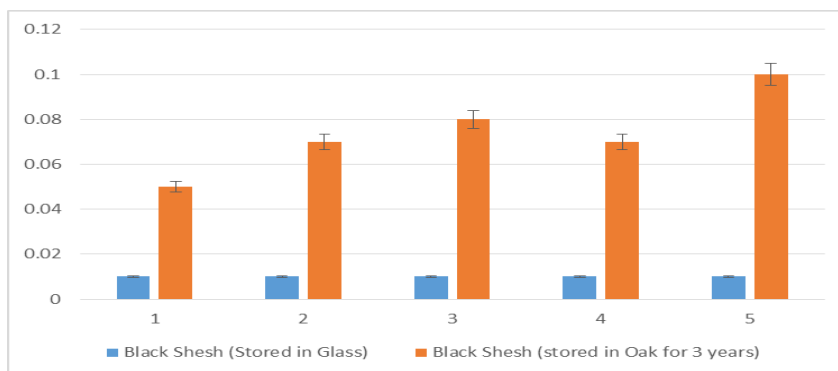


Figure 5. The content of terpenols in alcoholic distillates cv. Black Shesh and stored in two forms

The main terpenols found in alcoholic distillates are:  $\alpha$ -terpenol, linalool, geraniol, citronellol, these in the fresh distillate are not perceptible as their level is below the limit of 0.05, this is acceptable because cv. Black Shesh is a non-aromatic variety. After aging in the presence of oak wood, we notice an increase in them, mainly geraniol in 0.1 mg % a.a and linalool 0.08 mg % a.a are in higher quantities, while in the alcoholic distillate stored in a glass container there is no sign of an increase in terpenols.



### Sensory Analyses

The results reveal that the samples of Black Shesh aged in *Quercus robur* during 3 years have the best sensory profile and had obtained a greater intensity in all of the qualifying parameters in comparison with Black Shesh distillate stored in glass for the same time. The increased presence of geraniol and linalool gives the oak-aged distillate a floral aroma and light caramel color.



Figure 6. Organosensory comparison of cv. Black Shesh distillates stored in two forms.

### Discussion

At the end of the work carried out regarding the study of the physico-chemical and aromatic composition of the produced distillates, we reached the following conclusions: Alcoholic distillates produced from Black Shesh cultivar result in higher content of acetic aldehyde, high alcohols and furfural. It is characterized by the content of ethyl acetate and ethyl lactate as a characteristic part of esters. The content of terpenols is much smaller than the 0.05 capture level ( $n. c < 0.05$ ). This identifies the fact that the content of terpenic compounds is negligible in the Black Shesh as a non-aromatic cultivar. The content of physico-chemical indicators, esters, aldehydes and terpenols in alcoholic distillates do not undergo significant changes during the storage period in glass containers. The storage of alcoholic distillates in oak wood is accompanied by changes in the quantitative content of some physico-chemical indicators and aromatic compounds (esters and terpenols) for four years of the study, which are accompanied by improvements in their content and organosensorial qualities of the produced distillates. The results show that the change in the physico-chemical composition is observed in the third year of aging and mainly in the reduction of the methanol content, which decreases by 3.05 gr/l a,a; in the increase of high alcohols up to 4 gr/l a,a; increase of furfural in the amount of 0.22 gr/l a,a; increase of acetic aldehyde in the amount of 1.75 gr/l a,a; ethyl acetate increases to the amount of 3.8 mg %ml a,a. The alcoholic distillate of the Black Shesh cultivar, stored for three years in oak wood, results in large amounts of high alcohols and acetic aldehyde. During storage in oak wood, the alcoholic distillate Black Shesh acquires a very small amount of terpenol, sweetness and vanilla aroma. This is dedicated to oak wood as the Black Shesh distillate is characterized by the absence of terpenols. The alcoholic degree of alcoholic distillates of Black Shesh grape cultivars stored in oak wood does not undergo changes compared to storage in glass containers. The

organosensorial evaluation of the aged distillate shows an improvement in the aromatic picture even though the initial aromatic intensity of the distillate is negligible, the sweet taste is easily discernible, the color changes from transparent white to the shade of honey, these come as a result of the hydrolysis of lignin and wood hemicellulose. The distillate does not lose its clarity during aging in oak wood.

## Conclusion

Referring to the obtained results, we see that the distillates produced in different years do not present a change in the physico-chemical and organosensory characteristics, this refers to the fact that the production is done under the same conditions and the cultivar does not show variability in quality in different years of production. Also, from the methodology used to determine the variability of the physico-chemical characteristics and organosensory characteristics of the analyzed distillates, we reach the conclusion that the greatest variability of the compounds is shown in the Black Shesh alcoholic distillate aged for three years in thermally treated oak wood *Q. robur*, than in the distillate stored in a glass container for the same period of time, although under the same conditions of temperature and humidity of the storage environment. The results show that the change in the physico-chemical composition is observed in the third year of aging and mainly in the reduction of the methanol content, the increase of high alcohols, furfural, acetic aldehyde and ethyl acetate. The sensory evaluation shows that in the aged distillate with wood, floral aromas are added, attributed to the presence of Geraniol and Linalool, but also of other terpenols in the minority, which pass into the neutral distillate from oak wood a light vanilla flavor and sweetness is acquired too. Not only the aroma and taste, but also the color of the distillate changes, which goes from transparent white to a honey shade. During storage in glass, we do not see significant changes from the main components that affect the aromatic and taste fraction of the distillate.

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## **Preliminary Data on Systematics and Structure of Nematode Assemblages in Estuarine Environments, Albanian Adriatic Sea Coast**

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**Abstract:** Phylum Nematoda ranks among the most ubiquitous organisms on earth, colonizing almost every conceivable habitat. However, despite their wide spread, assemblages of nematodes in certain habitats present their own pattern depending on the influencing role of the habitat and the complexity of its ecological conditions. The present work brings data on systematics and distribution pattern of free living nematodes from upper subtidal habitats, located near the estuaries of two main rivers of Albania flowing towards the Adriatic Sea. The study was conducted under the faunistic study of meiofauna communities. Sediment samples were collected manually, using a hand corer, with an internal diameter of 5 cm, through a 5 cm depth sediment column. The extraction of meiofauna organisms was performed through a sieve of 42  $\mu\text{m}$  mesh size. Nematodes dominated all meiofaunal communities in all samples under the study. Their assemblages were further analysed in term of composition and structure, determining taxonomic composition up to genus level and biological traits. For each identified genus, trophic group and life strategies were determined. Each different habitat presented a distinct nematode assemblage in diversity, dominance and biological traits. Different assemblages presented some exclusive genera of the respective habitat, as well, shared genera due to the connectivity of the habitats and dispersal capability of living organisms.

**Keywords:** nematode assemblages, taxonomic composition, biological traits, estuarine environments, Adriatic Coast

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### **Introduction**

Estuaries and their surrounding waterbodies form an ecological unit, inhabited by a unique flora and fauna with

specially-adapted characteristic to brackish waters. These habitats are characterized by variability and instability of hydrological and physico-chemical conditions. They present a pronounced longitudinal salinity gradient (McLusky, 1993), drastically changing over a relatively short distance, determined by the water balance created by the exchange of water between the sea and freshwater inflows from rivers. The high fluctuation of salinity in these ecosystems constitutes an important abiotic factor, limiting the settlement of populations of living organisms and generating estuarine distribution patterns. The lower range of brackish water occupy a major factor, acting as both external ecological factor and physiological characteristics of internal environment of aquatic organisms, determining living appropriate conditions for freshwater and marine faunas, facing with osmoregulation problems and separating invertebrate communities with different osmotic regulation types, and thus controlling the distribution of the taxas (Telesh and Khlebovich, 2010). Considering all of these, estuarine communities appear to be mainly 'physically control' (Laprise and Dodson, 1993), resulting in low diversity, composed by species adapted to salinity fluctuations and other physico-chemical gradients. The mechanisms of generating environmental variabilities for animals in estuaries are mainly attributed to two components: to presence of longitudinal and vertical gradients in physico-chemical parameters and the dynamic interaction between the movement of animals against the spatial gradients (Laprise and Dodson, 1993). Benthic organisms constitute an important object in long-term studies in the assessment of different environmental pressures, which due to being immobile or of low mobility remain in the same water body for a long period of time and integrate the effects of environmental changes over time (Sandulli et al., 2021) and being exposed to the entire range of fluctuations of a given habitat.

Nematodes are known for their high biodiversity, ranking as the second most diverse of animal phyla, after arthropods (Kardong, 1997). They inhabit a wide range of ecological habitats, including terrestrial, freshwater and marine environments. Despite the high diversity currently known, it is thought that only a fraction of nematode diversity is known so far, which can be derived from their small size and the difficulty encountered in systematic determinations. Until recently, the study of nematodes has not received much attention in the Republic of Albania. The first observations on the free-living forms of this taxon date only two decades ago, with sporadic observations in soil, marine and freshwater environments. The first reports on free-living nematodes were made in the framework of faunal assessments of meiobenthic assemblages in marine environments, also noting the ignorance of the study of these assemblages in our country (Sandulli & de Zio Grimaldi, 2000, 2003; Sandulli et al., 2009). Until now, only Andr assy (2009) brings systematic data to the species level of this taxon, identifying 58 species, including also the description of three new species to science. These data come from a collection by the Hungarian Natural History Museum collected in 2004 and offered them for study to the paper author. This collection consisted on soil dwellers and some aquatic species, sampled mostly in mountainous regions from districts in Central and South Albania. Recent studies bring data on systematics up to genus level from marine and wetland areas (Miri, 2019; Miri et al., 2021). The present paper consist in biodiversity and structure pattern of nematode assemblages in estuarine habitats in Albanian Adriatic sea coast and their biological traits, adapted to environmental conditions and hydrological dynamics in estuaries.

**Materials and methods**

*Study area and sampling sites*

Albania is a mountainous country located on the Balkan Peninsula, washed to the west by two seas, Adriatic and Ionian, within the Mediterranean Basin. It is considered a country with a high content of water resources and sheltering an interesting flora and fauna of international importance (Çullaj et al., 2005). Albania is notable for a high number of rivers, with over 152 streams and rivers, confluent in eight larger rivers, of which seven flow towards the Adriatic Sea and one towards the Ionian Sea (Kabo, 1990-1991). Albanian rivers are characterized by a high flow rate, with a total annual mean flow of  $1308 \text{ m}^3 \text{ s}^{-1}$ , and an annual water volume of  $41,250 \text{ km}^3$  (Çullaj et al., 2005).

Assemblages of free-living nematodes have been investigated in estuary habitats near the mouth of the two main rivers of Albania, both of them flowing towards the Adriatic Sea, Drini of Lezha (in the north of Albania,  $19^\circ57'33.08'' \text{ E}$ ;  $41^\circ75'07.58'' \text{ N}$ ) and Semani (in the south of Albania,  $19^\circ36'63.59'' \text{ E}$ ;  $40^\circ82'36.43'' \text{ N}$ ) (Fig. 1).



Figure 1. (left) Map of Albania and localization of sampling sites; (top right) Map of area around Drini River delta; (bottom right) Map of area around Semani River delta (Map sources: <https://d-maps.com>; <https://maps.google.com>).

As in the whole world, rivers in Albania have undergone significant anthropogenic changes, disrupting and negatively affecting their ecological functions. The **Drini River** of Lezha was originally the largest river in Albania. In 1854, it became subject to a river bifurcation after a great flooding, in order to avoid them in the future, resulting in two distributaries, one remained in the original bed and continuing to flow towards the Adriatic Sea, while the other joined the Buna River that originates from the lake of Shkodra (Miho et al., 2013). A century later, the Drin River has undergone further changes, moving its entire flow to the Buna River. This deviation turned the Drini River into a modest drainage channel.

The Drin River has had a great impact on the morphological modifications of the coastal area near its mouth and in the formation of Kune-Vaini lagoon complex. The Drini delta is flat and open, strongly influenced by wind, waves, marine currents and other environmental factors. Interventions in its flow has led to a significant decrease in the coming of solid materials and an increase in erosion processes (Miho et al., 2013).

**Semani** is a major river of Albania which flows in the southern part of the Adriatic Sea. it is formed by two main branches, Devolli and Osumi. After its formation from these two branches, the Seman River joins the Gjanica River, as the latter passes through the town of Fieri. The Seman watershed consists of covered agricultural fields with little cover vegetation and subject to major erosion. The waters are characterized by a relatively high mineralization, of 440 mg/l (Miho et al., 2005).

#### *Sampling and sediment collection*

Sampling was carried out in spring, summer and autumn in the Seman delta during 2017 and in spring and autumn in the Drin delta in 2018. The sampling area were located on the southern side of the Seman estuary and on the northern side of the Drin estuary. Sediment collection was carried out in the upper subtidal using a hand PVC core (inner diameter 5cm, length 50cm), with a depth penetration into the sediment of 5cm, collecting a sediment volume of 98 cm<sup>3</sup> from an area of 19.6 cm<sup>2</sup>. At each estuary and sampling season were collected three replicate samples. The entire volume of collected sediment was preserved *in situ* with 4% buffered formaldehyde water solution.

#### *Sample processing and nematode analyses*

The sediment samples were further processed to extract the organisms by washing them with freshwater and subjecting them to the flotation technique. Floated organisms were retained using a sieve of 42 µm mesh size and preserved again in 4% buffered formaldehyde water solution and stained with Rose Bengal. Nematodes were sorted among meiobenthic organisms and randomly picked out by hand, using a fine pin. The captured nematodes were transferred in two series of ethanol – glycerol solution for the dehydration (Vincx, 1996) and finally transferred in pure glycerol and mounted in permanent glass slide for microscope observation. Nematodes were identified up to genus taxonomic level according to World Database of Nematodes – NeMys (Bazerra et al., 2021) and using the pictorial keys Platt and Warwick (1983), (1988); Warwick et al., (1998);



Weiser (1954); Weiser (1959); Schuurmans-Stekhoven (1950). Nematode identification was performed under a 100× oil immersion objective using a light microscope Motic BA 310 equipped with a digital camera 1/2" COMOS 3MP-2048x1536 pixels with USB 2.0 output.

For each identified genus was determined habitat affiliation based on data in the World Database of Nematodes; trophic group based on oral morphology according to Wieser (1953, 1959); and ecological values of c-p (c-colonizer; p-persisters) based on the colonizing and competitive abilities of the genera according to Bongers (1990) and Bongers *et al.*, (1991). Nematodes were classified into five habitat affiliation from marine to terrestrial; into four trophic groups: 1A- selective deposit feeders; 1B- non-selective deposit feeders; 2A- epistrate feeders; 2B- predators/omnivores; and into five c-p (colonizer- persisters) ecological classes: c-p 1 colonizers; c-p 2 tolerant; c-p 3 moderate; c-p 4 sensitive to stress; c-p 5 persisters.

The data processing is performed in SPSS 28.0. Nematode assemblages and their biological traits from two different estuaries were tested using the Chi- square and Fisher exact test.

## Results and Discussions

### *Taxonomic composition of Nematode assemblages*

A total of 616 individuals were subjected to taxonomic observation of nematodes in this study, of which 380 from the Drini estuary, and 236 from the Semani estuary. The systematic classification of total individuals resulted in 2 classes, 6 orders, 13 families and 24 genera. The distribution of the genera according the classes was Chromadorea with 16 genera and Enoplea with 8 genera. The most diversified order was Monhysterida, with 8 genera followed by Chromadorida with 7 genera and Enoplida with genera. Among the families, only Chromadorida consisted of 3 genera. The rest of the families were 6 with two genera and 6 with only one genus each.

The systematic classification according estuaries resulted: Drini delta- 2 classes, 4 orders, 10 families and 16 genera; Semani delta- 2 classes, 5 orders, 9 families and 15 genera.

Nematode assemblages of the two estuaries presented a distinct diversity between them, sharing only 6 (or 25%) genera, concretely the genera *Viscosia*, *Enoploides*, *Enoplolaimus*, *Thersitrus*, *Daptonema* and *Terschellingia* (Tab.1).

Table 1. Relative frequency, feeding type and c-p value of identified genera according the estuaries

Genus	Feeding type	c-p value	Relative frequency (%)	
			Drini Delta	Semani Delta
<i>Viscosia</i>	2B	3	6,9	2,55
<i>Enoploides</i>	2B	2	22,6	4,25

www.icres.net	May 18-21, 2023	Cappadocia, Turkiye	www.istes.org	
<i>Enoplolaimus</i>	2B	2	5,6	5,51
<i>Xyala</i>	1B	2	0	0,4
<i>Axonolaimus</i>	1B	2	0	11,9
<i>Ascolaimus</i>	1B	2	0	15,7
<i>Bathylaimus</i>	2A	2	0	1,7
<i>Marylynnia</i>	2A	3	0	0,9
<i>Pontonema</i>	2A	3	0	0,4
<i>Limhonoeus</i>	2A	2	0	0,5
<i>Microlaimus</i>	1B	2	0	4,3
<i>Theristua</i>	1B	2	6,1	18,3
<i>Daptonema</i>	1B	2	2,7	20,2
<i>Eudorylaimus</i>	1B	2	0	4,7
<i>Terschellingia</i>	1A	3	1,1	8,7
<i>Tripyloides</i>	1A	3	0,6	0
<i>Rhabdodemia</i>	2B	4	9,6	0
<i>Prochromadorella</i>	2A	3	37,1	0
<i>Chromadorina</i>	2A	3	2,0	0
<i>Chromadorella</i>	2A	3	1,1	0
<i>Camacolaimus</i>	2A	3	1,9	0
<i>Comesomatides</i>	1B	2	0,3	0
<i>Sabatieria</i>	1B	2	0,4	0
<i>Metadesmolaimus</i>	1A	2	2,0	0

#### Frequency of occurrence

Genera composition among estuaries was statistically different (Fisher exact test;  $p < 0.0001$ ). Based on the analysis of the data according to the estuaries, the genera presenting relative abundance  $> 5\%$  were *Theristrus*, *Prochromadorella*, *Rhabdodemia*, *Enoploides*, *Viscosia*, *Enoplolaimus*, *Ascolaimus*, *Axonolaimus*, *Daptonema*, *Terschellingia* (Fig. 2). The abundance of these genera appeared different between the two estuaries. Drini delta was dominated mostly by *Prochromadorella* and *Enoploides*, with relative abundance over 20%. Semani delta was dominated mostly by *Daptonema*, *Theristrus* and *Ascolaimus*, with relative abundance over 15%.

The assemblages were quantitatively dominated by class Chromadorea, respectively, 57% in Drini delta and 81% in Semani delta. In Semani delta, this class is mainly represented by the order Monhysterida, with relative abundance of 76%. The species of this orders are recognized as species inhabiting both freshwaters and marine habitats. Monhysterida in Semani delta is represented by 3 families, Xyalidae, Axonolaimidae and Linhomoeidae. Family Xyalidae is represented by the genera *Daptonema*, *Theristrus* and *Xyala*; family Linhomoeidae by *Axonolaimus* and *Ascolaimus*; family Linhomoeidae by *Terschellingia* and *Limhonoeus*.

Except *Xyala*, all other genera were the dominant ones in the Semeni delta. In Drini delta, the class Chromadorea is mostly represented by order Chromadorida, family Chromadoridae, and the most prominent genera *Prochromadorella*.

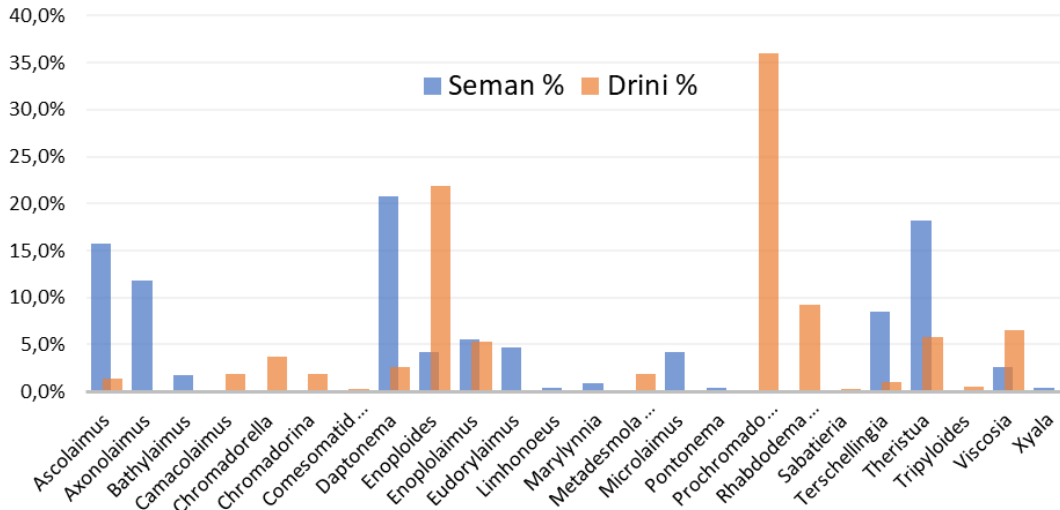


Figure 2. Relative abundance of genera according estuary areas, Drini delta and Semani delta

*Biological traits and functional diversity*

Trophic composition among estuaries was statistically different (Chi-square (3) = 310.7;  $p < 0.0001$ ). All four trophic groups have been observed in both estuaries (Tab. 1, Fig. 3), but with a pronounced dominance of non-selective deposit feeders (1B) in Semani delta and a codominance of epistrate feeders (2A) and predators/omnivores (2B) in Drini delta.

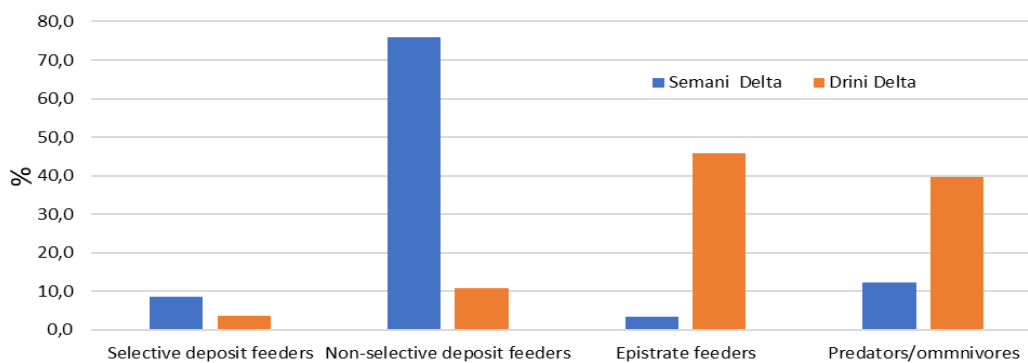


Figure 3. Relative frequency of trophic groups

Considering the life history traits, in Semani delta the assemblage was composed only by c-p 2 and c-p 3 ecological classes and strongly dominated by c-p 2 specimens (87%) (Tab. 1; Fig. 4). The assemblage in Drini delta represented 3 classes, c-p 2, c-p 3 and c-p 4, dominated by c-p 3, followed by c-p2. The dominance of

colonizer nematodes (c-p 2) is indicative of "r" reproductive strategies, reflecting the challenging conditions for settling assemblages in these environments.

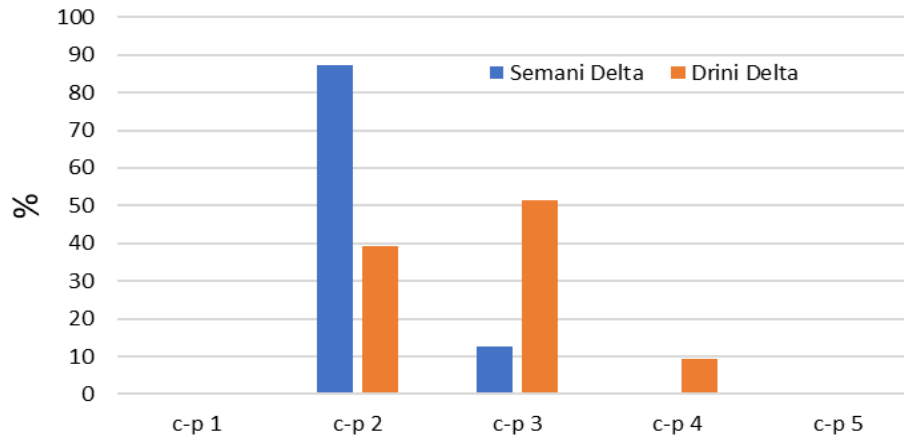


Figure 4. Relative frequency of ecological c-p classes

## Conclusions

Although few and sporadic, the reports on the biological diversity of nematode assemblages are promising and a potential for a high diversity of this taxon in our country. The data of this paper contribute in gathering data on taxonomical diversity of free-living nematode assemblages and evaluation of biological traits adapted to a certain habitat. Evidence from this study indicates that nematodes present their own pattern depending on the influencing role of the habitat and the complexity of its ecological conditions.

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## Characterization of Some Recipes Including Honey

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**Abstract:** Honey is a natural food product used for nutritional, as well as medical purposes since ancient times. This work intended to analyze the use of honey in gastronomy. For that purpose, there were analyzed 150 recipes that included honey as an ingredient. The recipes were classified according to different criteria, namely the dish type, confection method, type of ingredient and the moment that honey was incorporated into the recipe. The results showed that the main dishes with meat and also bakery products were the ones that included more recipes with honey. The majority of the recipes involved cooking methods, with more relevance for roasting, grilling and baking. Moreover, honey was essentially used as a secondary ingredient, except for deserts and it was mostly incorporated in the beginning. The most relevant nutrients that were combined with honey were flour, bread, onion, salmon, chicken, butter, cheese, egg, milk, lemon, pepper, garlic, olive oil, sugar and salt. This work showed that honey has a wide range of applications as an ingredient in gastronomic preparations.

**Keywords:** Honey, recipe, gastronomy, ingredient.

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### Introduction

Honey is a sweet flavorful liquid produced from the floral nectar by *Apis mellifera* L. (a unique specie of honeybee) (Nikhat & Fazil, 2022; Zafar et al., 2020). This natural product is used by humankind since ancient

times for different purposes, whether in the area of nutrition or medicine (Arawwawala & Hewageegana, 2017; Ramli et al., 2021). Regarding its chemical composition, honey is composed by approximately 200 substances, being characterized by a complex mixture of sugars, mainly fructose (to 40%) and glucose (to 35%), water (17-20%) and a minor concentration of other components, such as proteins, minerals, vitamins, phenolic acids, flavonoids, organic acids, enzymes, aromatic compounds, pigments, waxes, pollen grains and other phytochemicals (Fernandes et al., 2021; Nguyen et al., 2019; Zarei et al., 2019). Due to its characteristics, honey consumption is associated with different nutritional and biological benefits, such as antimicrobial, antioxidant, antiviral, anti-parasitic, anti-inflammatory, anti-mutagenic, anticancer and immunosuppressive effects (Alvarez-Suarez et al., 2010; Samborska, 2019). Like all products of natural origin, honey physicochemical properties are dependent on the climate conditions, harvest and post-harvest techniques and also the botanical and geographical origin (Escuredo & Seijo, 2019). Furthermore, honey's quality is also influenced by the bees' species (Zarei et al., 2019).

Worldwide, in 2021, the average annual production of honey was approximately 1.77 million metric tons, with China being the biggest producer, followed by Turkey and Canada (Shahbandeh, 2023). Nowadays consumers choose food based not only in its organoleptic characteristics, but also in its nutritional value and potential health benefits. For that reason, due to its characteristics and associated health benefits, honey consumption has increased among the consumers in recent years (Šedík et al., 2022). Honey is usually consumed as food or can be incorporated as an ingredient in various food recipes (Guiné et al., 2022). In fact, honey is frequently used as an alternative to sugar in sweet products (Patrignani et al., 2022). Furthermore, honey it is also used to produce alcoholic and non-alcoholic beverages, being mead, for example, a traditional alcoholic drink based on honey (Dantas et al., 2021; Starowicz & Granvogl, 2020). In addition, this natural product is still used as an antioxidant agent or for other foods, such as for example meat (Antony et al., 2000; Johnston et al., 2005; Nor Hasyimah et al., 2022). This work aimed to study the potential of the incorporation of honey as an ingredient in different recipes. For that purpose, the recipes were analysed according to different parameters, namely the dish type, confection method, which includes cooking time, type of ingredient or the moment of incorporation into the culinary preparation.

## **Materials and Methods**

### **Data Collection**

The 150 recipes including honey used for this work were randomly selected from online internet cooking sites or from printed culinary books, and they were based on the diversity usage of honey.

### **Data Analysis**

The classification of the recipes was performed according to the variables described in Table 1.



Table 1. Variables used for the classification of the honey recipes.

Variable	Description
Dish type	Soup/Starter Breakfast/Tea Snack Main dish – Fish, meat, vegetarian, others (shellfish, pizza, ...) Desert Bakery/Cookies Other types of dish (toppings, sauces, ...)
Cooking	Yes or No
Cooking method	Boiling Roasting Baking Grilling Frying Other cooking methods
Cooking time	Short – up to 10 min. Medium – between 10 and 30 min Long – over 30 min
Moment of incorporation of the honey	Beginning Middle End
Role of the honey	Primary or Secondary ingredient

As for the ingredients, they were classified according to two different criteria, as follows:

- Food groups (Cereals, Dairy & Eggs, Fish, Fruits, Herbs, Meat, Nuts & Dried Fruits, Oils & Drinks, Sauces, Shellfish, Spices, Vegetables & Legumes, Others)
- Relevance of the ingredients in the recipe (Major Ingredients, Complementary Ingredients, Minor Ingredients).

For the explanatory analysis of the data there were used different basic descriptive statistical tools.

## Results

### Recipes Characterization

As it can be observed in Figure 1, the main dishes with meat and also bakery products & cookies (n=21 in both cases) are the ones with more recipes that included honey. On the contrary, the number of recipes for other dishes (n=8) and for vegetarian dishes (n=14) is lower when compared to the other main dishes. The majority of

the recipes involved cooking (n=123), being roasting (n=30), grilling (n=25) and baking (n=11) the cooking methods most frequently used. As for the cooking time, 49 recipes have a cooking time from 10 to 30 minutes, 40 recipes take up to 10 minutes to be cooked and 34 recipes have a cooking time over than 30 minutes. In most of the recipes (n=94), honey is a secondary ingredient, being the principal ingredient in 56 recipes. In the majority of the recipes (n=84) honey was incorporated in the beginning, in 38 of them was added in the middle and 28 of the recipes incorporated in the end.

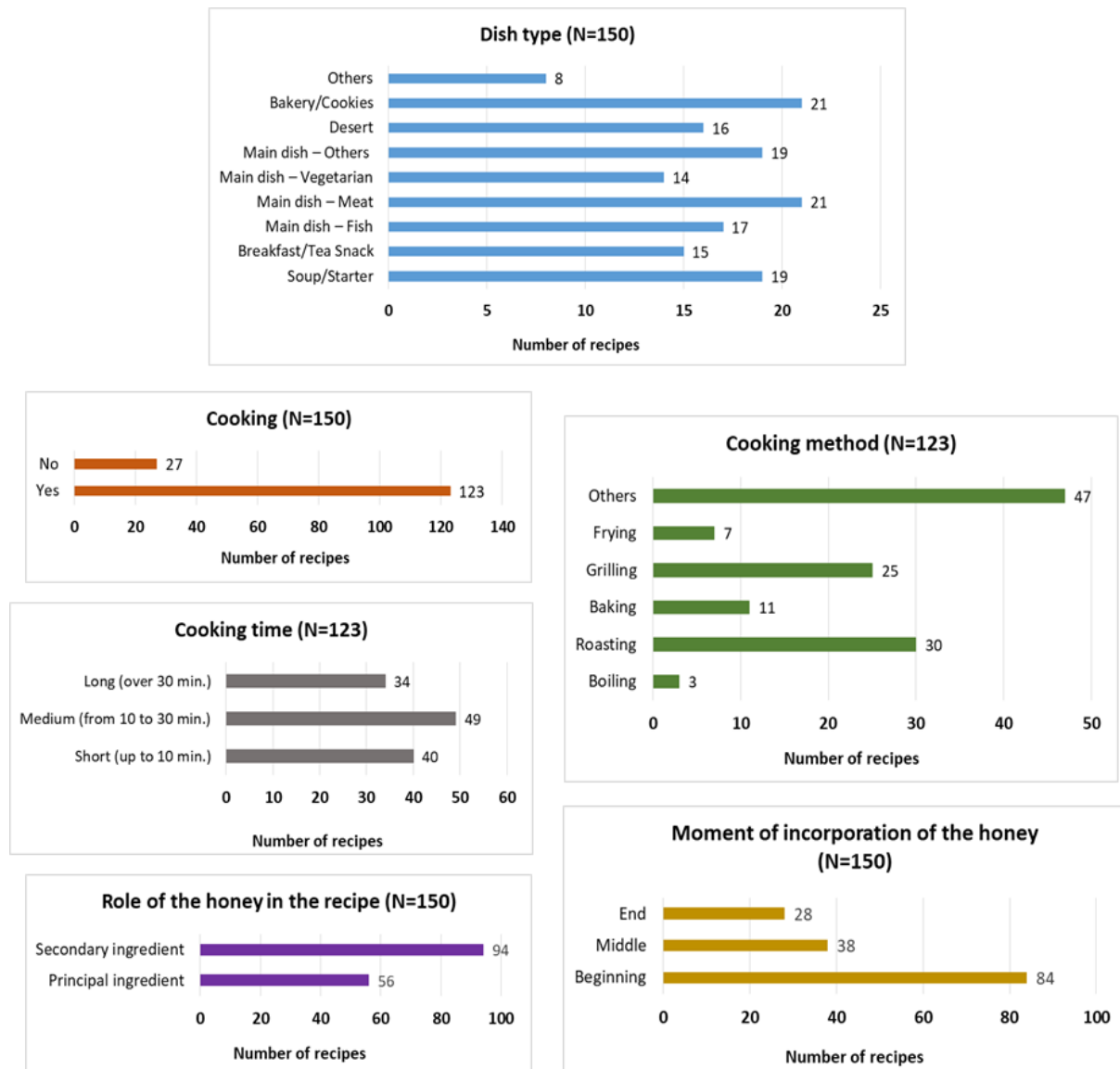


Figure 1. Classification of the recipes with honey under study.

### Ingredients Characterization

For the 150 recipes analyzed all of the ingredients (N=1112), except honey, were classified according to the two criteria defined:

- 1) By food groups: Cereals, Dairy & Eggs, Fish, Fruits, Herbs, Meat, Nuts & Dried Fruits, Oils & Drinks, Sauces, Shellfish, Spices, Vegetables & Legumes and Others;
- 2) By relevance of the ingredients in the recipe: Major Ingredients, Complementary Ingredients, and Minor Ingredients.

As it can be observed in Figure 2, the highest number of ingredients (n=198) were in the spices category, followed by dairy & eggs (n=133) and finally shellfish (n=16).

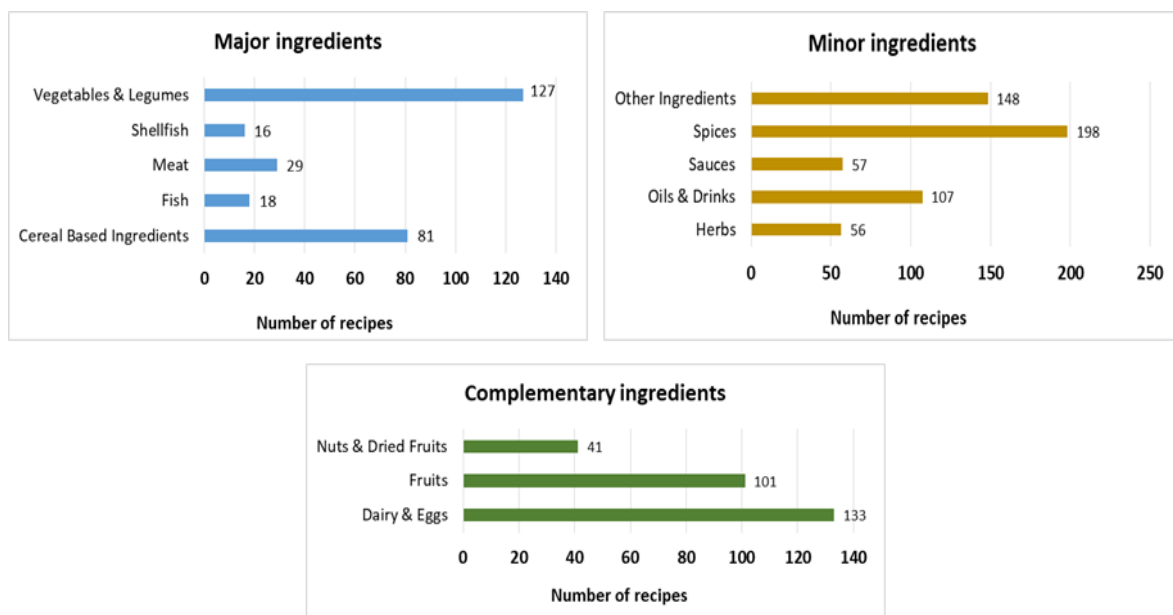


Figure 2. Classification of the ingredients according to the categories defined.

Table 2 shows the recipe count of the major ingredients according to the food groups and for that count were included the ingredients that appeared in at least two different recipes. Cereal and based ingredients were included in a high number of recipes, being flour (n=26) and bread (n=16) the most relevant ingredients. As for the fish group, only salmon (n=11) and sea bass (n=2) were included in at least two recipes. With respect to the meat group, both chicken and pork are present in a total of 9 recipes, followed by ham or bacon (n=5) and finally beef (n=3). Regarding shellfish, shrimp (n=7) was the ingredient most used in the recipes, followed by mussels (n = 3) and finally lobster and crabmeat (n = 2 for both).

Table 2. Number of recipes of the major ingredients according to the food groups.

Groups	Ingredients	Number of recipes
Cereal Based Ingredients	Flour	26
	Bread	16
	Oat	8
	Sesame	7

	Cornstarch	6
	Rice	3
	Wheat	2
	Flaxseed	2
	Chia seed	2
	Arrowroot starch	2
Fish	Salmon	11
	Sea bass	2
Meat	Chicken	9
	Pork	9
	Bacon/Ham	5
	Beef	3
Shellfish	Shrimps	7
	Mussels	3
	Lobster	2
	Crabmeat	2

With respect to the group of vegetables & legumes, there are 21 ingredients included in this group that appeared in the recipes more than once, with onion appearing in a higher number of recipes (n=30), being tomato the second most relevant ingredient (n=9).

Table 2 (Cont.). Number of recipes of the major ingredients according to the food groups.

Groups	Ingredients	Number of recipes
Vegetables & Legumes	Onion	30
	Tomato	9
	Carrot	8
	Shallot	6
	Tofu	5
	Scallion	5
	Bell pepper	5
	Arugula	4
	Vegetables	3
	Spinach	3
	Potato	3
	Pea	3
	Cucumber	3
	Brussel Sprouts	3

Broccoli	3
Pumpkin	2
Miso	2
Lentil	2
Cauliflower	2
Bean	2
Asparagus	2

Table 3 shows the number of recipes that include each of the ingredients, according to the complementary groups. As for the fruits group, the ingredient that appeared in a higher number of recipes were lemon (n=20), orange (n=12) or lime (n=8), or their juices. Nuts and dried fruits also appeared in some recipes more than once, with particularly relevance for almonds (n=9) and walnuts (n=6). Dairy and eggs are present in a higher number of recipes, with butter being present in 38 recipes, cheese in 27 and eggs in 25 recipes.

Table 3. Number of recipes of the complementary ingredients according to the food groups.

Groups	Ingredients	Number of recipes
Fruits	Lemon	20
	Orange	12
	Lime	8
	Lemon juice	8
	Lime juice	7
	Cocconut	6
	Orange juice	5
	Banana	5
	Apple	5
	Pear	4
	Peach	3
	Nectarine	3
	Mango	2
	Fig	2
Berries	2	
Nuts & Dried Fruits	Almonds	9
	Wwalnuts	6
	Raisins	4
	Pistachios	3
	Dates	3
	Cashew nuts	3

	Pecan nuts	2
	Chestnut	2
	Peanuts	3
	Peanut butter	4
Dairy & Eggs	Egg	25
	Egg yolk	5
	Egg white	2
	Butter	38
	Cheese	27
	Milk	15
	Cream	9
	Yogurt	8
	Condensed milk	2

As it can be observed in Table 4, parsley (n=12) and coriander (n=10) were the most frequently herbs used in the recipes. Spices were present in a higher number of recipes, highlighting the presence of pepper in 57 recipes and garlic in 48. With respect to sauces, soy sauce (n= 20) was the most relevant ingredient in this group. The most used oils and drinks were olive oil (n=43) and vinegar (n=22). Regarding the other ingredients, salt and sugar were the most used, in 81 and 28 recipes, respectively.

Table 4. Number of recipes of the minor ingredients according to the food groups.

Groups	Ingredients	Number of recipes
Herbs	Parsley	12
	Coriander	10
	Thyme	7
	Rosemary	6
	Chives	4
	Oregano	3
	Bay	3
	Basil	3
	Sage	2
	Mint	2
Spices	Pepper	54
	Garlic	48
	Mustard	18
	Ginger	18
	Cinnamon	15

Vanila	11
Chilli	9
Paprika	7
Cumin	6
Jalapeno	4
Nutmeg	3
Cloves	2

Table 4 (Cont.). Number of recipes of the minor ingredients according to the food groups.

Groups	Ingredients	Number of recipes
Oils & Drinks	Olive oil	43
	Vinegar	22
	Oil	20
	Lemon juice	8
	Sesame oil	9
	Lime juice	7
	Wine	6
	Orange juice	4
	Canola oil	3
	Coconut oil	2
Sauces	Soy sauce	20
	Hot sauce	7
	Tamari	4
	Worcestershire sauce	3
	Ketchup	3
	Barbecue sauce	3
	Oyster sauce	2
	Italian seasoning	2
	Hoisin sauce	2
	Chipotle sauce	2
Other ingredients	Salt	81
	Sugar	28
	Baking soda	12
	Baking powder	10
	Chocolate	8
	Yeast	4
	Cocoa	3

## Discussion

Honey is the first sweetener used by humankind and biological people are programmed to like sweetness (Linford, 2018). Nowadays, honey is still used in many cuisines worldwide, in which is included the Mediterranean cuisine (Raguž, 2017). In fact, honey has different applications in food industry, and can be used not only has a sweetener, but also as a food preservative, spice or even marinade (Gündoğdu et al., 2019; Raguž, 2017).

There are different recipes including honey and the search to find new culinary usages for this product continues, in order to improve the richness of aroma and flavor, as well as the nutritional composition of the dishes (Raguž, 2017). Honey is submitted to a heating procedure, such as boiling or even baking and then cooled, in some recipes. In order to minimize the undesirable effects of heating, this process must be done carefully (Alarcon, 2006).

Honey's characteristics are determined by its floral origin used to collect nectar by honeybee, as well as the geographical location and the climatic conditions of the region (Gündoğdu et al., 2019). These factors originate honeys with different flavours, which is reflected in the results of the recipes according to the type of honey incorporated. These differences are explored by chefs and mixologists in their creations (Alarcon, 2006).

## Conclusion

This work revealed interesting results about the multiplicity applications of honey for gastronomic purposes, not only for dishes like Deserts or Bakery/Cookies, but also to be used in Soups/Starters, Breakfast/Tea Snacks, Main Dishes with fish, meat, vegetarian or others. This natural product is generally used as a secondary ingredient, being incorporated into the recipes mostly in the beginning. Moreover, in the recipes, honey is combined with different ingredients, highlighting flour, bread, onion, salmon, chicken, butter, cheese, egg, milk, lemon, pepper, garlic, olive oil, sugar and salt.

## Recommendations

Based on the results revealed through this research, the results of this study can be used for all the professionals and general public that have interest in incorporate honey into different recipes, allowing them expand their knowledge about this subject.

## Notes

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# Validating the Drivers and Barriers of Circular Economy Implementation on the Indonesian Small Medium Enterprises in Food and Beverages Sector

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**Abstract:** In the implementation process of circular economy initiatives, many companies face several challenges in adopting the circular economy model in their business entirely. A suitable strategy is needed for a circular economy implementation. One of the ways to build the strategy is by understanding the circular economy implementation drivers and barriers. This work aims to identify the drivers and barriers of a circular economy implementation in Indonesian Food & Beverages (F&B) Small and Medium Enterprises (SMEs). The validation process starts through an extensive literature review and then employs a Modified Kappa method to examine the factors, incorporating experts from industry, non-governmental organizations (NGOs), academia, and government. The result shows eight drivers and fifteen barriers for the implementation of a circular economy in Indonesian F&B SMEs. These drivers and barriers are grouped into three dimensions, namely Economy, Social, and Environment. The output of this research might support the stakeholders in facing the issues regarding the feasibility of circular economy practices.

**Keywords:** Circular economy, Drivers and barriers, Food and beverages, Small medium enterprises

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## Introduction

Limited natural resources and an increasing world population threaten raw material scarcity and increased waste production in the world (Mathivathanan et al., 2022). According to The World Bank, the world population in 2021 will reach 7.84 billion people. Beside that, the amount of waste produced in the world will reach 2.24 billion tons in 2020 and is predicted to increase in 2050 to 3.88 billion tons (The World Bank, 2022).

A circular economy model emerges as a solution to minimize the scarcity of natural resources and restrain the

world's waste production (Khan et al., 2022). The circular economy itself can be defined as “an economic system that represents a change in people's perspective on interacting with the environment and aims to avoid resource scarcity, put energy and materials in a closed cycle, and facilitate sustainable development through the implementation of a circular economy at the micro (business and consumer), meso (stakeholder related to the economy), and macro (city, region, and government) level. The circular economy model calls for closed cycles and regenerative environmental innovation on how societies legislate, produce, and consume” (Prieto-Sandoval et al., 2018).

Implementing a circular economy in Small and Medium Enterprises (SMEs) has an essential role in this world because SMEs has a higher percentage of amount than big enterprise (Mura et al., 2020). SMEs dominate the world business by 90% and can employ half of the world's population (Dey et al., 2020). In Indonesia, there are 319.000 SMEs that employed 3,5 million workers in 2020 (Badan Pusat Statistik, 2022b, 2022a).

The implementation of a circular economy is difficult (Rizos et al., 2016) and requires a proper approach to ensure the continuity of the process (Gedam et al., 2021). Firms need to understand the drivers and barriers in their systems (Agyemang et al., 2019). The drivers of a circular economy adoption process are essential and must be identified to help the organization construct an effective and efficient implementation strategy (Khan et al., 2022). On the other hand, the barriers to a circular economy must be determined to find the proper enabler against the barriers. Hence, adopting a circular economy can be implemented without creating further problems (Khan et al., 2022).

BAPPENAS has identified five industry sectors that are prioritized to implement the circular economy concept. These sectors are the plastic, textile, electronic, construction, and food and beverage (F&B) industry (Bappenas et al., 2021). Previous studies focused on the drivers and barriers in Pakistanian manufacturing (Agyemang et al., 2019; Khan et al., 2022), and agriculture, textile, and F&B in India (Kumar et al., 2021; Mathivathanan et al., 2022; Mishra et al., 2022). These works mainly discuss big-scale businesses, and none focus on the drivers and barriers of implementing a circular economy in F&B SMEs.

The following research questions are suggested by this study to fulfill the research gap:

RQ1: What are the drivers of circular economy implementation in Indonesian SMEs in F&B sector?

RQ2: What are the barriers to circular economy implementation in Indonesian SMEs in F&B sector?

Hence, this study aims to identify the drivers and barriers of circular economy implementation in Indonesian F&B SMEs. In Indonesia, SMEs are classified into small and medium, and the two categories have a considerable financial and operational gap. Therefore, this study will focus more on medium-sized industries.

The remainder of this manuscript is organized as follows. Section II discusses the literature on a circular economy and the drivers and barriers to the circular economy implementation. Following that, section III discusses the methodology used in this research. Section IV discusses the results and discussion of this research.

The last section is the conclusions which consist of suggestions from the researcher.

## Literature Review

### Circular Economy

A circular economy is a regenerative system that uses resources repeatedly to impact the environment positively (Khan et al., 2022; Takacs et al., 2022). While the linear economy has the concept of “make-use-dispose”, the circular economy utilizes the reuse and replace concept for the resources rather than dispose of them (Gedam et al., 2021). A circular economy ensures minimizing waste production and benefits the environment by reducing resource consumption. A circular economy is implemented to achieve sustainable development through increased resource efficiency (Garcés-Ayerbe et al., 2019).

The circular economy model integrates all the 5R strategies, which consist of reduce, reuse, recycle, redesign, and repair to minimize resource consumption and ensure the resource or the product is still inside the closed loop so it can reduce waste production and environmental damage (Badhotiya et al., 2022; Chen et al., 2011; Delchet-Cochet, 2020; Garcés-Ayerbe et al., 2019; Khan et al., 2022). The circular economy concept separates economic growth from resource consumption and environmental loss through responsible resource use (Mathivathanan et al., 2022).

The circular economy has attracted many parties because it believes it can give economic, social, and environmental advantages (Bappenas et al., 2021; Garcés-Ayerbe et al., 2019). The government, organizations, non-governmental organizations (NGOs), and consultants have taken the initiative to adopt the circular economy, such as inventory optimization, environmental efficiency and effectivity, and reducing waste production (Khan et al., 2022). Despite the high presence of circular economy studies, the circular economy model implementation is still in the development stage (Takacs et al., 2022).

### Drivers of Circular Economy Implementation

One study identified the drivers and strategies of circular economy implementation in SMEs (Dey et al., 2020). This work concludes seven drivers of the circular economy implementation, including *Increased Image*, *Reduction of Cost*, *Business Development*, *Reduction of Emission*, *Productivity*, *Sustainability*, and *Social Well-Being*. Furthermore, several studies have analyzed the inter-relationship among drivers to the implementation of a circular economy in the manufacturing sectors (Agyemang et al., 2019; Khan et al., 2022). They analyze 15-17 driver factors in the paper, i.e., *Sustainable Business and Growth*, *Company's Social Responsibility*, *Government Encouragement*, and *Resource Efficiency*. Moreover, another study also analyzed the drivers of circular economy implementation in SMEs (Mathivathanan et al., 2022). They focused on ten driver factors which consist of *Circular Economy Awareness*, *High Financial Ability for the Circular Economy*, *Need for Business Resilience and Competitive Advantage*, *Increasing Population and Urbanization*, *the Rise of Raw*

*Material Consumption, Environmental Realization Among Consumers, Advanced Technology, Resource Efficiency, Product Design and Manufacturing, Consumer Perspective Towards Refurbished Products, and Social Responsibility and Ethics.*

In Indonesia, the government collaborated with the United Nations Development Programme (UNDP) and the Embassy of Denmark and successfully identified several drivers for implementing a circular economy (Bappenas et al., 2021). These driver factors are *Reducing Environmental Impact, Building Brand Reputation, Developing New Markets, Comply with Government Regulations, Less Charge of Natural Resources, Improving the Ability to Attract Investment/ Capital, Attracting, Retaining, and Engaging Workers, Minimizing Price Volatility of Resources, and Build Loyalty with The Customer Base.*

This study identified 15 factors from the literature review for further analysis. These factors are *Minimize Resource Cost* (Agyemang et al., 2019; Bappenas et al., 2021; Dey et al., 2020; Khan et al., 2022), *Incentives from the Government* (Mathivathanan et al., 2022), *Advanced Technology* (Agyemang et al., 2019; Khan et al., 2022; Mathivathanan et al., 2022), *Increased Profitability* (Agyemang et al., 2019; Khan et al., 2022), *Sustainable Growth and Business* (Agyemang et al., 2019; Dey et al., 2020; Khan et al., 2022), *Increased Investor Attention* (Bappenas et al., 2021), *Reduced Resource Volatility* (Bappenas et al., 2021), *Increased Company Reputation* (Bappenas et al., 2021; Dey et al., 2020), *Company Social Responsibility* (Agyemang et al., 2019; Khan et al., 2022; Mathivathanan et al., 2022), *Consumer Awareness Towards Environmental Issues* (Mathivathanan et al., 2022), *Government Encouragement* (Agyemang et al., 2019; Bappenas et al., 2021; Khan et al., 2022), *Business Resilience and Competitive Advantage* (Bappenas et al., 2021), *Increasing Population and Urbanization* (Mathivathanan et al., 2022), *Reduce Environmental Impact* (Bappenas et al., 2021; Dey et al., 2020), and *Reduce Resource Consumption* (Agyemang et al., 2019; Khan et al., 2022; Mathivathanan et al., 2022).

### **Barriers to Circular Economy Implementation**

Besides driver factors that can support organizations in implementing a circular economy, organizations must also be aware of the barriers they must face in adopting a circular economy. Several researchers have conducted studies that focused on the circular implementation barrier factors (Agyemang et al., 2019; Badhotiya et al., 2022; Bappenas et al., 2021; Chen et al., 2011; Dey et al., 2020; Garcés-Ayerbe et al., 2019; Gedam et al., 2021; Khan et al., 2022; Kumar et al., 2021; Rizos et al., 2016; Takacs et al., 2022).

Based on the literature review, two studies analyzed the barriers to implementing the circular economy in the Pakistanian manufacturing sector (Agyemang et al., 2019; Khan et al., 2022). Another study was also done to analyze the interrelationship among barrier factors in the SMEs (Takacs et al., 2022), prioritizing the barrier factor in the manufacturing sector (Badhotiya et al., 2022), identifying the barriers of industry 4.0 and circular economy in the agriculture supply chain (Kumar et al., 2021), analyzing the interrelationship among barrier factors in the textile industry (Chen et al., 2011), analyzing the interrelationship and prioritizing the barrier

factors in the F&B sectors (Gedam et al., 2021), identifying the behavior and barrier of a circular economy implementation (Garcés-Ayerbe et al., 2019), and identifying the barrier in the SMEs (Dey et al., 2020; Rizos et al., 2016).

We chose 20 barriers related to F&B SMEs from the literature review. These barriers are *Financial Limitations* (Bappenas et al., 2021; Dey et al., 2020; Gedam et al., 2021; Khan et al., 2022; Rizos et al., 2016), *Require High Investment* (Badhotiya et al., 2022; Garcés-Ayerbe et al., 2019; Gedam et al., 2021), *Limitation of Advanced Technology* (Badhotiya et al., 2022; Dey et al., 2020; Gedam et al., 2021; Khan et al., 2022; Takacs et al., 2022), *Limitation of Circular Potential and Supply Chain Design* (Gedam et al., 2021; Kumar et al., 2021; Takacs et al., 2022), *Limitation of Cold Chain and Packaging* (Bappenas et al., 2021; Kumar et al., 2021), *Limitation of Knowledge* (Badhotiya et al., 2022; Bappenas et al., 2021; Garcés-Ayerbe et al., 2019; Gedam et al., 2021; Khan et al., 2022; Kumar et al., 2021; Rizos et al., 2016; Takacs et al., 2022), *Focus on the Economic Issue* (Takacs et al., 2022), *Lack of Consumer and Organizational Awareness Towards the Environment* (Gedam et al., 2021; Kumar et al., 2021; Takacs et al., 2022), *Limitation of Skillful Workers* (Badhotiya et al., 2022; Dey et al., 2020; Garcés-Ayerbe et al., 2019; Gedam et al., 2021; Khan et al., 2022; Kumar et al., 2021; Rizos et al., 2016), *Lack of Encouragement and Incentive from the government* (Badhotiya et al., 2022; Kumar et al., 2021; Rizos et al., 2016), *Lack of Company's Commitment* (Badhotiya et al., 2022; Dey et al., 2020; Khan et al., 2022; Kumar et al., 2021; Rizos et al., 2016), *Lack of Supportive Regulation* (Badhotiya et al., 2022; Gedam et al., 2021; Khan et al., 2022; Kumar et al., 2021; Takacs et al., 2022), *Limitation of Reverse Logistics Infrastructure* (Masi et al., 2018), *Limitation of Collaboration* (Badhotiya et al., 2022; Gedam et al., 2021; Rizos et al., 2016; Takacs et al., 2022), *Limitation of Recycling Area* (Badhotiya et al., 2022), *Safety and Hygiene Issue* (Badhotiya et al., 2022), *Limitation of Reducing Gas Emission Scope* (Gedam et al., 2021), *Lack of Assurance of Environmental Safety* (Badhotiya et al., 2022), *Limitation of Food Waste Estimation Data* (Gedam et al., 2021), and *Complex Law, Administrative, and Permission* (Garcés-Ayerbe et al., 2019).

## Methodology

This study identified the drivers and barriers to the implementation of a circular economy in Indonesian F&B SMEs from the literature review. After that, we gathered seven experts from industry, NGOs, academia, and government to validate the identified drivers and barriers. The experts' lists can be seen in Table 1.

Experts A – C are operational managers in Indonesian F&B SMEs. Expert D is a co-founder of one NGO in Indonesia which focuses on environmental issues. Experts E and F are academia whose work focuses on circular economy fields in Indonesia. Lastly, expert G is a waste management director of one government institution in Indonesia.

The experts then validated the drivers and barriers by filling out a validation questionnaire. The scale used in the questionnaire is a Likert scale ranging from 1 to 4, indicating each factor's relevance (1 = not relevant, 2 = quite



relevant, 3 = relevant, and 4 = very relevant) (Polit et al., 2007). The expert who gives a score of 1 or 2 will be considered to disagree with the factor, and the expert who gives a score of 3 or 4 will be considered agreeing to the factor.

Table 1. List of Experts in the Validation Stage

Expert	Background	Experience
A	Industry	> 20 Years
B	Industry	15 – 20 Years
C	Industry	10 – 15 Years
D	NGO	10 – 15 Years
E	Academia	> 20 Years
F	Academia	5 – 10 Years
G	Government	15 – 20 Years

After the questionnaire was collected from the experts, we validated the drivers and barriers using the Modified Kappa. Experts highly recommend this statistic as an examining interrater agreement tool. The kappa statistic shows the percentage of an agreement after the chance agreement is removed (Wynd et al., 2003). The kappa coefficient computation produces better content validity results because it can eliminate random chance agreement (Shrotryia & Dhanda, 2019).

The kappa coefficient computation is done by counting the probability of chance agreement, which shows in the following formula (Shrotryia & Dhanda, 2019):

$$P_c = \left[ \frac{N!}{A!(N-A)!} \right] \times 0,5^N$$

After that, we calculate the kappa coefficient using the following formula (Shrotryia & Dhanda, 2019):

$$k = \frac{ICVI - P_c}{1 - P_c}$$

The ICVI variable is generated by (Kenanga & Ardi, 2022):

$$ICVI = \frac{\text{Total expert agreeing}}{\text{Total expert}}$$

The strength of agreement from the kappa coefficient is shown in Table 2. The acceptable kappa recommended by Gelfand and Hartmann (1975) has a kappa score  $\geq 0,60$  (Wynd et al., 2003).

Table 2. Acceptance Level from Kappa Statistic

Acceptance Level	Kappa Statistic
Poor	< 0,40
Fair	0,40 - 0,59
Good	0,60 - 0,74
Excellent	0,75 - 1,00

## Results and Discussion

Based on the Modified Kappa, it is obtained that there are eight drivers and fifteen barriers validated. All the validated drivers and barriers have an “Excellent” Strength of Agreement. The result of the Modified Kappa and the validated drivers can be seen in Table 3 and Table 4, and the barriers can be seen in Table 5 and Table 6.

### Modified Kappa Results and Validated Drivers

Table 3. Modified Kappa Result for Drivers

No	Factor	I-CVI	k*	Agreement
1	Minimize Resource Cost	0.5000	0.2727	POOR
2	Incentives from the Government	0.8333	0.8161	EXCELLENT
3	Advanced Technology	0.6667	0.5646	FAIR
4	Increased Profitability	0.5000	0.2727	POOR
5	Sustainable Growth and Business	1.0000	1.0000	EXCELLENT
6	Increased Investor Attention	0.8333	0.8161	EXCELLENT
7	Reduced Resource Volatility	0.3333	0.1293	POOR
8	Increased Company Reputation	0.8333	0.8161	EXCELLENT
9	Company Social Responsibility	1.0000	1.0000	EXCELLENT
10	Consumer Awareness Towards Environmental Issues	0.6667	0.5646	FAIR
11	Government Encouragement	0.8333	0.8161	EXCELLENT
12	Business Resilience and Competitive Advantage	0.6667	0.5646	FAIR
13	Increasing Population and Urbanization	0.6667	0.5646	FAIR
14	Reduce Environmental Impact	1.0000	1.0000	EXCELLENT
15	Reduce Resource Consumption	1.0000	1.0000	EXCELLENT

Table 4. List of Validated Driver Factors

Dimension	Factor
Economy	Incentives from the government
	Sustainable business and growth
	Increased investor attention
Social	Increased company reputation
	Company social responsibility
	Government encouragement
Environment	Reduce environmental impact
	Reduce resource consumption

A circular economy requires high investment to provide advanced technology and a skillful workforce.

Therefore, the organization needs to be supported by the government, such as incentives to support the organization's financial aspect (Mathivathanan et al., 2022). Moreover, implementing a circular economy can help businesses grow and sustain, supported by 11% of respondents in a previous study (Agyemang et al., 2019). Furthermore, the study by the Indonesian government shows that implementing a circular economy can attract more attention from an investor to invest in an organization which can drive the organization to implement the circular economy (Bappenas et al., 2021).

From the Social dimension, one study shows that adopting a circular economy can increase the company's reputation, such as a green image among consumers and stakeholders, which can drive the company to do so (Dey et al., 2020). Besides that, the company has a social responsibility, which can be done by adopting a circularity in their business (Agyemang et al., 2019). More importantly, a company needs the government's support to implement a circular economy (Bappenas et al., 2021).

From the Environment dimension, the circular economy is believed to have the ability to minimize the environmental impact by reducing waste production (Bappenas et al., 2021). In addition, the circular economy implementation is also believed can reduce resource consumption by recycling and reusing products into new resources (Agyemang et al., 2019).

### Modified Kappa Results and Validated Barriers

Implementing a circular economy requires high investment in conducting R&D and upgrading infrastructure and workforce to support the implementation process. The implementation process might not be successful if the organization has limited financial resources to invest in supporting infrastructure (Gedam et al., 2021). Furthermore, the circular economy model needs more advanced processes by advanced technology. If the company lacks advanced technology, implementing a circular economy might be difficult (Dey et al., 2020). Moreover, cold chain and packaging are essential in the F&B sector. Lack of cold chain and packaging, especially in developing countries, will lead to more food waste production, which contradicts the circular economy concept (Gedam et al., 2021). Additionally, a circular economy concept requires advanced knowledge, which can be obtained through formal or informal education, and employee training and learning (Badhotiya et al., 2022). On top of that, the implementation might be hindered by organizations focusing on economic rather than environmental issues (Takacs et al., 2022).

Table 5. Modified Kappa Result for Barriers

No	Factor	I-CVI	k*	Agreement
1	Financial Limitations	1.0000	1.0000	EXCELLENT
2	Require High Investment	1.0000	1.0000	EXCELLENT
3	Limitation of Advanced Technology	0.8333	0.8161	EXCELLENT
4	Limitation of Circular Potential and Supply Chain Design	0.6667	0.5646	FAIR

	www.icres.net	May 18-21, 2023	Cappadocia, Turkiye	www.istes.org
5	Limitation of Cold Chain and Packaging	0.8333	0.8161	EXCELLENT
6	Limitation of Knowledge	1.0000	1.0000	EXCELLENT
7	Focus on the Economic Issues	1.0000	1.0000	EXCELLENT
8	Lack of Consumer and Organizational Awareness Towards the Environment	0.8333	0.8161	EXCELLENT
9	Limitation of Skillful Workers	0.8333	0.8161	EXCELLENT
10	Lack of Encouragement and Incentive from the Government	0.8333	0.8161	EXCELLENT
11	Lack of Company's Commitment	1.0000	1.0000	EXCELLENT
12	Lack of Supportive Regulation	1.0000	1.0000	EXCELLENT
13	Limitation of Reverse Logistics Infrastructure	1.0000	1.0000	EXCELLENT
14	Limitation of Collaboration	0.8333	0.8161	EXCELLENT
15	Limitation of Recycling Area	0.5000	0.2727	POOR
16	Safety and Hygiene Issues	0.6667	0.5646	FAIR
17	Limitation of Reducing Gas Emission Scope	0.6667	0.5646	FAIR
18	Lack of Assurance of Environmental Safety	0.8333	0.8161	EXCELLENT
19	Limitation of Food Waste Estimation Data	0.6667	0.5646	FAIR
20	Complex Law, Administrative, and Permission	0.8333	0.8161	EXCELLENT

Table 6. List of Validated Barrier Factors

Dimension	Factor
Economy	Financial limitations
	Require high investment
	Limitation of advanced technology
	Limitation of cold chain and packaging
	Limitation of knowledge
	Focus on the economic issue
Social	Lack of consumer and organizational awareness towards the environment
	Limitation of skillful workers
	Lack of encouragement and incentive from the government
	Lack of company's commitment
	Lack of supportive regulation
	Limitation of reverse logistics infrastructure
	Limitation of collaboration
Environment	Lack of assurance of environmental safety
	Complex law, administrative, and permission

From the Social dimension, consumer and company awareness of the environment has a vital role in implementing the circular economy. The lack of awareness can lead to a strict circular economy implementation

(Gedam et al., 2021). Besides that, to implement a circular economy, the employee must know the technical know-how to do it effectively. Having a limited qualified workforce will hinder the implementation of the circular economy (Gedam et al., 2021). Furthermore, the majority of SMEs have limited financial resources. A lack of encouragement and incentive from the government will reduce the organization's initiative to implement the circular economy (Badhotiya et al., 2022).

Moreover, the lack of a company's commitment can hinder the circular economy implementation because it can lead to poor management expertise to adopt a circular economy (Badhotiya et al., 2022). Also, supportive government regulations such as policies, rules, regulations, and legislation are essential in implementing the circular economy. The organization's lack of government support can hinder the implementation process (Badhotiya et al., 2022). In addition, reverse logistics infrastructure is essential in the circular economy. The lack of reverse logistics infrastructure will limit the supply chain's material exchange (Masi et al., 2018). On top of that, the lack of a collaboration network can hinder the implementation of a circular economy because the core of a circular economy needs collaboration among stakeholders to adopt it (Gedam et al., 2021) effectively.

From the Environment dimension, the lack of assurance of environmental safety can hinder the implementation of a circular economy. The recycled or reused products might not be in safe and hygienic conditions for humans to consume (Badhotiya et al., 2022). Lastly, the complex law, administration, and permission also hinder the implementation of a circular economy. One study shows that organizations that already and have not implement a circular economy experience complex administrative or legal procedures to implement a circular economy (Garcés-Ayerbe et al., 2019).

## **Conclusion**

In conclusion, this study identifies the circular economy implementation drivers and barriers in Indonesian F&B SMEs. The drivers and barriers were collected from the literature review, which discusses the drivers and barriers of circular economy implementation in several industry sectors, including F&B. Through literature review and expert opinion, eight drivers and fifteen barriers were identified. Those drivers and barriers are classified into three dimensions, which consist of Economy, Social, and Environment.

## **Recommendations**

This study is limited to identifying the drivers and barriers of a circular economy implementation in Indonesian F&B SMEs using Modified Kappa technique to validate the identified factors. Future study is needed to analyze further and evaluate the drivers and barriers to know the interrelationship among factors and the priority level from all factors. Further research is also expected to construct an effective strategy to implement a circular economy in Indonesian F&B SMEs.

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## Policy Evaluation of Shipping Industry on CO2 Emission Production in Indonesia: A Causal Loop Analysis

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**Abstract:** As an archipelagic country with two-thirds of its territory consisting of water and in line with global trade, Indonesia has made the shipping sector an essential and strategic role in supporting national development by paying more attention to developing its maritime industry. The increasing need for shipping services will also increase the phenomenon of global warming. CO2 emissions from the marine transportation sector have become a concern for transport policymakers and climate change regarding sustainability issues, including CO2 emissions in ports which continue to increase due to their significant impact on emerging environmental, social, and economic issues. However, the existing studies focus primarily on CO2 emissions from shipping, with little attention to vessel berthing in ports and cargo handling in ports. This study takes the marine transportation sector in Indonesian Ports by using part of the System Dynamics methodology, Causal Loop Diagram Analysis on the production of CO2 emissions, to show the interrelationships between these factors. The purpose of this study is to propose a CO2 emission mitigation strategy and evaluate policies that have been implemented in the marine transportation sector. The results show a validated Causal Loop Diagram that can be used for dynamic system assessment under the scenario.

**Keywords:** Causal Loop Analysis, CO2 Emissions, Policy Scenario, Port Sustainability

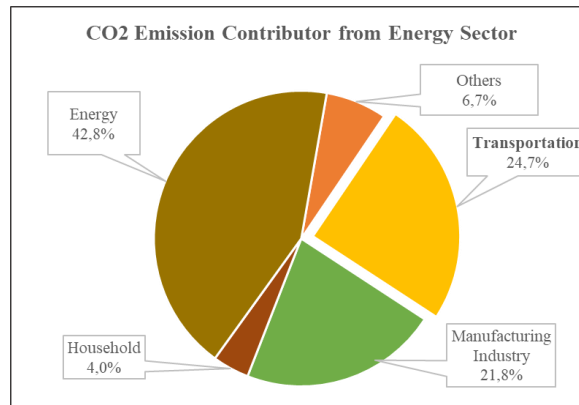
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### Introduction

The distribution of goods will rise in response to increased industrial activity. Whereas more than 90% of worldwide trade is conducted by sea, distribution by sea is the most affordable option compared to air or land (Kong et al., 2022). According to a study by the Ministry of Environment and Forestry, transportation is the second-largest source of carbon dioxide (CO2) emissions in the energy sector, after electricity production, as shown in Figure 1, which shows estimates of an inventory of CO2 emissions for 2019 (KLHK, 2020). The



higher the energy consumption, the higher the Greenhouse Gas (GHG) emissions. Sea transportation is a contributor to GHG emissions of 2.89 percent (Meng et al., 2022).



**Figure 11. CO2 Emission Contributor from Energy Sector**

(Source: KLHK (2020))

In sea transportation, two components have a vital role, namely, ships and ports. Ships are the largest source of emissions. According to Wang et al. (2023), port emissions are a small part of shipping emissions, accounting for around 3% of transportation emissions that ports release during production. As a form of commitment to reducing GHG emissions, in 2015, Indonesia signed the Paris Agreement. In this agreement, Indonesia agreed to reduce GHG emissions by 29% from BAU (Business As Usual) with national support in 2020 – 2030 and 41% with international assistance (ITF, 2018). These various commitments continue to be carried out in accordance with the targets set. One of these efforts is that Indonesia updated its Nationally Determined Contributions (NDC) document in July 2021. The document discusses the issue of shipping decarbonization and states that 19% of CO2 emissions come from shipping activities in Indonesia. These emissions come from the number and type of ships Indonesia owns (Kemenkomarves, 2022).

Through Presidential Regulation Number 59 of 2017 and decarbonization initiatives in the shipping industry in 2022, the Coordinating Ministry for Maritime Affairs and Fisheries is preparing to accelerate the spread of renewable energy and decarbonization in Indonesia. At sea, the efforts are to establish ports as one of the main actors in reducing emissions by applying environmentally friendly ports (green ports) by implementing zero carbon fuel for each ship's voyage. Most recently, at the SOE International Conference in the G20 series in 2022, the use of Onshore Power Supply (OPS) facilities at ports was signed, which is a land electricity service for ships carrying out loading and unloading activities at ports/terminals to replace the role of ship auxiliary engines, as steps to realize a green port to reduce CO2 emissions in the port sector (Kemenkomarves, 2022). In addition, in the shipping sector, Indonesia determines the use of low-sulfur fuel, which must be consumed by ships crossing Indonesian waters. Millions of tons of CO2 are emitted due to cargo fleet operations. Ports, the main hub of transportation for the shipping sector, play a crucial role in the economy and are strongly linked to expanding maritime freight. However, further study is required on the emissions generated in ports, notably in Indonesia. Understanding how the shipping industry operates and analyzing the evaluation of policy

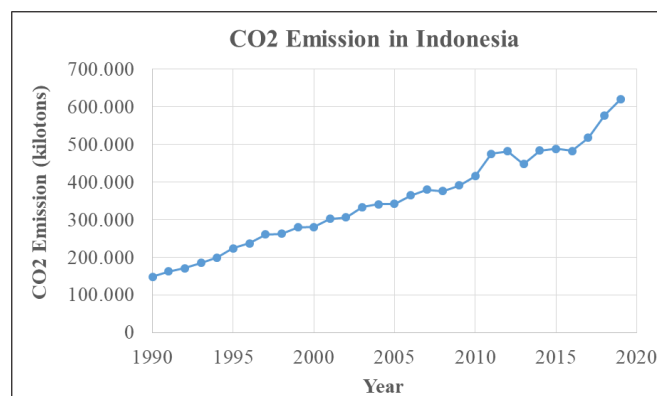
interventions are necessary if one wants to get insight into how to reduce the production of CO<sub>2</sub> emissions in this sector. Understanding the system's structure and the causal connections between the variables that make it up requires a systems perspective.

In order to evaluate the feasibility of current strategies that improve port sustainability, this study aims to investigate the dynamics of sustainable ports. The policy analysis framework (Thissen & Walker, 2013) and system dynamics approach (Sterman, 2000; Moeis et al., 2020) are used to simulate the sustainability of the port system and examine how it impacts the economy, society, and environment. Implementing the Onshore Power System (OPS) and the carbon tax will be evaluated because of their potency in lowering air pollution and moderating the generation of CO<sub>2</sub> emissions. This research contributes to the knowledge of maritime logistics and sustainable development.

**Literature Review**

The authors conducted a literature review for several articles on this research topic. The purpose of the literature review is to gain in-depth knowledge of the research topic, learn more about the discussion of relevant topics in the research conducted, and find research gaps and research positions. Research about the CO<sub>2</sub> Emission Production in Indonesia is still limited due to its timeliness compared to other topics.

The shipping sector is an important part of global trade, and the increasing need for shipping services will increase the phenomenon of global warming. Global CO<sub>2</sub> emissions have increased by 1.9% in 2019 compared to 2018 (Cahyono et al., 2022). This increase was consistent with the 2018 global economic boom, which showed an increase to an average annual growth rate of 3.5% since 2012. Changes in per capita GDP and the energy intensity of transportation are the key contributors to the rise in CO<sub>2</sub> emissions in Asia, including Indonesia. The IPCC report states that global warming caused by industry increases the earth's temperature by 0.87% and will rise to 1.50C every year between 2032 - 2052. In 2019, Indonesia alone contributed 619,841 kilotons of CO<sub>2</sub>.



**Figure 12. CO2 Emission in Indonesia**  
(Source: data.worldbank.org (2022))

0According to the Coordinating Ministry for Maritime Affairs and Fisheries, Indonesia's fleet currently numbers 39,510 cargo ships. It has 3,089 ports managed by PT Pelabuhan Indonesia, the Ministry of Transportation, and special terminals for private interests (Kemenkomarves, 2022). Because Indonesia has many international and domestic ports, many emissions must be generated (Huzaifi et al., 2020). Indonesia needs to implement the concept of green (low-emission) ports and evaluate the emissions from ships and ports. To realize this long-term objective, cooperation, sincerity, and consistency in policy are required.

Previous studies that evaluated the reduction of CO<sub>2</sub> emission production and its mitigation were carried out in industrialized nations like the United States, South Korea, Japan, and China. One is at the Taipei port to estimate container emissions and then determine the most efficient path for the container. Another study on emission calculations is among them. Then calculations were done on each activity's ship speed, and distance traveled, and energy consumption in Busan, Korea. Additionally, that research considers all active ship types and other port-related equipment, which will be examined to see whether emissions can be reduced (Liao et al., 2010; Shin & Cheong, 2011; Sim, 2018).

After conducting a literature review, the gap in research is determined from the studies that have been reviewed to determine the position of this research. Gaps from previous studies found that many studies focused on the shipping industry, both ports and ships. However, not many studies have evaluated policies on reducing CO<sub>2</sub> emission production using a dynamic system with case studies of the shipping industry in Indonesia. System dynamics is used in the analysis of complex systems. Since the study conducted here aims to offer recommendations for the government on port development alternatives that support sustainability, a system dynamics analysis that can consider a system's dynamics is necessary. The approach also attempts to provide modeling to address policy uncertainty (Pruyt, 2013). The present research is being done continuously. Modeling of CO<sub>2</sub> emission reduction needs to be done because the system is complex, and the many variables involved and influencing each other are difficult to study directly.

## Method

In this study, the conceptual model as a component of the System Dynamics model is described using a Causal Loop Diagram (CLD). However, the scope of this study is restricted to model conceptualization, the first stage of the System Dynamics approach. The conceptualization of the model presents the overall picture of the subjects covered, such as the identification of stakeholders, the characterization of the problem and statement of objectives, the variables in the form of a CLD, and the policy interventions and scenarios for it.

Conceptualization of the model begins with defining the problem by determining the research topic based on the author's observations. The issue of problems with increasing production of CO<sub>2</sub> emissions is the focus of this observation. Then a literature study was carried out to understand the topic and find research gaps to decide on the position of this research. The Input-Process-Output (IPO) model is used to conceptualize the model in this

study. It consists of several factors that show a causal relationship with the generation of CO2 emissions at ports: inputs are the variables that will be utilized as separate inputs for the model, and processes are the elements and their interactions in the CLD system. The simulation results' dependent variable is the output. Multiple experts must authenticate the CLD to reflect real-world conditions accurately.

## Results and Discussion

The conceptualization of the shipping industry model in port operations is presented in several stages. The data used to build the model results from literature studies and interviews with port experts. Therefore, several scenarios are applied to find the most appropriate strategy for reducing CO2 emission production.

### System Diagram

The system diagram, as shown in Figure 13, is used to help understand the system's complexity under study by providing the overall model concept. The system diagram contains the following components: the problem owner, the objectives of the system being reviewed, stakeholders, strategies that the problem owner can apply to the system being reviewed, external variables that affect the system, the processes that occur in the system, namely for dynamic system modelling causal loop diagrams are used to determine the factors that influence each other in the system, and the output indicators of the system under review determine whether the objectives of the model are achieved or not.

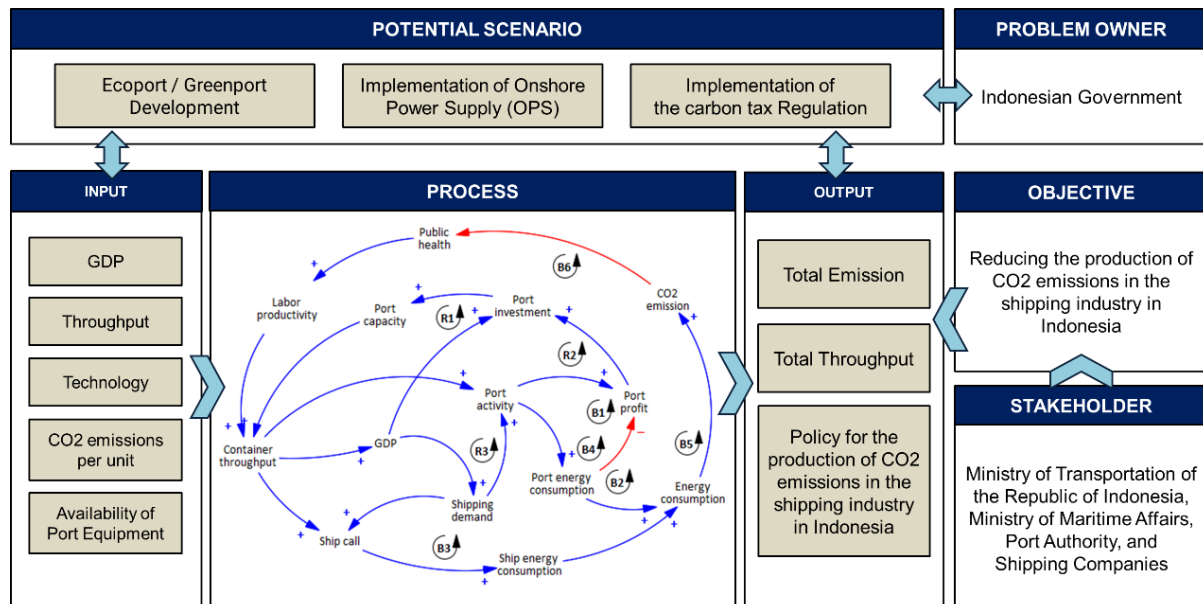


Figure 13. Model Conceptualization

A conceptualization model for applying shipping sector rules in port operations is being developed by the problem's owner, the Indonesian government, with the aim of better understanding how implementing policies

will affect the country's production of CO2 emissions. For the model conceptualization to be utilized in Indonesia, the chosen stakeholders are the key decision-makers and industry actors. As policymakers, the Ministry of Transportation, the Directorate of Sea Transportation, and the Ministry of Maritime Affairs are additional stakeholders in this issue. Port operators, who organize the policy, and shipping corporations, who carry out the policy's impact, are additional stakeholders.

This model consists of input, process, and output. The author needs data such as GDP growth rates, port throughput, emission factors, and port capacity. From the model designed and simulated, the author will get the total throughput and total emissions as output to achieve the goal of reducing the shipping industry's CO2 emission production at port operations. The author will apply a potential scenario of implementing green ports in the model: Onshore Power Supply (OPS) and carbon tax.

**Causal Loop Diagram**

The CLD describes the relationship of a system. The author combines reference models belonging to Li et al., (2019), Kong et al., (2022), and Moeis et al., (2020) which have been adapted to the context of CO2 emission production and also the operational situation of ports in Indonesia. The relationship of all variables is explained by arrows indicating the causal influence between variables. Each arrow is given a polarity, either positive (+) or negative (-), depending on the interaction between variables. The causal loop diagram was made with Vensim software and can be seen in Figure 14.

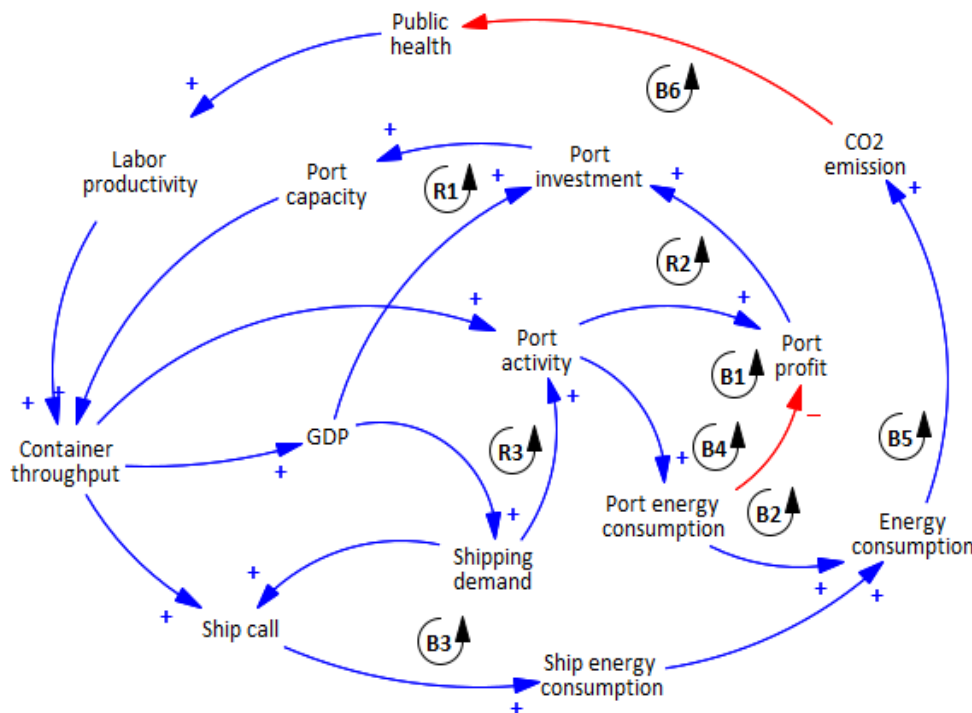


Figure 14. Causal Loop Diagram

The model has 9 (nine) causality loops: six balancing and three reinforcing. Output indicators to be used are Indonesia's GDP, container throughput, a number ships visiting the port, and energy consumption of ships at ports, to determine whether the model achieves the CO<sub>2</sub> emission reduction parameters as desired. This paper reviews the sources of CO<sub>2</sub> emission production, namely the amount of energy consumption. Energy consumption comes from energy consumption generated by ships at ports and energy consumption resulting from operational activities at ports. The use of proper equipment and fuel will reduce the production of CO<sub>2</sub> emissions produced by a port. In the case of port operations, the energy consumption generated by ships depends on the number of ships and the length of time they berthing at the port. Apart from ships, energy consumption is also generated by fuel in loading and unloading equipment at a port which depends on port throughput.

R1, R2, R3, B1 and B4 represent the economic and social loops. GDP, shipping demand, and port activity volume are the variables in these loops, which have positive polarity in loops R1, R2, and R3. According to Callen (1999), this relationship uses the total final use of commodities and services, as measured in buyer prices, which includes total consumption, investment, government spending, and exports. For this relationship, the theory that states that as GDP rises, so too will shipping demand makes sense. Additionally, port activity grows along with an increase in demand. The relationship between rising GDP and port activity is shown by loops B1 and B4, which will result in higher energy consumption and decreased port profits.

The environmental loop, B2, B3, B5, and B6, consists of demand for goods, port activities, energy consumption, and production of CO<sub>2</sub> emissions. This is built from the hypothesis that increased activity will support the acceleration of CO<sub>2</sub> emission pollution. A variety of fuels are used in the port's operations. Hence, when energy usage rises, it also increases the demand for fuel. Increased fuel use will result in greater emissions with various emission variables. Increased emissions from this will adversely affect the environment near the port and may raise awareness of adopting green energy (supporting sustainable energy).

## Scenarios

After knowing the production flow of CO<sub>2</sub> emissions at the port and the relationship between the variables that influence each other, the authors designed two scenarios to reduce the amount of CO<sub>2</sub> emission production.

### 1) *Application of Onshore Power Supply (OPS)*

OPS allows electricity to be channeled to the berths so that a ship does not need to turn on its engine, which produces high emissions in the port. The application of OPS can reduce CO<sub>2</sub> emissions by more than 30%, nitrogen oxides and other exhaust gases by more than 95% and eliminate pollution (Gibbs et al., 2013; Styhre et al., 2017). In addition, implementing this policy also follows the Indonesian Government's commitment based on the Minister of Transportation No Decree 201 of 2013 concerning the Stipulation of the National Action Plan for Reducing Greenhouse Gas Emissions in the Transportation Sector and the Transportation Sector GHG Inventory, namely Port operational management efficiency.

## 2) Application of Carbon Tax

The application of a carbon tax, namely by giving a price to carbon emissions, can impact various countries with a maritime sector. A carbon tax is a pricing on emissions produced by increasing the price of energy consumption, which reflects its social costs. Several countries that have implemented carbon taxes include Norway, with a reduction in carbon emissions of 2.3%, Japan, can reduce carbon emissions by 8.2% in 2013 – 2018; and Finland, Denmark, the Netherlands and Sweden can reduce carbon emissions by 1, 5% - 6% (Rojon et al., 2021; Parry et al., 2018).

## Conclusion

The production of CO<sub>2</sub> emissions is a problem that still has much potential to find a solution. The goal of this study is to create a conceptual model that gives a clearer understanding of the factors that contribute to reducing CO<sub>2</sub> emission production and may be used as a benchmark for future research. The CLD, created using step one of the System Dynamics technique, is at the center of the conceptual model. Nine loops focus on energy consumption, throughput growth, and environmental impact. Production CO<sub>2</sub> emissions cannot be eliminated, but the amount can be reduced. From the conceptual model, the key variables supporting emission handling in Indonesia are part of implementing the green port. This paper proposes two strategic scenarios expected to reduce CO<sub>2</sub> emission production significantly. The government must formulate different policies to mitigate environmental pollution in the shipping industry, which requires stakeholder collaboration.

## Recommendations

A valid model conceptualization can support the following modeling stage. The next step in this research is to design stock and flow diagrams based on CLD and perform simulations to assess detailed quantitative and qualitative analyses while examining policies. Additionally, more relevant data must be collected to be verified and validated, affecting the simulation outcomes.

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## Developing Supply Chain Resilience Strategy for Logistics Service Provider Industry in Indonesia

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**Abstract:** Globalization in an increasingly advanced era without any restrictions on movement has encouraged the movement of goods. The development of the movement of goods encourages growth in demand for logistics services activities. Among the growing business fields in Indonesia, the logistics services industry has the highest growth opportunity among other business fields. At the same time, developments in business processes have the potential to be in a state of uncertainty and increase the risk of disruption. Hence, logistics service industry companies need a resilient supply chain strategy to help companies survive all possible risks that can harm the company. This study aims to develop a relevant supply chain resilience strategy for the logistics services industry in Indonesia. The data is taken from the literature review to obtain an initial shortlist of existing supply chain resilience strategies. Then strategies were assessed and validated by six logistic experts from industry, industry associations, and academic. Next, the scores were analyzed using the item-content validity index (I-CVI) and the modified kappa (K) statistic. From this study, 16 strategies have been validated and furthermore could be used by the logistics service industry to achieve their supply chain resilience system.

**Keywords:** Supply Chain Resilience Strategy, Logistics Service Provider, Content Validity Index, Kappa Analysis

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### Introduction

Developments in global production have increased the complexity of supply chains and strengthened the notion of strategic logistics as the implementation of business strategy elements, where logistics is a major component of the manufacturing system (Mehami et al., 2018). One of the most important logistics activities in the supply chain network is to meet the transportation needs of various products and various suppliers; the intermediary between the different supply chain members is played by the logistics service provider (Kucukaltan et al., 2022).

The growth in logistics service activities caused by increased demand, and then causing the movement of goods to increase. According to data on BPS (2022), the volume of movement of exported and imported goods in Indonesia from 2016 to 2022 has increased even though it experienced a decline in 2020. In addition, the growth in Gross Domestic Product (GDP) for transportation and warehousing jobs was the highest, reaching 15.79%, where transportation and warehousing are one of the logistics activities (BPS, 2022b).

The complexity of the supply chain network can reach 20 to 30 actors involved in one transaction (Arif & Jawab, 2018). But on the other hand, the company will focus more on the core business and establish partnerships with outsourced operating processes beyond the company's expertise. Logistics Service Provider (LSP) can provide benefits in terms of spending costs and maintaining operational processes in the supply chain by using the latest technological knowledge (Kucukaltan et al., 2022). According to Arif & Jawab (2018), the logistics service industry based on the outsourcing logistics model has four types, namely, Basic Services, Third-party Logistics Provider (3PL), Lead Logistics Provider (LLP), and Fourth-party Logistics Provider (4PL), each model has its characteristics, one or other based on the services offered from Basic Services are transportation, warehousing, etc., and the services offered will be increasingly more sophisticated respectively up to 4PL, such as integration supply chain.

According to presidential regulation of Indonesia number 26 of 2012, logistics service providers in Indonesia are dominated by shipping and freight forwarding with a total organization of 81.88%, and serving logistics service activities as much as 38.05%. While other service providers, such as shipping services serve logistics activities as much as 43.83%, warehousing 3.83%, courier 3.28%, and containers, packaging, land transportation and storage are below 3%. These logistics activities keep growing since there is a large number of various industrial sector that outsourcing their logistics. Companies in the 3PL sector were able to offer sophisticated logistics solutions on a continental or even global scale. By increasing their scale and breadth of operations, these LSPs aim to play a more strategic role in their clients' supply chains (Selviaridis & Spring, 2007). The term "3PL" typically refers to providing various bundled services instead of merely discrete transport or warehousing operations. Instead of spot purchases of logistical services, modern 3PL agreements are based on formal (short-term and long-term) contractual relationships.

Business processes to survive must always evolve. However, these developments will add risks to business activities. Risk will increase uncertainty through new product development, customer demand, geographical location or business strategy (Sheffi, 2015). Logistics performance is a part of supply risk which has an external position in the company but is internal to the supply chain network. Poor logistical performance is one of the causes of supply chain risk (Shekarian & Parast, 2021). The supply chain needs to be very reliable to help logistics service provider companies survive all possible risks that can harm the company. The benefit of building a corporate resilience strategy is an initial step to adapt to changes in the operating function to increase competitive ability, where avoiding damage can be done by evaluating the stages in the supply chain network (Sheffi, 2015).

The dynamic phase of disruption of SCR operations is based on the time sequence if a disruption occurs, namely readiness, response, recovery, and renewal (Song et al., 2022). Detection, prevention, and response are part of investing in risk management and resilience. Serves to reduce the duration and magnitude of the disruption. Hence, the supply chain system can detect risks as quickly as possible and provide added value to the company (Sheffi, 2015). The complexity of the supply chain resilience system makes it unable to be assessed with usual risk management assessments, due to unpredictable long-term disruption impact factors. Thus, in this context, it is very important to understand the various sources of uncertainty and the best strategic response for a company in a dynamic environment (Gunasekaran et al., 2015). A supply chain resilience strategy is the capacity of a company or business entity to survive, adapt, and grow in the face of turbulent changes (Isti'anah et al., 2021).

SCR is an adaptive capability that 3PLs can use to plan for unforeseen events, react to disturbances, and recover from them by ensuring business continuity. This capability involves handling, adjusting, and responding to supply chain disturbances. Given the complexity of their supply chain network and the unpredictability of the market, 3PLs must deal with operational issues brought on by inclement weather, disrupted or backed-up transportation networks, equipment failures or subpar service from logistics partners, among other things. They have to think about when a disruption might happen and how long things might take to return to normal. Therefore, this study aims to develop a supply chain resilience strategy in the Indonesian third-party logistics services industry. This study will discuss the element strategies that are relevance for 3PL supply chain resilience in Indonesia.

## **Method**

### **Strategy Development**

In this study, the existing literature review was carried out concerning the strategy of implementing supply chain resilience systems. This study's main objective is to identify relevant strategies for third-party logistics service supply chain resilience in Indonesia. Research methodology used in this study by incorporating several steps. The first step involves carrying out a study relating to the issues covered in this study, outlining the context of the issues, formulating the problems, setting research goals, and conducting a preliminary literature assessment to identify the research gap.

Next, some literature was reviewed to develop supply chain resilience strategy in the logistics service provider industry context. From the literature study, 21 strategies were identified. There are consisting of 6 strategies from the collaboration between various parties dimension (See Table 25), collaboration is regarded as a crucial component of SCR because it relates to information sharing between various parties, which is necessary for quick responses in disruption situation. Furthermore, there are 10 strategies from the flexibility of organizational adaptation dimension (see Table 26), Flexibility was recognized as one of the crucial qualities the business should cultivate, particularly during times of disruption. Flexibility demonstrates how businesses can successfully adjust to disruptions condition. Finally 5 strategies from the agility of system configuration

dimension (see Table 27), agility emphasizes rapid system reconfiguration in the face of unpredictable changes.

**Table 25. List of SCR Strategies in The Collaboration Between Various Parties Dimension**

No.	Code	Collaboration Strategy	Definition	Sources
1	C1	Sensitivity to situations	Employee capabilities in analyzing various information, then interpreting the information into continuous planning, mapping supply chain vulnerabilities, warning strategies, and risk mitigation.	Ali et al. (2017), Belhadi et al. (2021), Xu et al. (2021)
2	C2	Development of supply chain network robustness	Build collaborative programs in such as configuration, segmentation, and decentralization of infrastructure throughout the supply chain network to reduce uncertainty and increase responsiveness to disruption.	Ali et al. (2017), Lam & Bai (2016)
3	C3	Supply chain relationship development	Develop and maintain good relations with all actors in the supply chain for collaboration in dealing with possible disruptions that may occur.	Ali et al. (2017), Burgos & Ivanov (2021), Lam & Bai (2016), Praharsi et al. (2021), Sharma et al. (2021)
4	C4	Designing security system	Build an information security system to counteract counterfeit threats, cyber security, layered defend, form Public-Private Partnerships (PPP), and establish cooperation with supply chain partners	Ali et al. (2017)
5	C5	Knowledge management implementation	Implement supply chain knowledge management, workforce education and training, simulation and training in various supply chain conditions, moreover establish a risk management department.	Ali et al. (2017)
6	C6	Improved forecast accuracy by coordinating across levels of the supply chain	Develop an appropriate demand forecast strategy by sharing information at each level of the supply chain to increase the visibility and responsiveness of the supply chain system, thereby avoiding excess supply accumulation in inventory and avoiding long	Burgos & Ivanov (2021), Lam & Bai (2016), Praharsi et al. (2021)

queues of the loading and unloading process.

### Content Validity Process

Content validity was performed for the next step to obtain the relevant supply chain resilience strategy in the context of the Indonesian logistics service provider. A questionnaire was distributed to experts on the third-party logistics and supply chain resilience as part of the validation procedure. The panel of expert had been selected based on the following criteria: 1) Have a minimum of 5 years experience in the logistics service industry; 2) Experts are from industry/logistics service companies, non-governmental agencies (NGOs), or academics field; 3) Holding managerial positions for private and non-private companies in the field of logistics services or having research experience in supply chain resilience for academics/NGOs.

**Table 26. List of SCR Strategies in The Flexibility of Organizational Adaptation Dimension**

No.	Code	Flexibility Strategy	Definition	Sources
1	F1	Order fulfilment optimization	Build a flexible service through the collaboration of several supply partners for order fulfilment and achieve resource flexibility.	Ali et al. (2017), Sharma et al. (2021)
2	F2	Expansion of the transportation network	Combining and expanding some of the flexibility of the transportation network to be able to meet consumer demands immediately, as well as increasing the ability to adapt to changes in environmental conditions that can disrupt the supply chain system.	Herold et al. (2021), Sharma et al. (2021)
3	F3	Postponement strategy implementation	Postpone the sale of services to carry out more detailed modularity regarding service differentiation to ensure the flexibility of the services provided and in accordance with the latest consumer needs.	Ali et al. (2017)
4	F4	Pricing dynamics	Adjusting the price list for services due to limited capacity by evaluating supply and demand data, complemented by analysis that can help determine the effectiveness of service pricing.	Ali et al. (2017), Sharma et al. (2021)
5	F5	Set up redundancy strategy	Build supply chain redundancy to anticipate disruptions by using excess capacity in transportation or resources from multi-	Ali et al. (2017), Burgos & Ivanov (2021), Belhadi et

			suppliers or low capacity utilization as an effort to mitigate the impact of disruptions.	al. (2021)
6	F6	Revenue stream innovation	Designing innovative financial stability solutions in the context of different scenarios, taking advantage of business potential that can still grow, and working capital liquidity.	Burgos & Ivanov (2021), Herold et al. (2021), Sharma et al. (2021)
7	F7	Infrastructure optimization	Optimizing shipments through consolidation with suppliers and consumers to make deliveries as needed without having to meet infrastructure capacity, as an effort to maintain main transportation routes.	Ali et al. (2017), Herold et al. (2021)
8	F8	Human resource management planning with new contracts	Implementation of a human resource management strategy with short time work which will temporarily reduce temporary workers to optimize work load and workforce.	Herold et al. (2021)
9	F9	Diversification and outsourcing strategy	Modify the service portfolio according to current conditions through analysis of core and non-core business descriptions, and use outsourcing through existing collaboration with external partners.	Sharma et al. (2021)
10	F10	Utilization of information technology for demand sensing	The supply chain information system uses big data capabilities to collect the latest information that occurs throughout the supply chain to support the right decision making.	Ali et al. (2017), Belhadi et al. (2021)

The experts scored by item-rating scale with four points, 1 = "not relevant," 2 = "somewhat relevant," 3 = "quite relevant," and 4 = "highly relevant" to rate a set of items derived from a thorough literature research on the notion of supply chain resilience. Then, to evaluate the content validity, I-CVI and multi-rater kappa statistics were both applied. Each item's CVI value (I-CVI) is based on the amount of experts who judge its content to be valid (3 or 4), or invalid (1 or 2). I-CVI is the proportion of experts who concur that the question is relevant to the field divided by the total number of experts. The multi-rater kappa coefficient of agreement was afterwards analyzed and compared. Fleiss et al. (2003), defined "K" as "excellent" if the value was greater than 0.74, "good" if it was between 0.60 and 0.74, "fair" if it was between 0.40 and 59, and "poor" if it was below 0.40. Those items classified as fair or poor were removed from the questionnaire list, while items classified as excellent or good will be taken into consideration for future research. Table 28 displays the results of the I-CVI and kappa analyses.

*Table 27. List of SCR Strategies in The System Configuration Agility Dimension*

No.	Code	Agility Strategy	Definition	Sources
1	A1	Contingency plan design	Performing time to market analysis, scenarios, reconfiguring supply chains, reconfiguring resources, then preparing recovery plans, restoration plans, and planning capacity additions.	Ali et al. (2017), Lam & Bai (2016), Praharsi et al. (2021)
2	A2	Strengthen market position	Increase financial, equity, efficiency, strategic alignment, and adaptability strength of the company in maintaining consumer trust and communication.	Ali et al. (2017)
3	A3	Knowledge management development	Evaluate feedback on post-disruption conditions, develop post-disruption curriculum insights, and increase innovation in business processes.	Ali et al. (2017)
4	A4	Increased visibility of IT-based supply chain systems	Adopting digital technology and advanced IT systems in several business processes to maintain essential business functions through system integration and connectivity.	Ali et al. (2017), Belhadi et al. (2021), Burgos & Ivanov (2021), Gupta et al. (2022), Herold et al. (2021), Praharsi et al. (2021), Sharma et al. (2021)
5	A5	Implementation of monitoring and maintenance of supply chain systems	Carry out performance control and monitoring activities by evaluating the KPI matrix to ensure suppliers, work partners, and personnel perform the expected performance.	Belhadi et al. (2021), Lam & Bai (2016), Praharsi et al. (2021)

## Results

This study focused on the relevance strategies for supply chain resilience in third-party logistics provider industry. Six experts were given a questionnaire, and the results were gathered. A four-level scale was used by each expert to rate the relevance of the strategies. The result of this research was presented in Table 28, consist of I-CVI, K values, and interpretation of Kappa results. As a result, only 16 strategies from the initial set of 21 strategies selected for this study were determined to be relevant for the Indonesian logistics sector. Figure 15 compiles all of the relevant strategies.

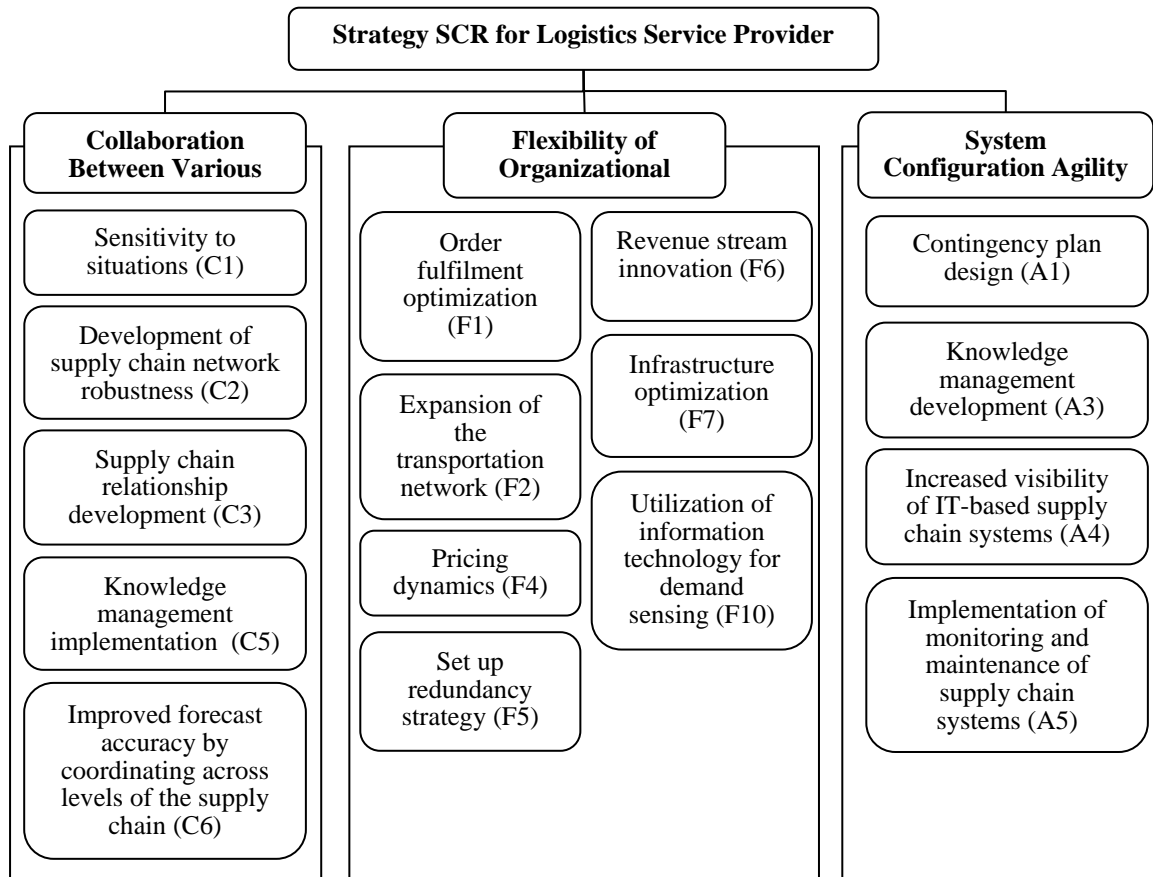


The strategy on collaboration between various parties dimension, "sensitivity to situations", "development of supply chain network robustness", "supply chain relationship development", "knowledge management implementation", and "improved forecast accuracy by coordinating across levels of the supply chain" have an interpretation of K excellent, while "designing security system" was poor. For the flexibility of organizational adaptation dimension, "order fulfilment optimization", "expansion of the transportation network", "pricing dynamics", "set up redundancy strategy", "revenue stream innovation", "infrastructure optimization", and "utilization of information technology for demand sensing" strategies were excellent, beside that "postponement strategy implementation", and "diversification and outsourcing strategy" were fair, and "human resource management planning with new contracts" was poor. Lastly, for the system configuration agility dimension the strategies that has excellent interpretation of K were "contingency plan design", "knowledge management development", "increased visibility of IT-based supply chain systems", and "implementation of monitoring and maintenance of supply chain systems", meanwhile "strengthen market position" strategy was fair.

**Table 28. Result of Expert Validation**

Dimension	Strategy Code	Number of Agree	I-CVI	K	Interpretation of K
Collaboration Between Various Parties	C1	6	1.000	1.000	Excellent
	C2	6	1.000	1.000	Excellent
	C3	6	1.000	1.000	Excellent
	C4	3	0.500	0.273	Poor
	C5	5	0.833	0.816	Excellent
	C6	6	1.000	1.000	Excellent
Flexibility of Organizational Adaptation	F1	5	0.833	0.816	Excellent
	F2	6	1.000	1.000	Excellent
	F3	4	0.667	0.565	Fair
	F4	6	1.000	1.000	Excellent
	F5	5	0.833	0.816	Excellent
	F6	6	1.000	1.000	Excellent
	F7	5	0.833	0.816	Excellent
	F8	3	0.500	0.273	Poor
	F9	4	0.667	0.565	Fair
	F10	5	0.833	0.816	Excellent
System Configuration Agility	A1	5	0.833	0.816	Excellent
	A2	4	0.667	0.565	Fair
	A3	5	0.833	0.816	Excellent

A4	6	1.000	1.000	Excellent
A5	5	0.833	0.816	Excellent



**Figure 15. Supply Chain Resilience Strategy for Logistics Service Provider Industry**

**Discussion**

According to the I-CVI values, items with an I-CVI of 0.78 or above for three or more experts could be regarded as strong evidence of content validity (Polit et al., 2007). However, I-CVI incapacity to account for chance agreement, and become one of its weaknesses. By converting item-level CVI into values of a modified kappa statistic, we were able to resolve issue. In terms of K value, "excellent" refers to scores above 0.74, "good" to scores between 0.60 and 0.74, "fair" to scores between 0.40 and 0.59, and "poor" to scores below 0.40 (Fleiss et al., 2003).

The supply chain resilience strategy namely "postponement strategy implementation", "diversification and outsourcing strategy", and "strengthen market position", were among the three strategies that received 'fair'. Then "designing security system" and "human resource management planning with new contracts" were strategies that received 'poor' outcomes in the Kappa analysis. Despite reflecting positive values, these items I-CVI and K values were not statistically significant. Therefore, these objects should to be dropped (Fleiss et al.,

2003). One of the advantages from using this method for validity is the denominator in Kappa Statistics computations represents the highest level of agreement achievable over and beyond what might be expected by chance. The agreements that truly go above and beyond the odds are completed in the numerator. As a result, this calculation demonstrates content validity by concentrating on relevant things; it only demonstrates that there is complete consensus among experts (Polit et al., 2007). In this study the result of I-CVI of all strategies are statistically significant, therefore none of the strategies has a "good" K value interpretation. So the Kappa Statistics also made sure the I-CVI would stay within threshold.

Meanwhile, the five strategies of the collaboration, there are "sensitivity to situations", "development of supply chain network robustness", "supply chain relationship development", "knowledge management implementation", and "improved forecast accuracy by coordinating across levels of the supply chain", has the K interpretation that produced 'excellent' results. Implementing internal integration within a company and working with outside parties to form supply chain partnerships allow companies to improve their competitive advantages such as sustainability and resilience (Tarigan et al., 2021). The strategies such as "supply chain relationship development" and "improved forecast accuracy by coordinating across levels of the supply chain" have a support to integration on supply chain.

The flexibility dimension has seven strategies that also receiving 'excellent' result in kappa analysis, i.e. "order fulfilment optimization", "expansion of the transportation network", "pricing dynamics", "set up redundancy strategy", "revenue stream innovation", "infrastructure optimization", and "utilization of information technology for demand sensing". In addition, the study on Siagian et al. (2021) indicates that supply chain integration enhances corporate performance by increasing supply chain resilience and flexibility. Additionally, supply chain resilience is impacted by supply chain flexibility. Therefore, a plan for preparing the company's adaptability and flexibility is required to achieve supply chain resilience.

Moreover, four of the agility strategies also has 'excellent' K interpretation, there are "contingency plan design", "knowledge management development", "increased visibility of IT-based supply chain systems", and "implementation of monitoring and maintenance of supply chain systems" strategies. The innovation system has an impact on supply chain resilience. The business may quickly innovate to create new goods and modify internal procedures in response to shifting consumer demand. Hence, business operation could achieved one of supply chain resilience objectives which is quick recovery to return to the norm (Bernardes & Hanna, 2009).

In total, just 16 items remained relevance to use in the further research for context of third-party logistics service provider in Indonesia. This finding suggests that internal integration has a variety of benefits for enhancing competitive advantage. According to Alamsjah & Asrol (2022) study's findings, even though the measurement of certain strategies may be appropriate in a business environment, but they may not be as relevant as in the context of Indonesia, which an example of a developing nation. This is due to the fact that Indonesian logistics are unique in that; they are marked by unusually high supply chain uncertainties, such as, inter-island logistics, the highest number of natural disasters worldwide, and inadequate infrastructure. The items that were removed

lacked precision in measuring some dimensions and weren't suitable for developing a supply chain resilience strategy. Finally, all of the strategies that were chosen for each dimension were found to be significant and relevant in structuring an appropriate SCR strategy for an Indonesian logistics service provider.

## Conclusion

Supply chain resilience strategy was needed to be identified for business performance and growth. This research studied the relevance strategies for supply chain resilience in Indonesia logistics service provider industry. This study found there is 21 strategies in the context of logistics service provider industry through a literature review. The strategies were divided into three dimensions, i.e. collaboration (6 strategies), flexibility (10 strategies), and agility (5 strategies). Validation by six experts was carried out and calculated the K value, resulting 16 strategies that relevance for third-party logistics service provider in Indonesia. The relevance strategies are 5 strategies in collaboration between parties dimension, 7 strategies in flexibility of organizational dimension, and 4 strategies in system configuration agility dimension.

The main focus of this study was content validity. Future studies can therefore evaluate the other form of validation questionnaire or reliability. Implication of strategies in this research only for supply chain resilience of third-party logistics service provider in Indonesia. For the future research it is recommended to analyze the interrelationship between element strategy by using the multi-criteria decision-making (MCDM) approach. Recommended to develop a structure strategy to achieve the vision for several years in supply chain systems.

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# Exploiting Ontological Engineering Paradigm in Smart Decision Support Systems

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**Abstract:** Ontological engineering (OE) is a subset of knowledge engineering (KE). Ontology is a powerful technique for knowledge management, processing, and representation in a specific domain and enables inference as well as reasoning tasks. Most of the applications of OE in the fields of informatics and artificial intelligence (AI) are related to developing robust smart software systems and knowledge-based systems. On the other side, Knowledge-Based decision support systems (KDSS) are consultation intelligent systems that contain a knowledge base (KB) and inference engine (IE). The KB contains static knowledge and experiences (heuristics knowledge) of many experts in a specific task. In this article, we focus our discussion on the potential role of OE in Knowledge-Based Decision Support Systems (KDSS). Moreover, the article presents the research issues for developing ontologies for any task. In addition, web-based ontologies for expert systems, e-business, and e-medicine, e-education are also included. The ontological engineering paradigm is an effective methodology to manage and represent knowledge. Ontologies are now ubiquitous in many information-systems enterprises. They constitute the backbone of the Semantic Web as well as they are used in all e-activities and applications. Furthermore, the ontology approach enables us to solve the uncertainty and complexity of the instructional systems.

**Keywords:** Ontological Engineering, Knowledge-Based Decision Support Systems, E-Business, E-Medicine, E-Education.

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## Introduction

From a philosophical point of view, "Ontology" is the branch of philosophy that deals with the nature and the organization of reality. In the informatics and artificial intelligence domains, ontologies aim at generically capturing domain knowledge and providing a commonly agreed understanding of a domain, which may be

reused and shared across applications and groups. Ontologies provide a common vocabulary of a specific area. At present, there are many applications of ontologies in commercial, industrial, medical, bioinformatics, education, and business.

During the previous decade, increasing attention has been focused on OE (Fernández-López & Gómez-Pérez, 2022) and (Su & Ilebrekke, 2002). The main advantages of using the OE paradigm are: (a) to share insights and mutual understanding of the structure of information among people or intelligent software agents; (b) to enable the reusability of domain knowledge; (c) to represent the domain of interest in an explicit way; (d) to differentiate the domain knowledge from operational knowledge; and (e) to analyze domain of interests. Currently, there are applications of OE with commercial, industrial, biological, medical, educational, and research focuses (Su & Ilebrekke, 2002), (Tankeleviciene & Damasevicius, 2009), (Bodenreider & Burgun, 2005). On another side, ontology design, approaches, and methodologies are very important aspects of building ontologies in different domains and tasks. In the addition, reusability is a key issue that is determined by the level of compatibility among ontology concepts and among the theories of the different domains they convey.

In this article, we focus our discussion on exploiting the potential role of ontological engineering in knowledge-based decision support systems. Section 2 presents an overview of ontological engineering from the Artificial Intelligence Perspective. Section 3 discusses the research issues of ontological engineering. Section 4 introduces the main aspects and characteristics of knowledge computing and KDSS. Section 5 presents the general methodology for developing web-based ontology. Section 6 presents the web-based ontology for expert systems. Section 7 - Web-based Ontology for E-business Technology, Section 8 - Web-based Ontology for E-business Technology, Section 9 - Web-Based Ontology for Education. Finally, section 10 and 11 concludes the work.

### **Ontological Engineering (OE) from the Artificial Intelligence (AI) Perspective**

According to (John, 2000), the main components of ontology are (a) concepts; (b) relations between concepts; (c) properties, and attributes of the concepts; and (d) rules, axioms, predicates, and constraints. The main objective of using ontologies is to share knowledge between computers or computers and humans. Computers are capable to transmit and present the information stored in files with different formats, but they are not yet compatible to interpret them. To facilitate communication and intelligent processing of information, all actors of the digital space (computers and humans) must have the same vocabulary. Ontologies are the foundation of cooperation and the semantical understanding between computers (running a lot of non-homogenous software programs) and of the cooperation between computers and humans. Trausan 2004 explained the idea that ontologies are the binder, which integrates database systems, knowledge-based systems, and object systems in collaboration-based applications.

Most of the usages of ontologies in the field of AI are related to knowledge-based systems and intelligent systems. These types of ontologies include a small number of concepts and their main objective is to facilitate reasoning. For example, in multi-agent systems, the knowledge representation is accomplished through a basic



ontology, private ontologies, and a knowledge base. Private ontologies of the agents are derived from the basic ontology. The names of the concepts used in private ontologies of the agents are unknown, but their definitions use terms from the basic ontology. From an AI perspective, OE involves a group of activities that focuses on the ontology development process, the ontology life cycle, the methodologies for building ontologies, and the languages and software tools that support them. Figure 1 shows the main aspects, activities, and components of OE (for more details, see Sowa 2000). Ontologies are the foundation of cooperation and the semantic understanding between computers (running many non-homogeneous software programs) and of the cooperation among humans and computers. Trausan 2004 explained the idea that ontologies are the binder, which combines database systems, knowledge-based systems, and object systems in collaboration-based applications.

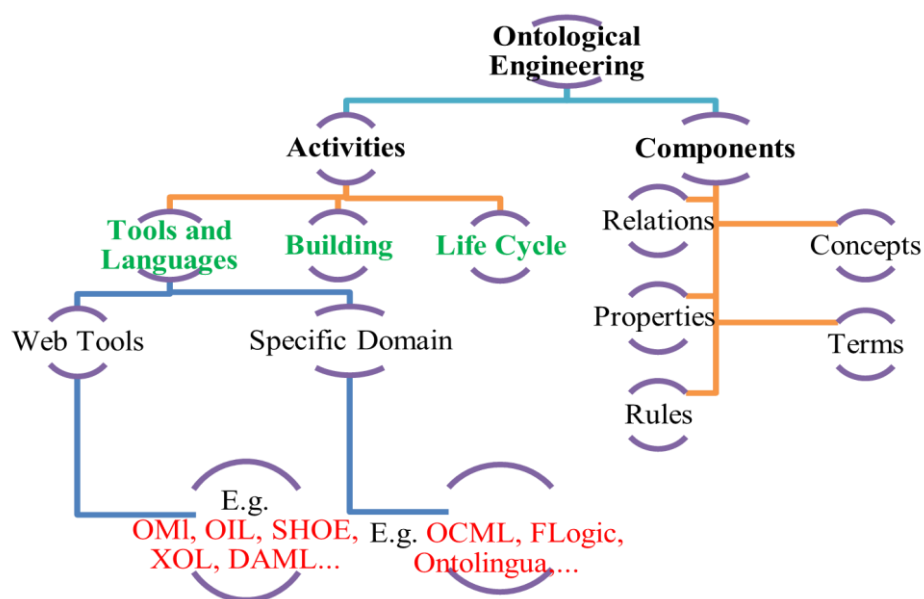


Figure 1. Activities and Components of Ontological engineering

OE is still an immature field of research where knowledge engineers employ their developing methodology. Ontology-building requirements differ based on the way of identifying concepts. There are three common approaches:

- a. "bottom-up" - it starts with the identification of the most concrete concepts to the most abstract concepts;
- b. "top-down" - it starts with the most abstract concepts to the most concrete concepts;
- c. "middle-out" - from the most closely related concepts to the most abstract concepts and most concrete concepts.

### Ontological Engineering Research Issues

OE refers to the set of activities that concern the ontology development process, the ontology life cycle, methodologies for building ontologies, and the tool suites and languages that support them.

## Methodologies

OE is still a relatively immature discipline; each research group employs its methodology. Ontology methodologies differ according to the strategy of identifying concepts. The well-known three possible strategies for identifying concepts are: (a) bottom-up from the most concrete to the most abstract; (b) top-down from the most abstract to the most concrete; and (c) middle-out from the most relevant to the most abstract and most concrete. The last one is the most common strategy.

### Ontological Languages (OL) and tools

A great range of OL have been used for implementing ontologies during the last decade; e.g. Ontolingua, LOOM, OCML, FLogic, CARIN, OKBC, Telos, and Cyc (Parusheva, et al., 2017) and (Dean, et al., 2014). These languages are in a stable phase of development, and their syntax consists of plain text where ontologies are specified (many of them have a Lisp-like syntax).

Recently, Web-based ontology specification languages have been developed in the context of the World Wide Web. These languages have had a great impact on the development of the Semantic Web (e.g. SHOE, XOL, OML, OIL, DAML+OIL, and OWL. (Buraga, et al., 2006)). The syntax of these languages is based on XML. On the other side, ontological tools have emerged for creating, editing, and managing ontologies that are written in various languages. These tools usually provide a graphical user interface for building ontologies, which allows the ontologist to create ontologies without using directly a specific ontology specification language (e.g. OntoEdit, OilEd, WebODE, Ontolingua Ontosaurus Link Factory).

### Ontology Interoperability

The domain of ontologies is extremely vast. A lot of ontologies were developed, even different ontologies for the same domain. To assure the interoperability between software applications, it is necessary to guarantee the interoperability between their ontologies. In the literature, there are different technologies related to the ontologies' interoperability, namely; ontology alignment, ontology mapping matching, ontology translation, ontology integration, ontology refinement, and ontology unification (Salem & Alphonse, 2007), (KhakAbi, et al., 2009), (Motta, et al., 2000).

- (a) **Ontology alignment:** Alignment is the process of mapping between ontologies possibly transforming them (i.e. eliminating the unneeded information or adding new concepts and relations to ontologies).
- (b) **Ontology mapping:** Despite the increasing usage of ontologies and the creation of standard languages to define ontologies, there are no common points of view regarding the formalism of ontologies' mapping.

- (c) **Ontology translation:** Ontology translation is used in tasks consisting in reusing the ontology or a part of the ontology.
- (d) **Ontology integration:** Ontology integration is the process of finding common parts of two (or more) ontologies (X and Y) and developing a new ontology Z that allows interoperability between two systems based on the ontologies (X and Y). The new ontology Z may replace ontology X or ontology Y or may be used as an “intermediary” (John, 2000). between the systems based on ontology X or ontology Y, respectively.
- (e) **Ontology refinement:** Refinement is the process of mapping between two ontologies so that every concept of one ontology has an equivalent in the other ontology. A primitive of one ontology may be equivalent to a non-primitive of the other ontology.
- (f) **Ontology unification:** Ontology unification is the process of aligning all concepts and relations of two ontologies. The unification process is the refinement process in both directions.

### **Ontology Validation**

Validation is the process to determine whether a work product satisfies its requirements. Validation can be performed after the ontology has been developed, but it is usually better to validate while the ontology is being built. Several techniques can be used to validate ontology: (a) Verify the fulfillment of the purpose, (b) Check that all usage examples are expressible, (c) Create examples that are consistent with the ontology, and determine whether they are meaningful, and (d) Check that the ontology is formally consistent. The quality of the ontology is validated based on the following criteria: (a) consistency; (b) completeness; (c) conciseness; (d) clarity; (e) generality; and (f) robustness.

### **Ontology Evaluation**

In (Lama, & Sánchez, 2009) perform ontology evaluation based on the following criteria: (a) completeness; (b) correctness; (c) decidability; (d) maintainability; (e) minimal redundancy; (f) rich axiomatization; and (g) efficiency. A more formal ontology evaluation method was proposed by Obrst et al. (Lama, & Sánchez, 2009), includes (a) the development of an ontology and ontology tool competition; (b) principled certification of ontologies by a reviewing organization or community; and the development of an ontology.

## **Knowledge Computing and Knowledge-Based Decision Support Systems (KDSS)**

### ***Knowledge Engineering and Computing***

The disciplines of Knowledge Engineering (KE) and Knowledge Management (KM) are closely tied. KE deals with the development of intelligent information systems in which knowledge and reasoning play a pivotal role. KM is a developed field at the intersection of computer science and management, which deals with knowledge as a key source in modern organizations. Figure 2. shows the the main areas of research of

knowledge computing from the AI perspective.

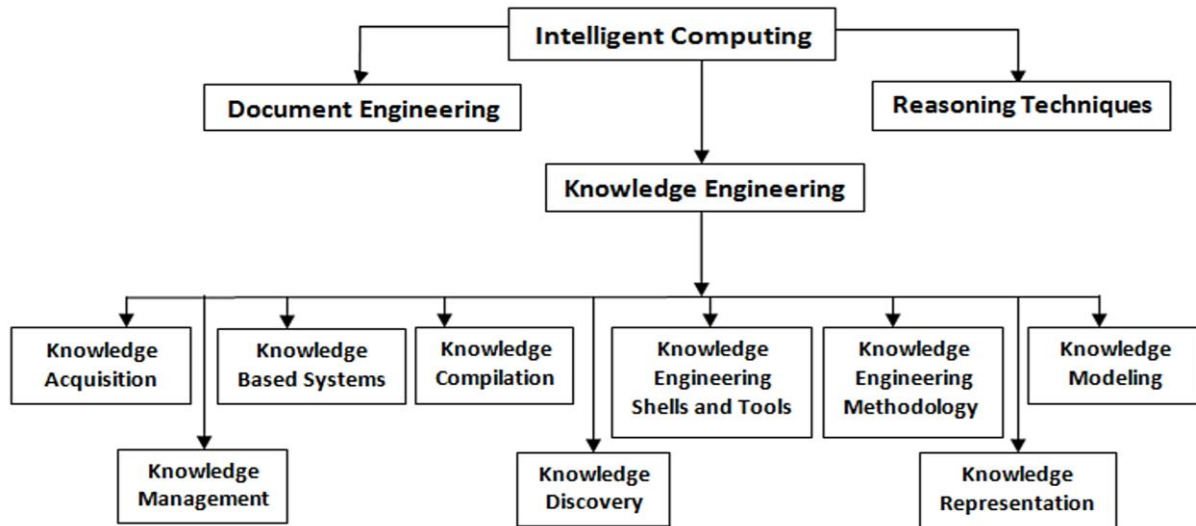


Figure 2. The Main Areas of Research of Knowledge Computing From the AI Perspective

### Knowledge Based Decision Support systems (KDSS)

KDSS is a consultation intelligent system that contains a knowledge base (KB) and inference engine (IE). The KB contains static knowledge and experiences (heuristics knowledge) of many experts in a specific task. The most common KDSS is rule-based expert systems (RES) and case-based expert systems (CES). In RES the knowledge base stores the knowledge in the form of production rules. The IE contains a set of formal logic relationships which may or may not resemble the way that real human experts reach conclusions. CES uses a case-based reasoning methodology in which the system can reason from analogies from past cases.

On the other side, expert systems (ES) are a special type of knowledge-based system. It is a highly specialized piece of software that attempts to duplicate the function of an expert in some field of expertise. The ES acts as an intelligent consultant or advisor in the domain of interest, capturing the heuristic knowledge of one or more experts. Non-experts can then tap the ES to answer questions, solve problems, and make decisions in that domain.

Expert systems will make knowledge more widely available and will help overcome the age-old problem of translating knowledge into practical, useful results. And perhaps best of all, it is a new more way that technology is helping us get a handle on the information glut. All AI software is knowledge-based as it contains useful facts, data, and relationships that are applied to a problem. From the AI point of view, expert systems include the following topics; (a) Knowledge-representation techniques, (b) knowledge engineering tools and shells, (c) intelligent programming languages, (d) inference techniques (e) reasoning methodologies, (f) machine learning, and (g) user interface technologies.

### General Methodology for Developing Web-based Ontology

Our methodology for developing the web-based ontology for any task in a specific domain can be summarized in the following steps:

**Step 1:** Organizing and scoping: Determining the objectives and defining the boundaries of the ontology.

**Step 2:** Data collection: the raw data needed for ontology development is acquired. In our applications, data was collected from AI, knowledge engineering, specific organizations, and books.

**Step 3:** Data analysis: the ontology is extracted from the results of data collection. This step includes the following tasks: (a) define the classes and class hierarchy, (b) define the properties of classes (slots), (c) define the facets of the slots (e.g., domain and range of a slot, cardinality, slot-value type), and (d) create individual instances of classes.

**Step 4:** Development of initial ontology: The preliminary ontology is developed (i.e., classes, relations, and properties). This process was done by using OWL-DL language using the Protégé-OWL editing environment (Protege is a free, open-source ontology editor that supports the latest OWL 2.0 standard. Protege has a pluggable architecture, and many plugins for different functionalities are available).

**Step 5:** Ontology refinement: The initial development is iteratively refined.

**Step 6:** Ontology validations: The process to determine whether a work product satisfies its requirements.

### Web-based Ontology for Expert Systems

Expert systems were originally developed to solve ill-defined problems and well-defined problems that are not efficiently solved with algorithmic approaches. This technology provides innovative and robust techniques to capture and package knowledge. Its strength lies in its ability to be put to practical use when an expert is not available. This technology has proven to be especially effective when the task is in a rapidly changing environment. On the other side, ontology is the foundation of describing a domain of interest and it consists of a collection of terms organized in a hierarchical structure that shapes reality. The main objective of using ontologies is to share knowledge between computers or computers and humans. Most of the usages of ontologies in the field of artificial intelligence are related to knowledge-based systems and intelligent systems. These types of ontologies include a small number of concepts and their main objective is to facilitate reasoning tasks. This paper presents the development of a web-based ontology for expert systems technology. The developed ontology was encoded in OWL-DL format using the Protégé-OWL editing environment.

## Web -based Ontology for E-business Technology

E-business or smart business is the integrated execution of all automated business processes of an enterprise using ICT and the use of the Internet of Things (IoT). E-business involves all aspects of business, which rely on the use of IT and networks. Comparing E-business and E-commerce, most authors emphasize that E-business is a somewhat broader concept. In addition to the buying and selling of products and services, E-business refers to servicing customers, electronically communicating, discovering information, collaborating with business partners, delivering e-learning, performing electronic transactions within an organization, e-government, social networks, and far more. Moreover, some researchers are ready “to use the broadest meaning of electronic commerce, which is equivalent to the broadest definition of E-business and these terms can be used interchangeably”. E-business links value chains across businesses involving new technologies in the value chain, reducing costs, and improving business efficiency.

The E-business is very complex and varied involving many activities, organizational units, and technologies. It includes many E-business applications. To perform these applications, organizations and companies need appropriate infrastructure and support areas. These support areas are the following: people, public policy, marketing and advertising, support services, and business partnerships. The new developments, maturation, and growth of E-business continue. One of the main prerequisites for this is the relentless evolution in technology and new commercial approaches, which exploit it. The latest trends in recent years in E-business are relevant to the growth of social media phenomenon and especially of social networks Facebook, Twitter, Google+, etc., and the use of mobile technologies and conducting E-business via mobile devices.

Our application presents the design and the development of five web-based ontologies for E-business technology, namely: (a) E-business applications; (b) E-business participants; (c) E-business infrastructure; (d) E-business support areas, and (e) Fields in E-business. The developed ontologies were encoded in the ontology web-based language OWL2 using the Protégé tool version 5.0.0 editing environment. Building ontologies is still a matter of craft skill rather than an understood engineering process. Some languages and tools have been created to support ontologies management. A semantic network refers to a graphic notation that enables the representation of knowledge in terms of interlinked nodes and arcs. It identifies the main objects and relationships between objects. The computerized implementations of semantic networks were first created to be applied in the AI and machine translation fields, but earlier versions have long been used in psychology, philosophy, and linguistics.

What distinguishes the semantic networks, they present a declarative graphic representation technique that can be used either to represent knowledge or to support automated systems for reasoning about knowledge. Figure 2 shows the proposed architectural diagram of the semantic net of E-business based on a comprehensive analysis of the literature published during the previous 10 years. In this net, there are five main super-classes namely (a) E-business applications; (b) E-business participants; (c) E-business infrastructure; (d) E-business support areas, and (e) Fields in E-business. Figure 2 shows the abstract view for the developed E-business ontology encoded in

OWL2 format using the Protégé tool Version 5.0.0 editing environment.

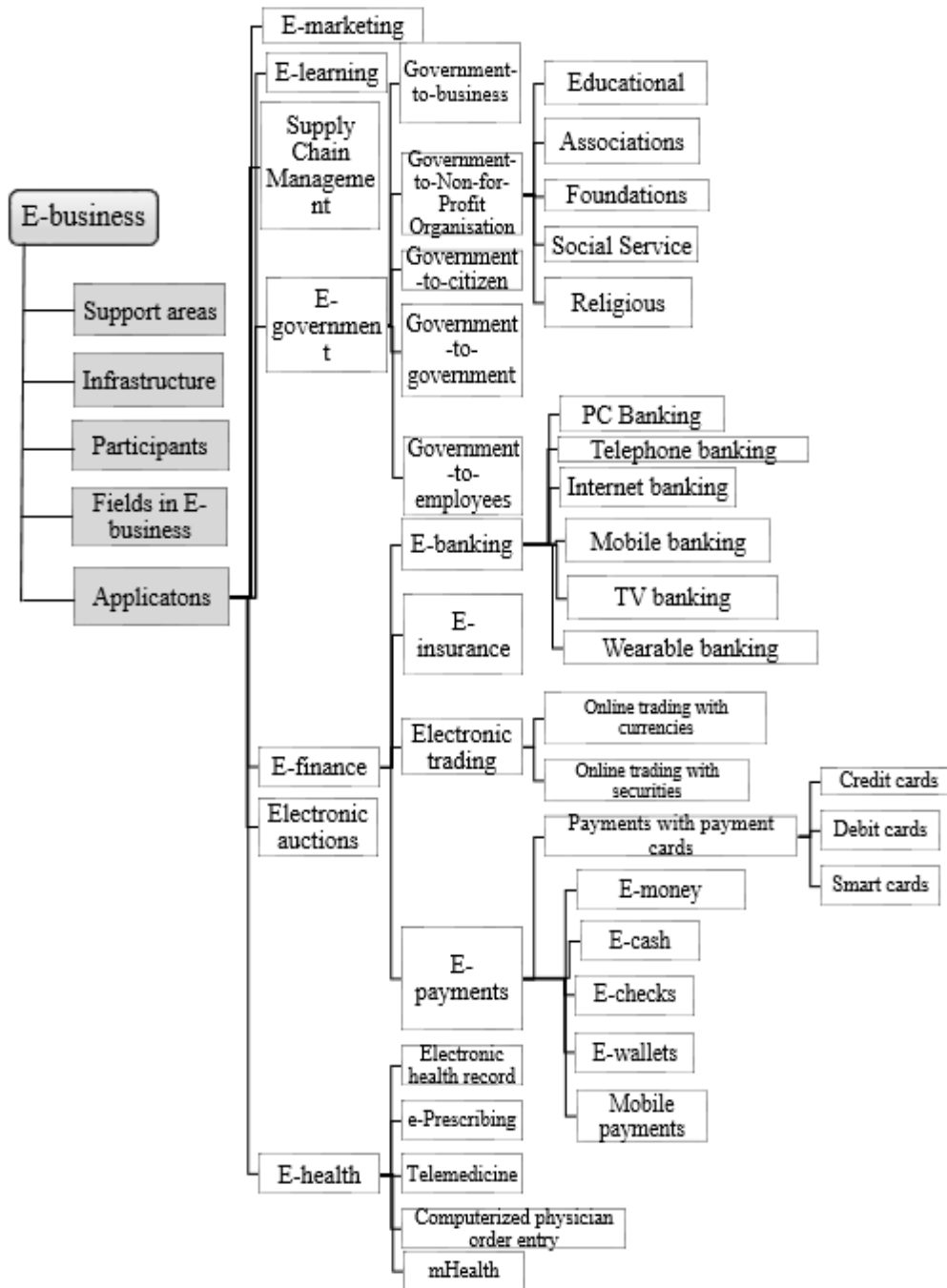


Figure 3. The Proposed Architectural Diagram of the Semantic Net of E-business

### Web-based Ontology for Lung Cancer

Lung cancer, like all cancers, results from an abnormality in the cell, the body's basic unit of life. Fig 4 shows the initial ontology of Lung cancer encoded in OWL-DL format using the Protégé- OWL editing environment. In this ontology we have 4 main superclasses namely.

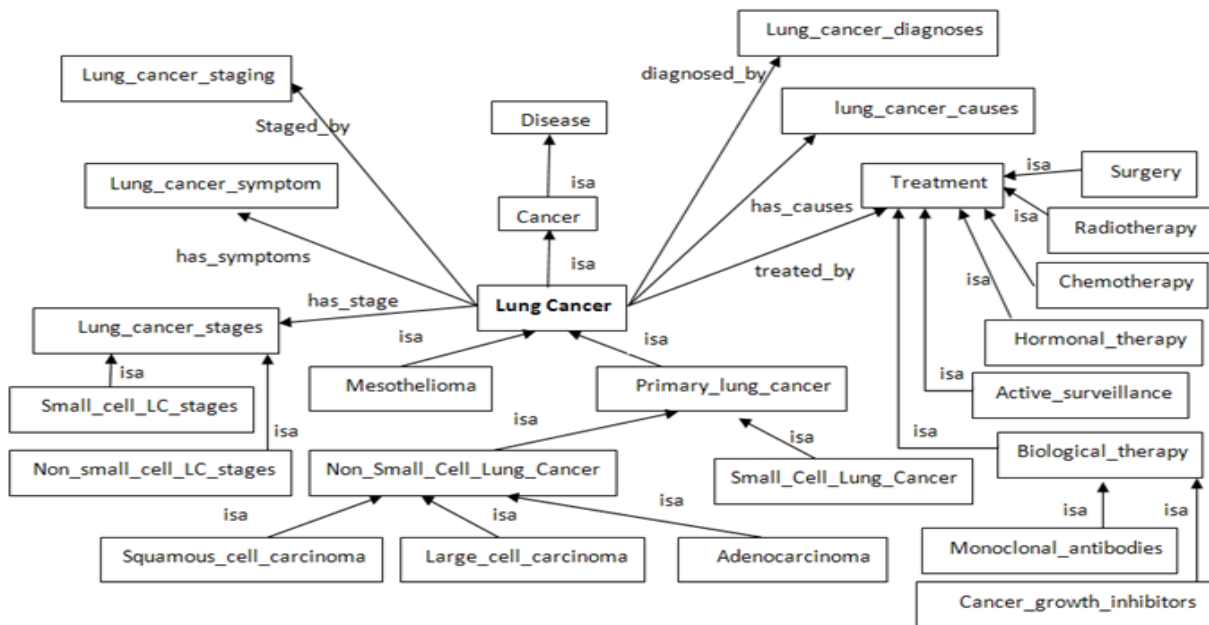


Figure 4. These semantic net knowledge representation of Lung Cancer.

People which have the subclasses; *male and female*.

Medical\_Interventions which has subclasses: *Treatment, Staging, and Diagnosis*.

A disease that has subclass *cancer* which has subclass; *lung\_cancers*.

Disease\_attributes which has subclasses;

*Causes, Disease\_stage, Pathological\_category, Staging\_systems and Symptoms*.

### Web-based Ontology for the Education

In the educational domain, several ontologies have been developed. Ontologies have been developed to describe the learning contents of technical documents and formalize the semantics of learning objects; model the elements required for the design, analysis, and evaluation of the interaction between learners in computer-supported cooperative learning; and describe the learning design associated with a unit of learning in which the learning flow is explicitly declared. The field of education is now dominated by the use of quantitative, trend-identifying, predictive methodologies such as quantitative modeling, randomized control trials, surveys, brain imaging, and the like; and research funders are now specifying that these are the most appropriate methods to use. It needs to move from studying and understanding manifest phenomena to the structures that generate them since we are dealing with a stratified world. If the understanding of those manifest phenomena is misconceived, because, for example, the use of inappropriate methods, then our understanding of deeper lying structures, the actual and vertical relations, moments, and meeting points between these structures, and the many manifestations of agency that take place in the world, is likely to be limited (Lama, & Sánchez, 2009). The ontological perspective leads to raising the following questions: *What is the nature of learning? What happens and matters when it comes to education in current societies?*



What is key in the ontology of education is the human and natural world as it is and is becoming. Educational research is concerned with an ontology in motion—with transitions over time, which can be as small as learning a new word, as long and wide as the collective development of practices across generations, and as large as a global transition to online education due to the outbreak of a COVID 19 pandemic. These movements are defined, more specifically, by people acting from particular positions in the world (e.g., an institutional position as a student or teacher) with certain purposes defined by themselves (e.g., as students wanting to become a doctor) and for them (e.g., by educational standards) with emergent potential in the future (Akkerman, et al., 2021).

Today much is being done to promote competency-based education therefore one of the goals is to develop a competency ontology for the semantic web to be used as a shared reference in the description of competencies and competency profiles. Competency-based education, as well as competency-based knowledge management in organizations, both require a competency profile grouping related competencies in a structured way. Competency is a central concept for human resource management, training, and education. We define competency as the capacity of a person to display a generic skill with a certain level of performance when applied to one or more knowledge entities. Competencies, and competency referential grouping competencies, are essential elements for user models, e-Portfolios, adaptive learning, and personalization in Technology-based learning. Several competency definitions and competency profiles have been proposed in the last 15 years for specific knowledge domains. In most of the implementations we have consulted, competency is expressed as a simple natural language sentence, which is inherently informal and ambiguous. Competency profiles are a collection of these sentences, where semantic relations such as prerequisite relations are not explicit and any two competencies are difficult to compare. To be used in software environments for education or knowledge management, competency and competency profiles must be instances of a formal model that can be managed computationally.

- First, it must be generic to be specialized for any competency profile or model, and in any subject or knowledge domain.
- Second, it should be flexible in its use, meaning it can encompass a large variety of educational or knowledge management applications where competencies associated with persons and resources can be expressed, compared, and assessed.
- Third, it should take into account and have connections with the growing number of educational vocabularies and ontologies that populate the web of linked open data.

Competency can be related to another one by a subsumes (S) property declared as a sub-property of a SKOS broader transitive property, thus gaining a precise meaning defined in the W3C SKOS reference document. Also, a domain ontology is defined as a SKOS concept scheme designed to represent Resource Description Framework Schema (RDFS) or OWL ontologies as well as less elaborated knowledge schemes such as thesauri or taxonomies, thus adding flexibility to the notion of a “domain ontology”. The Skill’s taxonomy and performance Classes are both defined here as SKOS:OrderedCollections, also defined precisely in the SKOS definition document.

*The next Stage1 —core competency model*

The Core COMP2 model offers a structural description of competencies to be used in any educational application. We have maintained the COMP1 method to decompose a natural language competency statement into three structural parts: skill, knowledge, and performance. The generic skill and knowledge parts of a competency are both mandatory while the use of performance indicators is optional, but adds precision to a skill. The central Competency class shown in Fig.5 includes the mandatory properties in the Rteearch Core Dataset (RCD) information model: competency title and identifier related to a catalog term and an entry in this catalog.

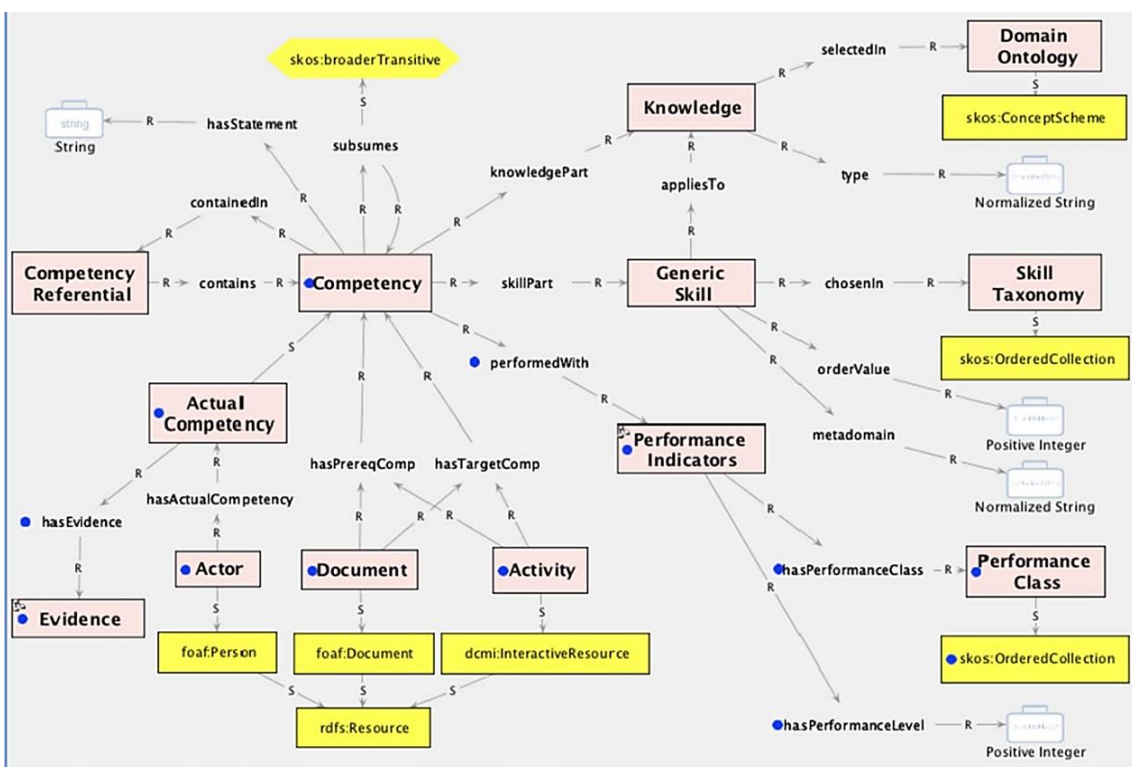


Figure 5. RDFS Model for the COMP1 Ontology

*Stage 2—extension to competency performance and proficiency levels*

The stage 2 extension adds (as a sub-model of stage 1) the classes and properties that are needed to define a proficiency level and a performance class. These concepts are based on five performance indicators: Frequency, Scope, Autonomy, Complexity, and Contextvariety.

*Stage 3—extension to competency referencing of actors, activities, and resources*

Stage 3 adds to the stage 1 model, independently of stage 2, the possibility to associate Competencies with Resources or Activities. A prerequisite competency property means that someone should have this competency

to use the resource or engage in the activity. A target competency means that someone who has built or used such a resource or achieved such activity has demonstrated the corresponding target competency. The resource or the activity can then serve as Evidence that an Assessed Actor now owns an Actual Competency.

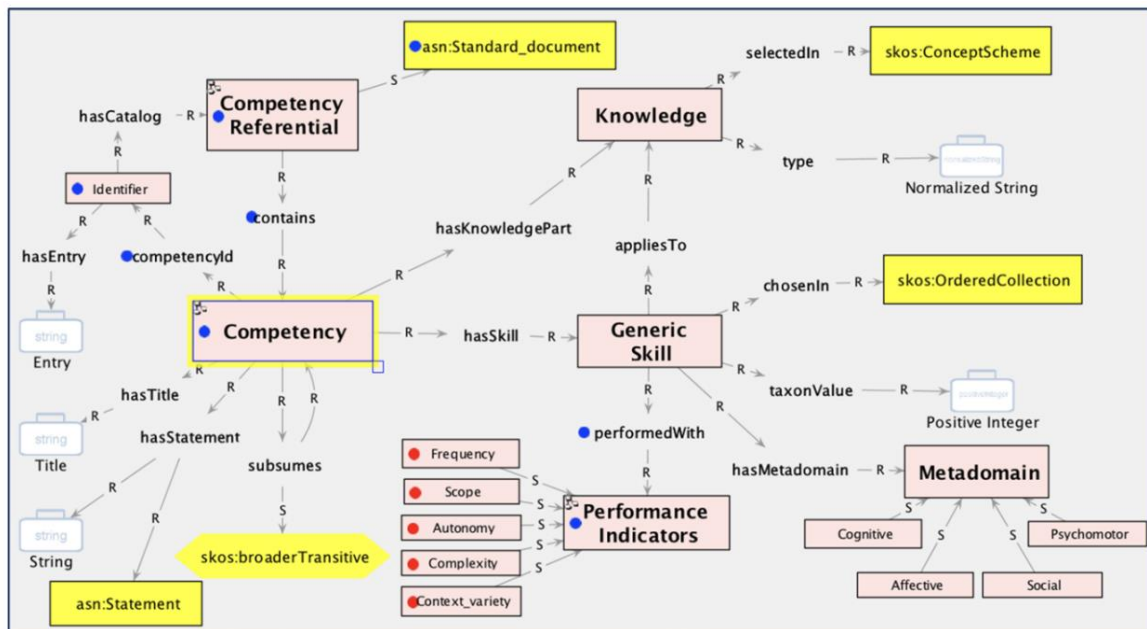


Figure 6: The Core COMP2 Competency Model

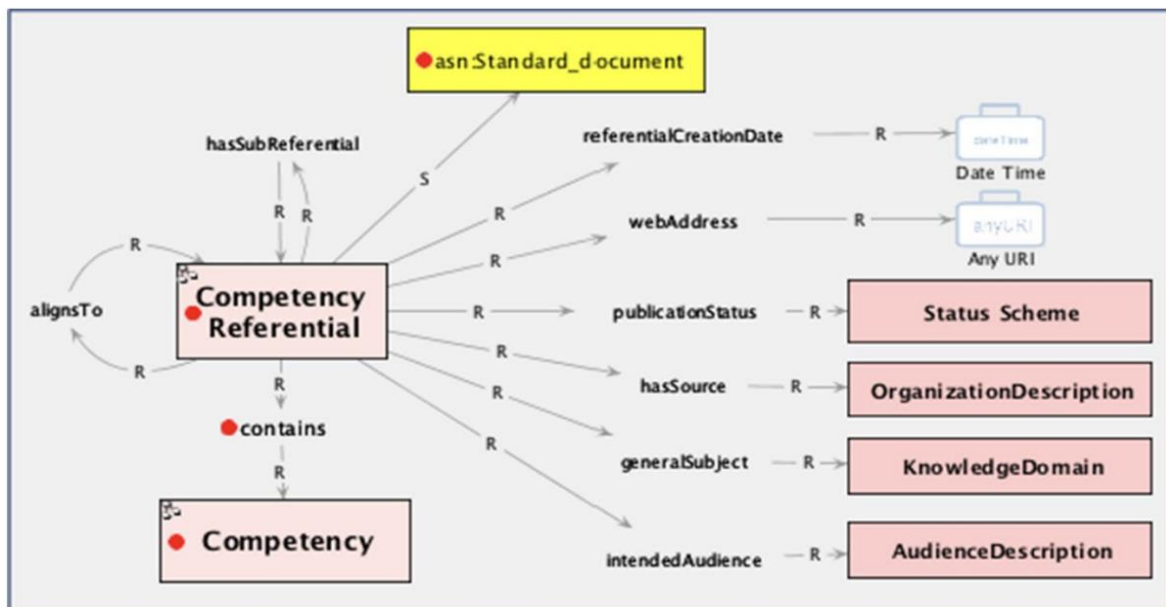


Figure 7. Competency Referential Information Sub-mode

Stage 4—extension to evidence records and portfolios

The stage 4 extension of the COMP2 ontology is centered on the Evidence class. Evidence owned by an

Assessed actor is grouped in Evidence Records that testify of the acquisition of an actual competency by this actor.

#### *Stage 5—extension to contextual provenance information*

Here is the last extension for the contextual provenance information of a competency referential, to compare and align competencies from different sources. As shown in Fig.6,a Competency Referential, that contains one or more competencies, can be subdivided into a tree of modules or competency sections by the hasSubReferential property. It can also be associated with another competency referential by an aligned property.

#### *Specifying a competency referential*

The general process for competency-based personalization of learning environments is schematized in Fig. 7. The role of the COMP2 ontology is to provide a generic schema that serves to define a particular competency referential for a learning environment or a work process. Competency referential is built by a process that starts with the COMP2 ontology model that structures the concepts, properties, and individuals in the subject domain of the learning environment.

In all fields of education and human resource management, competency definitions play essential roles. They provide clear objectives for learning or knowledge-based work processes. They help focus on the right knowledge to consider and the right strategies to employ. They are essential pieces of user models and e-portfolios showing evidence of competency acquisition. They provide a basis to evaluate a person's performance and personalize learning or working activities. Within competency management processes, some tasks can be performed by computer programs and others by human tutors or managers.

The principle of generativity means responsivity to what future is in the making, in the sense of care about what is given life and put into the world with the potential to develop further, although in unpredictable ways. The value of generativity, with responsivity and care for the future, has been stressed in other domains, including in social discourse, psychosocial development, and social change. In the context of educational research, it is about responsivity to what possibilities and impossibilities in positions, purposes, and emergent potential are (re)produced by and for people, including what sorts of interpretations and conditions scientific work coproduces along the way.

Ontologically then, generativity moves beyond determining the effects of targeted processes of learning. It includes care about what significance learning has for people's further lives while unfolding. When it comes to studying education and learning settings, generativity reflects even wider care about the significance of potentially lasting structures for current and next generations.

## Discussion

Ontologies were developed in intelligent learning systems to facilitate knowledge sharing, refining, search, and reuse. These ontologies may be used as an assessment procedure. For example and from the educational point of view, candidates show their knowledge and understanding while creating ontologies. Knowledge entities that represent static knowledge of the domain are stored in the hierarchical order in the knowledge repository and can be reused by other candidates. At the same time, those knowledge entities can be also reused in the description of the properties or arguments of methods of another knowledge entity. Moreover, the ontology approach enables solving the complexity and the incertitude of the instructional systems. An intelligent learning system based on a multi-agent approach consists of a set of intelligent agents, which have to communicate. They collaborate through messages. Software agents can understand and interpret the messages due to a common ontology or the interoperability of private ontologies. In this work, the developed ontologies could be useful for researchers and specialists working for start-up organizations who need the knowledge to be represented in a semantic way that allows reasoning capabilities. On the other side and from the technical point of view, building ontologies is still a matter of craft skill rather than an understood engineering process. Some languages and tools have been developed to support ontologies management. Ontological web-based language, OWL, is the appropriate ontology implementation language as it is highly expressive, scalable, and possesses powerful inference capabilities.

## Conclusion

The ontological engineering paradigm is an effective methodology to manage and represent knowledge. Ontologies are now ubiquitous in many information-systems enterprises. They constitute the backbone of the Semantic Web as well as they are used in all e-activities and applications. Furthermore, the ontology approach enables us to solve the incertitude and complexity of the instructional systems. Ontological web-based language, OWL, is the appropriate ontology implementation language as it is highly expressive, scalable, and possesses powerful inference capabilities. Our approach in this study demonstrates that the ontology development process needs some innovative efforts of meta-concepts definition that helps to name the groups and structure the chaos. Our future work will be related to research in the field of social business, social commerce, and social networks based on their phenomenal growth and prospects of increasing importance, as well as developing web-based ontologies for them.

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## Policy Modeling for Reduction Food Loss and Waste in Indonesia with System Dynamics Approach: A Conceptual Model

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**Abstract:** Food loss and waste is generated throughout the stages of the food supply chain – production, post-harvest & storage, processing & packaging, distribution & marketing, and consumption. Every year, the amount of food waste generated increases significantly, resulting in economic, environmental, and social losses. Indonesia is one of the countries that has committed to reducing half of the current amount of food waste through the Sustainable Development Goals 2030 agreement. To support this commitment, a policy that is comprehensive and integrated is needed to reduce the amount of food waste. This work aims to examine the dynamic relationships in food supply chain systems that produce food loss and waste. This study provides appropriate policy recommendations for reducing food loss and waste in Indonesia. This study uses a causal loop analysis to see the feedback relationship of the variables in the food supply chain system that results in food loss and waste. The result shows that two policies can be used to reduce food loss and waste: investment in infrastructure and technology and implementation of waste management.

**Keywords:** Food Loss, Food Waste, Food Supply Chain, Sustainability, Indonesia

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### Introduction

Food loss and waste are the food waste generation throughout the supply chain. Food loss refers to waste during production, post-harvest, storage, processing, and packaging. Meanwhile, food waste refers to waste that occurs during distribution, marketing, and consumption (Bappenas, 2021). This waste is also seen as a form of inefficiency in the operation of the food supply chain (Aramyan et al., 2021). According to the Food and Agriculture Organization's (FAO) report in 2011, the global food waste generated was 1.3 billion tons per year, equivalent to one-third of the total food produced. The amount of food waste will continue to increase every year, considering the growing human population, which increases the demand for food production (FAO, 2011).

Food loss and waste are global issues because the waste generated is a significant global problem due to ethical, environmental, and economic reasons, and it is difficult to manage because of its low visibility (Derqui et al., 2018). Food loss and waste is also a problem that has a negative impact on the environment. The amount of carbon emissions generated contributes to the world's third-largest carbon emissions after the United States and China, amounting to 3.6 GtCO<sub>2</sub> per year (FAO, 2015). Food loss and waste not only have environmental impacts but also cause economic losses due to the reduction of food value. Globally, the total losses generated by food loss and waste amount to \$936 billion, equivalent to the GDP of countries such as Indonesia or the Netherlands (FAO, 2015).

Indonesia, as the world's fourth most populated country, also faces a problem of food waste. With a continuously growing population, Indonesia has the potential to generate a significant amount of food loss and waste, which will only continue to increase. According to a report from the Ministry of Environment and Forestry in 2020, Indonesia has produced 40% of food waste out of the total waste generated (KLHK, 2020). Based on the food loss and waste study released by the Ministry of National Development Planning in 2021, the total food waste generated in Indonesia from 2000 to 2019 was between 23-48 million tons per year, or equivalent to 115-184 kg/capita/year (Bappenas, 2021). The increasing amount of food loss and waste in Indonesia supports the government's involvement in forming policy interventions to reduce food loss and waste. In 2015, Indonesia committed to supporting the Sustainable Development Goals (SDGs) agenda for 2030. One of Indonesia's goals is SDG 12, which focuses on responsible consumption and production. SDG 12.3 aims to "halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses, by 2030" (Bappenas, 2021). To achieve integrated food loss and waste management, the Indonesian government has integrated food loss and waste management into the National Development Plan and Medium-Term Development Plan (RPJMN) 2020-2024, with one of the priority programs being the National Priority Program (PN) 6, which aims to build a sustainable environment, improve disaster resilience, and address climate change. Therefore, in 2021, through a food loss and waste report formed by Bappenas, Indonesia released a study on recommendations and strategies to support the reduction of food loss and waste in Indonesia. The five policy directions recommended for food loss and waste management include behavior change, improving food system support, strengthening regulation and optimizing funding, utilizing food loss and waste, and developing studies and data on food loss and waste.

Food waste is a national issue, so comprehensive and integrated management and handling are needed from upstream to downstream. The five policy directions recommended by Bappenas are the initial steps in a long journey toward implementing strategies and policies for food loss and waste management in Indonesia. There are no official government regulations specifically governing food waste management in Indonesia. Based on the 2018 Food Sustainability Index for middle-income countries, Indonesia ranks 53 out of 67 for sustainable food waste management. This index indicates that policies and food waste management in Indonesia are needed to make significant changes in terms of environmental and economic impact. Comprehensive and integrated waste management can provide economic, social, and environmental benefits and help change people's behavior to increase awareness of the importance of food waste management. Effective and efficient waste management



requires efforts to address food waste that requires legal certainty, clear responsibilities, community roles, government and local government authority, and the role of food businesses. Legal certainty ensures that public policies made by the government contain legal certainty accompanied by sanctions and wiser waste management rules. Therefore, as a country with the potential to produce more waste, Indonesia needs collective and multi-sectoral collaboration policies and strategies to work together for better and sustainable food loss and waste management. Multi-actors involved in food loss and waste management are government ministries and agencies, workers in the food sector, industry and small and medium-sized enterprises, communities (as consumers), academics, development partners, and the media.

### Literature Review

According to literature studies, many countries are starting to realize the importance of specific policies for reducing food loss and waste in their respective countries. The United States is one of the countries that has implemented policies to reduce food waste through improving its citizens' behavior. Based on the "Food Recovery Hierarchy," the United States prioritizes food waste reduction at the top of the hierarchy and avoids landfilling as much as possible (Lozano et al., 2014). Singapore has also launched a pilot project to recycle food waste into compost and energy since 2010.

Over the past 30 years, 95% of research investments have been reported to focus on increasing food production, while only 5% have been directed towards reducing food waste, despite the high potential for reducing food waste to provide more food in the future. Several studies have researched ways to reduce the amount of food waste generated. Lozano created a hierarchy for food waste reduction that starts with prevention, reuse, recycling, recovery, and direct disposal (Lozano et al., 2014). Chalak suggested that reducing food loss and waste should be designed with non-binding action paths by both government and non-government, fiscal and economic enforcement regulations to increase decision-makers awareness, setting targets to reduce waste by a certain time, and creating and monitoring strategies to reduce food loss and waste (Chalak et al., 2018). Reducing food loss and waste is also done by using recycling methods or using natural biodegradable materials. Ng & Tay utilized China's government program to use Organic Waste Treatment Facility (OWTF) and implement a waste tariff payment based on volume to reduce food waste by 40% in China by 2022 (Ng & Tay, 2019). In addition, food waste in Cambodia is processed using four food waste management methods: turning food waste into compost, using natural decomposers, using anaerobic digestion, and using landfill (Chinda, 2022).

Babalola (2019) suggested strengthening existing government regulations and applying costs to food waste incineration activities to maximize the potential for processing the food waste and biodegradable materials in Japan (Babalola, 2019). In the United States, Chen & Chen (2018) implemented food donation activities, feeding animals, and using food waste as compost to reduce food loss and waste (Chen & Chen, 2018). In Australia, Verghese et al. (2015) improved product packaging and involved technological innovation in packaging production to reduce food loss and waste in the packaging aspect of products (Verghese et al., 2015).

Additionally, during the Post-Harvest Losses phase in Mozambique, Popat et al. (2022) recommended reducing food loss and waste by increasing the production of corn, reducing the use of water resources, increasing transportation efficiency, and increasing accessibility to private storage (Popat et al., 2022).

Overall, this study aims to develop a dynamic model for reducing the amount of food loss and waste using a system dynamically. The study aims to analyze the interconnectivity of various factors involved in the food supply chain that generates food loss and waste and apply intervention strategies scenarios to the food supply chain to reduce the amount of food loss and waste. The scenario strategies implemented can assist stakeholders in making more targeted policies for reducing food loss and waste from the upstream to the downstream food supply chain.

## Method

The study focuses on the initial stage of the System Dynamics approach, which involves the conceptualization of the model by using Causal Loop Diagrams. Model conceptualization is translated into a system diagram to illustrate the model development. System diagram is a tool to describe the conceptual model formed from existing problems. The system diagram consists of a causal loop diagram, problem owners, related stakeholders, model objectives, policy interventions, model inputs, and output model results.

The causal loop diagram (CLD) is a tool to describe a system's structure and represent how a system works (Sterman, 2000). Causal loop diagrams have variables connected to each other by causal links and are indicated by arrows, and arrows can be understood as causal influences. The arrows are given positive (+) and negative (-) signs, which indicate the relationship between one variable and another. Variables that have been connected to each other will form a feedback loop, where several series of loops that are put together can create a coherent description of a particular problem (Kim, 1994). Each relationship is marked with causal polarity, either positive (+) or negative (-), to show how the dependent variable changes when the independent variable changes. The loop in the causal diagram indicates whether the rotation in the loop is positive feedback (reinforcing loop) or negative feedback (balancing loop).

## Results

The development of the food loss and waste model is described in the conceptualization model, which is translated into the system diagram shown in Figure 1. The problem owner of this research is the Ministry of Environment and Forestry. The main goal of its problem is to reduce food loss and waste in Indonesia based on the output data generated from the model. The output that has resulted from the model are total food loss and waste, total recycled food waste, and total CO<sub>2</sub> gas emissions. The output is issued from the simulation results of two policy interventions: investment in infrastructure and technology and implementation of waste management policies. This intervention will affect the inputs in the model, namely Indonesia's population, food

demand, resource supply, population growth rate, food loss and waste factor, and the emission rate produced. Input will be run in the model structure, described using a causal loop diagram. The causal loop diagram was made based on reference models used from several kinds of literature, namely the food supply chain model (Balkan et al., 2021), the waste management model (Babalola, 2019), and the regulatory and education model for food waste (Ng & Tay, 2019). The causal loop diagram consists of 8 balancing loops and three reinforcing loops, resulting in three submodels: food supply chain modules, food loss and waste modules, and waste management modules.

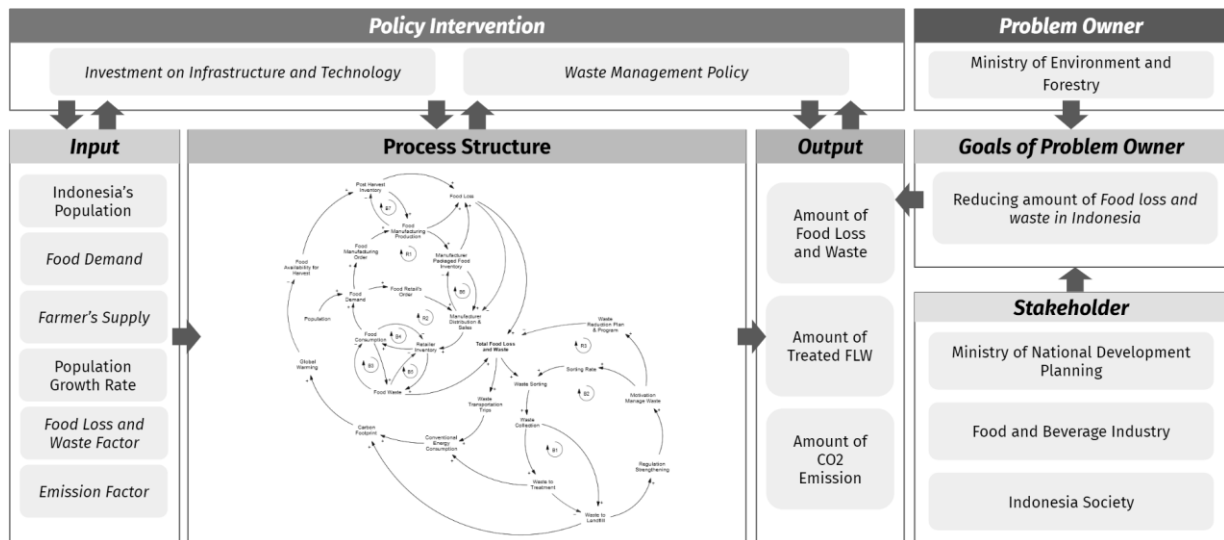


Figure 1. System Diagrams

Food Supply Chain Modules

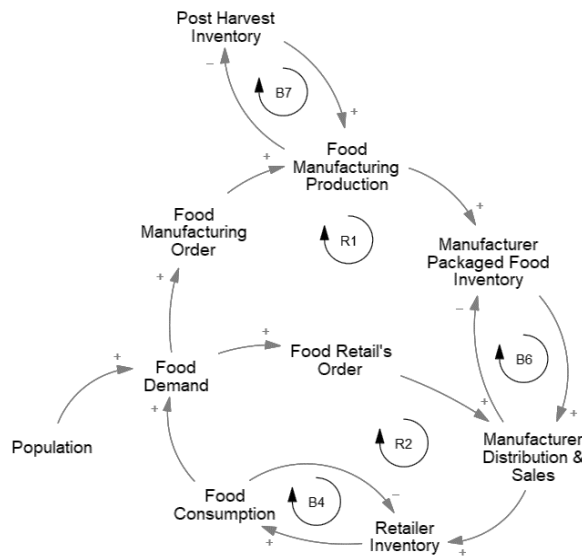


Figure 2. Food Supply Chain Modules

The Food Supply Chain is the basic system that influences the emergence of food loss and waste. This submodel

is influenced by the total population, which also influences the amount of food demand. Food demand will affect the flow of material orders and information in the food supply chain system from upstream to downstream. The food supply chain system is formed based on the real-world system of the forward supply chain, which has a feedback loop from variable demand to order flow in the supply chain. This submodel consists of R1, R2, B4, B6, and B7 that shown in Figure 2.

**Food Loss and Waste Modules**

Sources of food loss and waste come from the production and storage of food in the stages of the food supply chain. Food loss is generated from post-harvest inventory, food manufacturing production, and manufacturer-packaged food inventory. Food loss also affects the availability of the number of food products that will be ready to be sent to distributors and sales markets (Manufacturer Distribution & Sales). Meanwhile, food waste is generated by retailer inventory and food consumption. Total food loss and waste are obtained from the sum of the total food loss and food waste that arise along the food supply chain. The feedback loop in this submodel is the amount of waste that affects the availability of food in retail stores and the amount consumed by consumers. This submodel is shown in Figure 3.

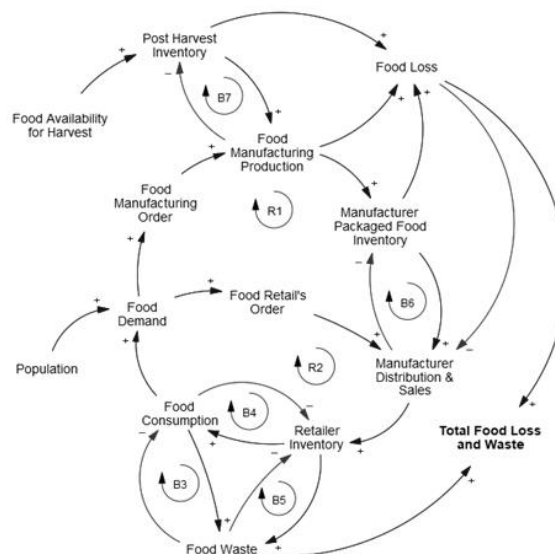


Figure 3. Food Loss and Waste Modules

**Waste Management Modules**

All waste has the opportunity to be processed first before being disposed of directly in public landfills. Food loss and waste is food waste that can be sorted and collected before finally being treated or handling the waste. Waste handling can be in the form of incineration or burning, composting, and biodigester implementation. The rest of the food waste processing will be disposed of directly in the general waste bin or landfill. The amount of waste in landfills will trigger increased regulation to increase motivation for waste management and also increase the emergence of planning and education programs to support food waste reduction. This submodel is shown in Figure 4.

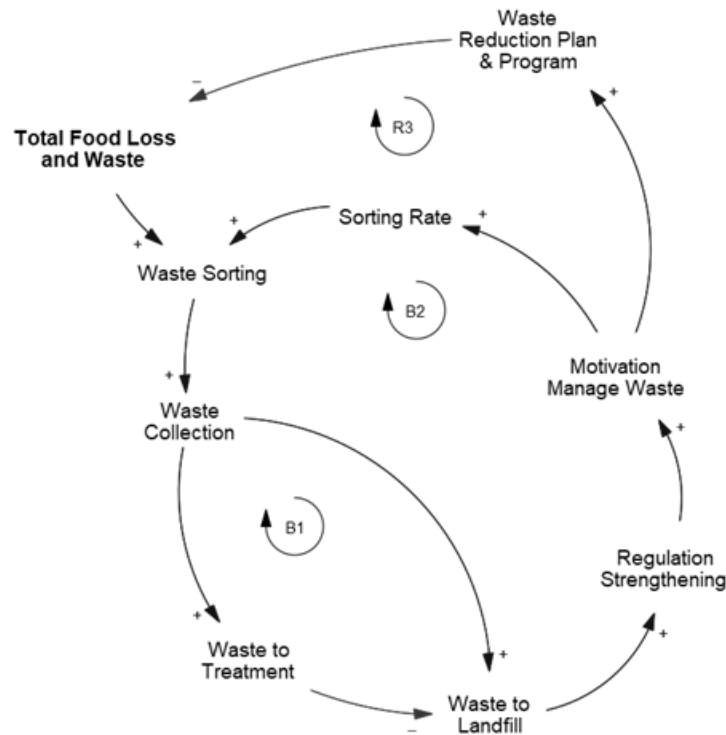


Figure 4. Waste Management Modules

## Discussion

Based on the causal loop diagram, There are eight balancing loops and three reinforcing loops which are formed from variables that are connected to each other. The model aims to reduce the number of food loss and waste in Indonesia. Several policy recommendations are needed to be implemented. Two policy recommendations can be implemented to reduce food loss and waste: an investment in technology and infrastructure and the implementation of waste management.

### Investment in Technology and Infrastructure

One of the policy recommendations that can be a solution for reducing food loss is optimizing investment funding to improve infrastructure and logistics. Infrastructure is an important aspect because it is one of the basic needs to support better food delivery and processing processes. Infrastructure improvements will support better logistics distribution of food, such as improving roads, providing appropriate long-distance transport, standardized storage, and refrigeration to preserve food. Infrastructure improvements can also be supported with the help of technology implementation for producers when harvesting and handling harvested products. Proper harvesting techniques will slow down the shelf life of food that will run out. The policy of optimizing funding for infrastructure and logistics is expected to be able to prevent food expiration dates so that the consumption period and form of food will last a long time to be deemed fit for consumption.

## Waste Management Policy

Waste management policies, especially food waste, must be emphasized to all stakeholders within the scope of the food supply chain. Waste management can be implemented using the food recovery hierarchy released by the United States Environmental Protection Agency (EPA), which reduces the source of food surplus, donating excess food, feeding animals, composting, and landfills (Lozano et al., 2014). Waste management is one way to deal with the amount of food loss and waste before it is finally disposed to public trash. Waste management does not directly reduce the amount of waste generated in the food supply chain. Still, on the other hand, waste management can reduce the amount of food waste in landfills and reduce the environmental impact of food loss and waste on greenhouse gas emissions.

## Conclusion

This study aims to develop a model conceptualization that illustrates food loss and waste that resulted from inefficient food supply chains in Indonesia. The amount of food loss and waste will always increase as long as humans still need food and produce food, so the policy is needed to be implemented to reduce the number of food loss and waste, especially in Indonesia. Food demand and population variables are the variables that most determine the amount of food loss and waste. This study conducts a results causal loop diagram consisting of three modules: the food supply chain, food loss and waste, and waste management modules. Food loss and waste are unavoidable, but the amount can be reduced by implementing several initiatives, such as investment in technology and infrastructure and applying the principles of waste management.

## Recommendations

The model can be a pioneering reference for the next research study. Further study should be able to construct an extension model by making a stock and flow diagram that developed from a causal loop diagram. The stock and flow diagram will make specific quantitative and qualitative results while exploring the policies. Validation and simulations will be conducted to allow for quantitative analysis of the model.

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## Doping Influence on Chemically Deposited Pbs Thin Films Properties

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**Abstract:** In this work chemical bath deposition (CBD) was used to prepare PbS thin films. These latter were grown on ordinary glass substrates. The precursor aqueous bath contained 1mole of lead acetate, 1mole of Thiourea and complexing agents (triethanolamine (TEA) and NaOH). Bath temperature and deposition time were fixed at 60°C and 3 hours, respectively. However, small rate (2%) of doping has been added in the reactive bath: Au nanoparticles, copper and zinc. A co-doping has also been realized by adding the same rate of Au nanoparticles and Zn simultaneously. Structural properties of the undoped deposited films were characterized by X-ray diffraction. The PbS crystal structure was confirmed. Optical studies showed that films thickness was strongly affected by doping nature, it varied between 380 nm for PbS: Cu films and 840 nm for PbS: Au films. The behavior of films growth has been studied. Energy band gap values have been calculated and found to take value in the range 0.67 - 1.46 eV. The used doping elements were revealed to enlarge the optical band gap and increase the disorder Eu. The properties of PbS make this material an excellent candidate in several fields as solar energy conversion near the infrared ray or IR detection.

**Keywords:** Pbs, Thin Films, Doping, X-Ray Diffraction, AFM, UV-Visible.

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### Introduction

Recently, thin films experienced a growing interest on the part of researchers. A particular craze was generated



by doping them using various elements according to the referred implementation. Ternary compounds thin films materials are attracting due to their potential applications in optoelectronics, gas and humidity sensors, solar control coatings, photo-electrochemical solar cells and many other fields (Nayak, et al., 1985), (Nadir, a tal., 2012). Lead sulfide (PbS) is an interesting semiconductor(Chattarki, et al., 2012), (Thiagarajan, et al., 2012).

. It is belonging to IV-VI group with a narrow band gap (0.41eV) and a large exciton Bohr radius of 18 nm (Rempel, 2007), (Obaid, et al., 2012). Thin material is used in infrared optics as a material for temperature sensors and photo-detectors (Rempel, 2007), (Bauer & Clemens, 1990). The influence on doping concentration on PbS films properties has been investigated by several workers (Bushan, et al., 2002), (Maskaeva, at.al., 2003). Kumar et al. 2014 recently reported that crystallite sizes determined by XRD have been enlarged with increasing Sb doping concentration in PbS. Thangavel et al. 2012 studied band gap of PbS films behavior as function of Cd doping rate. Band gap energy as high as 2.61 (2.66) eV is achieved by annealing and the addition of Cd element into PbS films. Doping represents an excellent way to widen the gap by replacing Pb with less heavy chemical elements. A judicious choice of the doping ion can enhance the electrical properties of PbS to be useful in photovoltaic applications. Depositions of ternary thin films have been demonstrated by a variety of techniques, including chemical bath deposition (CBD) (Gadave, et al., 1994), successive ionic layer adsorption and reaction (Puiso, et al., 2003) and sol-gel methods (Ray, et al., 1998). A lot of doping have been tested on thin films : conductive nanoparticles such as gold (Au) nanoparticles to dope silica glass intended to the manufacture of optical fibers(Le Rouge, 2013). Zn and Al doping effect on PbS thin films properties has been studied by B. Touati et al. 2015 and K.C Preetha et al. 2012, respectively. In this work, various impurities have been added in different PbS thin films deposited by CBD: Au nanoparticles, Cu and Zn. The main goal of the present work deals with the investigation of various doping effects on optical PbS thin films properties.

## Experiment Details

**Ordinary glass slides were used as substrates. They were washed with distilled water, immersed in methanol, cleaned ultrasonically for 20 min and dried in air, successively.**

The deposition was done in a reactive bath prepared in a beaker. The bath was composed of distilled water as a solvent, sulfur and lead precursors, 1M of thiourea [ $\text{CH}_3\text{CSNH}_2$ ] and 0.1M of lead acetate [ $\text{Pb}(\text{CH}_3\text{COO})_2$ ]. Triethanolamine (TEA) [ $\text{N}(\text{CH}_3\text{CH}_2\text{OH})_3$ ] was added as buffer solution to control the rate reaction and sodium hydroxide NaOH to fixe pH at 12.5. For the first part of this work, small rates (about 2 ml) of Au nanoparticles (colloidal gold), Cu ( $\text{CuCl}_2$ ) and zinc ( $\text{Zn}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$ ) were added in different beakers keeping another bath undoped as reference. The second part consists in co-doping PbS thin films with Zn and Au nanoparticles by adding a same volume of colloidal gold and zinc acetate simultaneously.

Cleaned substrates were vertically dipped in the heated solutions by external hot plate set at  $60^\circ\text{C}$  for 3hours. After the deposition elapsed time, the synthesized samples (PbS:  $x=0$ , Au, Cu, Zn, Zn-Au) were removed from the bath and rinsed with distilled water. Films with mirror-like gray aspect were characterized by X-ray

diffraction using a X'PERT PRO diffractometer with  $\text{CuK}\alpha$  radiation ( $\lambda_{\text{CuK}\alpha} = 1.54\text{\AA}$ ). The optical transmission of the PbS films were carried out by a double-beam spectrophotometer system (*SHIMADZU 3100S*) in the wavelength range 190-3000 nm. A non-contact profilometer (*AltiSurf500*) was used for the films thicknesses measurements. Electrical measurements were carried out using two-probes method with the aid of a *Keithley 2000 multimeter*.

## Results and Discussion

### Part 1

Observed with the naked eye, all PbS deposited films present a high reflectivity. They are smooth and blackish gray. The variation in the thickness of PbS layers with different doping is shown in Table I. The increase in the number of ions in the bath, due to doping, reduced mobility in the solution for lack of space, which indicates a slowdown in the deposition on the substrate (Kumar, et al., 2014) (Das, et al., 2012). We conclude decreased growth rates regardless of the doping atoms. This effect is expressed in terms of thickness reduction for doping zinc or copper. For the doping with au nanoparticles, the slowdown of the growth rate is probably offset by the large size of doping element which slightly increases the thickness of the film (Gültekin, et al., 2014). Doping with Al with substantial quantities also increases the thickness of PbS film (Preetha, 2014).

### Structural Properties

Figure 1 represents X-ray diffraction spectra of undoped and doped PbS thin films with the different elements: Au Np's, Cu and Zn. The spectra shows diffraction peaks at different  $2\theta$  angles assigned to the (111), (200), (220), (311), (222), (400) and (331) planes indicating the formation of PbS phase for all films. It can be seen the whole peaks intensities of PbS films are affected by doping; they decrease for Au Np's doping and increase for those with Zn and Cu. An appearance of a bump for the respective XRD spectra of the PbS: Cu and PbS: Zn films can be observed.

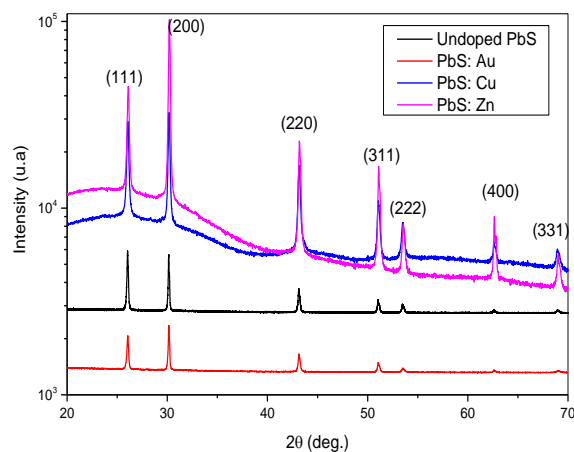


Fig.1. XRD patterns of PbS thin films, pur and with several doping (Cu, Zn and Au Np's).

This is generally indicative of the occurrence of an amorphous phase in the film but can also be due to the diffraction of the glass substrate (amorphous) caused by the thinness of the two films PbS: Cu and Cu: Zn (table I).

Table I. Optical properties of PbS films with several doping.

Samples	PbS	PbS: Au	PbS: Zn	PbS: Cu
Thickness (nm)	460	500	300	250
$E_u$ (eV)	0.27	0.30	0.37	0.41
$E_g$ (eV)	0.64	0.71	1.46	1.27

However, we notice the absence of peaks indicating the presence of Au, Cu and Zn in doped PbS films. This absence is probably due to the uniform dispersion of dopants in the PbS films network. Not forming clumps, those elements cannot diffract, as suggested in a study of the influence of Au N<sup>o</sup>s doped TiO<sub>2</sub> thin films (Gültekin, et al., 2014). It can also be assumed that at  $2\theta$  value of 53.5° there is a superposition of the (511) plane of the Au phase (card No. 021095) with the (222) plane of the PbS phase. The preferred orientation of crystallites growth in the deposited films is along the plane (111) for the undoped sample PbS and changes to the (200) for the doped films. This probably indicates a change in growth process in the presence of dopants. The change in the preferred orientation has been observed in many other materials (Preetha, et al., 2012), (Obaid, et al., 2013), (Osherov, et al., 2007) indicating the growth in three dimensions of the crystallites. The average crystallites size  $D$  and the strain  $\varepsilon$  within PbS doped films (along the preferred orientation) were calculated from the Scherrer equation:

$$\beta \cos \theta = k \lambda D + \varepsilon \sin \theta \quad (1)$$

Where  $\beta$  is the peak width at mid height,  $\theta$  is the diffraction angle,  $k$  is constant having a value of 0.9, the constant  $\lambda=1.54 \text{ \AA}$ .

The obtained values are given in Table II. As it can be seen, the crystallites size is affected by the element and rate of doping. It decreases for PbS: Zn and PbS: Cu films comparatively with the undoped PbS film. This decrease of  $D$  can be explained by shrinkage of the unit cell in these films. The substitution of Pb atoms of the PbS unit cell by Cu or Zn atoms leads to its size reduction in size, given their atomic radius: 154 pm, 145 pm and 142 pm. By cons, the crystallite size in the PbS: Au films increases slightly compared with that in the undoped films. It is possible that Au nanoparticles, placed at the center of the PbS cells, exert an expansive stress thereon leading to the lengthening of lattice parameter  $a$  which, in turn, induces an increase of the crystallite size  $D$  in PbS: Au films (table II).

Table II. Structural properties of PbS films with several doping.

	$2\theta$ (°)	(hkl)	$\beta$	$a$ (Å)	$D$ (nm)	$\varepsilon$ ( $10^{-2}$ )

<i>PbS</i>	26.33	(111)	0.086	5.923	102	1.05
<i>PbS: Au</i>	30.09	(200)	0.086	5.934	106	1.25
<i>PbS: Zn</i>	30.19	(200)	0.125	5.914	73	1.81
<i>PbS: Cu</i>	30.16	(200)	0.187	5.920	50	2.72

The lattice strain  $\epsilon$  of doped PbS films is greater than those of the undoped ones. It is known that the injection of doping in the film network generally creates additional strains (Thangavel, et al., 2012), (Touati, et al., 2015).

### Optical Properties

The transmittance spectra, in the visible and near infrared range wavelength of free and doped PbS films were shown in figure 2.

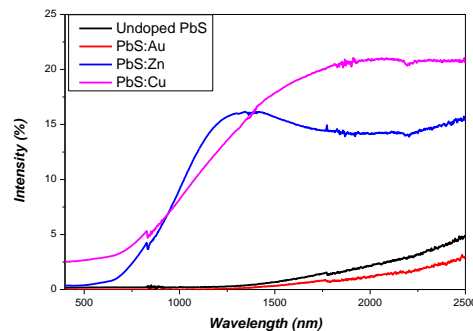


Fig.2. Transmittance spectra of PbS thin films, pur and with several doping (Cu, Zn and Au Np's).

The whole films exhibited a low transmittance in the visible range. The transmittance in the near infrared range varied from 3 to 20%. This difference can be explained in terms of difference in thickness (table I).

The optical energy gap  $E_g$  of the PbS films was calculated using Tauc formula:

$$\alpha h\nu = A(\alpha h\nu - E_g)^n \quad (2)$$

Where  $\nu$  is the frequency of the incident photon,  $h$  is Planck's constant,  $A$  is constant,  $\alpha$  is absorption coefficient and  $n$  is the number which characterizes the optical process ( $n=1/2$  for direct transition).

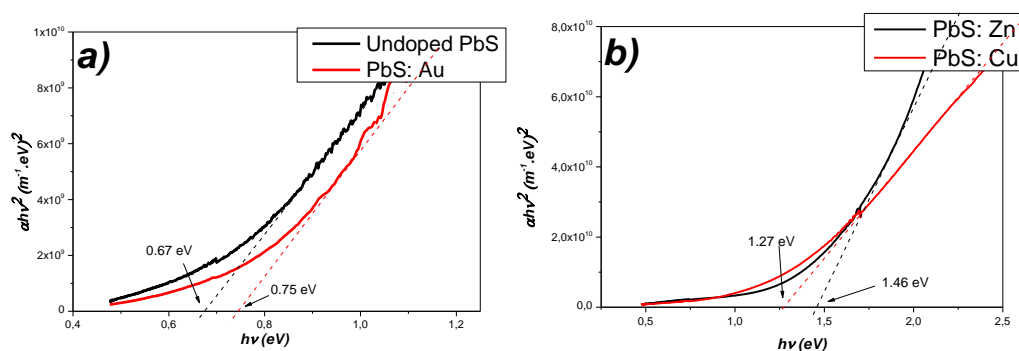


Fig.3. The plot of  $\alpha h\nu^2$  as a function of  $(h\nu)$  to extract energy band gaps of PbS thin films, pur and with several doping (Cu, Zn and Au Np's).

On figure 3, were represented the  $(\alpha h\nu)^2$  variation as function of  $h\nu$  to estimate the optical gap of doped PbS thin films. The results are reported in Table I. They indicate that the three elements: Cu, Zn and Au, tend to broaden the optical band gap of PbS films. This varies slightly from 0.67 eV for undoped sample to 0.75 eV for the PbS: Au film. However, a significant band gap widening was observed in PbS: Cu and PbS: Zn films, where its value is multiplied by a factor of 2 (1.27 eV and 1.46 eV for PbS: Cu and PbS: Zn films, respectively).

The three doping atoms would ensure an increase of the carrier concentration within PbS films. This increase shifts the Fermi level toward the valence band (p-type conductivity for all samples), it is the Burstein-Moss effect. The "seeming" optical gap in doped samples is greater than the gap of the undoped one. It is known that the optical gap is sensitive to doping. Several authors have observed its increase with doping concentration (Thangavel, et al., 2012), (Touati, et al., 2015). (Gültekin, et al., 2014).

Structural disorder  $E_u$  within PbS thin films network was calculated using Urbach formula (Urban formula). Its variation as function of the different doping elements is given in Table I. It can be observed that  $E_u$  varied from 0.27 to 0.41 eV with doping. The increase in the films disorder is a good indicator of the incorporation of doping atoms in the PbS matrix. This may be related to the different atomic radii of doping elements. The substitution of some Pb atoms by one of the three doping atoms leads probably to a slight variation such as the angle or length of the inter-atomic bonds. This fact leads to localized states appearance in PbS semiconductor which is the definition of disorder.

### Electrical Properties

The electrical conductivity  $\sigma$  of PbS films are measured in the dark, at room temperature. The obtained values, as function of the doping metal, are reported in table III. The incorporation of Au nanoparticles improves the conductivity of more than an order of magnitude while the Cu and Zn doping decreases it. The gold nanoparticles doping provides films more holes which are majority carriers (p-type conduction) and, therefore, improves the conductivity. Substitution of some  $Pb^{2+}$  ions by  $Zn^{2+}$  and  $Cu^{2+}$  probably causes a reduction of crystallites size by shrinkage of the unit cell (table II).

Table III. Electrical properties of PbS films with several doping.

<i>Samples</i>	<i>PbS</i>	<i>PbS: Au</i>	<i>PbS: Zn</i>	<i>PbS: Cu</i>
$\sigma$ (1/ $\Omega$ .cm)	0.15	2.06	0.014	0.04
<i>Type conductivity</i>	p	P	P	p

This fact is probably due to the inferiority of doping elements size comparatively with  $Pb^{2+}$  ions size (Touati, et al., 2015). The decrease of the size of the crystallites induces an increase in the grain boundaries density which impede carriers mobility and results in the decrease of the conductivity in the PbS: Zn and PbS: Cu films.

**Part 2**

Structural, optical and electrical PbS thin films properties can be altered through doping with various elements. There are several reports on PbS nanostructures doped with different elements as Al, Mn, Sn, Sb, and Cd (Kumar, et al., 2014), (Thangavel, et al., 2012), (Das, et al., 2012), (Thangavel, et al., 2010), (Silva, et al., 2009). B. Touati et al. 2015 have reported that Zn doping enlarges PbS films band gap from 0.72 eV to 1.46 eV and, then, suggested those films as absorbent layer in the modern solar cells devices. X. Zheng et al. 2016 attempted to reduce PbS thin films resistivity using Cu doping. They achieve a lowest value of 0.15 Ω cm at 6.3 at.% Cu doping but the optical film properties had not been studied. A low resistivity is desirable for electric and optoelectric device applications due to small power consumption. Besides, for solar cell, it will result in low series resistance and high fill factor so as to a high efficiency (Zheng, et al., 2016).

**Structural Properties**

Figure 4 represents X-ray diffraction spectra of co-doped PbS thin film. The spectra show diffraction peaks at different 2θ angles assigned to the (111), (200), (220), (311), (222), (400) and (331) planes indicating the formation of PbS phase for all films with no secondary phase. Peaks shift to higher angle values can be observed. However, we equally notice the absence of peaks indicating the presence of Au or Zn phases. This is probably due to the uniform dispersion of doping atoms in the PbS films.

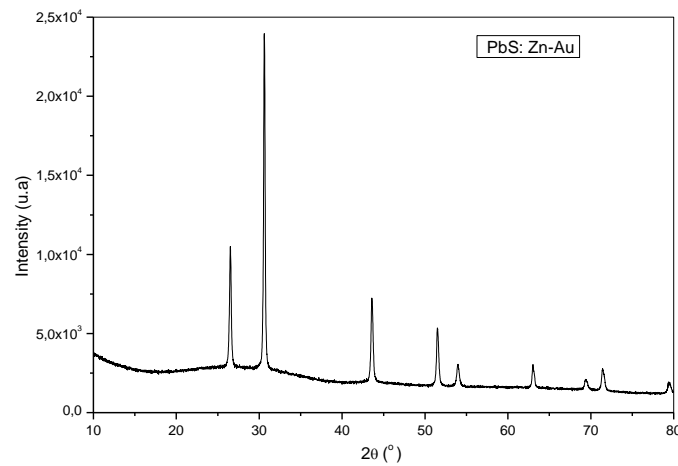


Fig.4. XRD patterns of Au-Zn co-doped PbS thin films.

The average crystallites size *D* and the strain  $\epsilon$  within Zn-Au co-doped PbS films (along the preferred orientation) were calculated using Scherrer formula (equation 1). The obtained values are given in Table IV.

Table IV. Structural properties of Au-Zn codoped PbS thin films.

	$2\theta (^{\circ})$	$(hkl)$	$\beta$	$a (A^{\circ})$	$D (nm)$	$\epsilon (10^{-2})$
<i>PbS: Au-Zn</i>	26.33	(111)	0.181	5.830	45.35	1.30

As it can be seen, the crystallites size is affected by the co-doping. It decreases to achieve a value of 50 nm comparatively with the undoped PbS film (part 1). This decrease of D can be explained by shrinkage of the unit cell in these films. Lattice parameter a, also calculated and reported in table I.V, is actually smaller in Zn-Au co-doped films than in the other studied PbS films. The crystallites size in the Zn-Au co-doped PbS films is close to their size in the Cu doped films studied in the first part.

### Optical Properties

The transmittance spectra in the visible and near infrared range wavelength of co-doped PbS film were shown in figure 5.

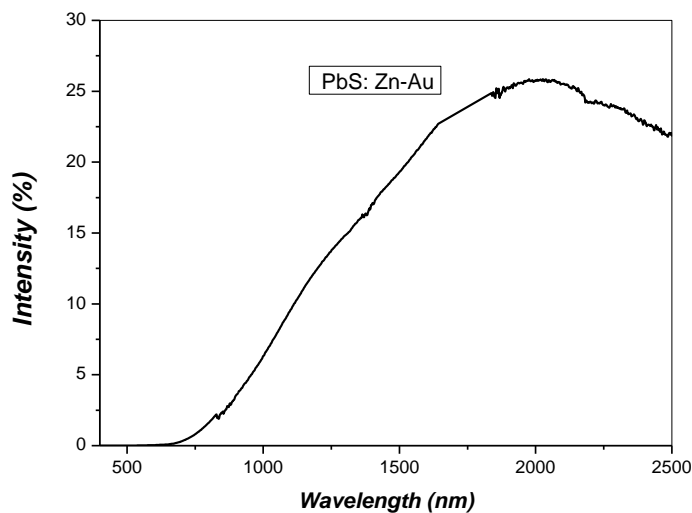


Fig.5. Transmittance spectra of Au-Zn co-doped PbS thin films.

The Zn-Au co-doped PbS film exhibited a low transmittance in the visible range and of about 25% in the infrared range.

The optical energy gap  $E_g$  of Au-Zn co-doped PbS films was calculated using Tauc formula (equation 2) and revealed to be equal to 1.39 eV. A significant band gap widening was observed in PbS: Au-Zn films as for PbS: Zn ones. The Burstein-Moss effect most be the explication of this gap widening.

### Electrical Properties

The electrical conductivity  $\sigma$  of PbS: Au-Zn films was also measured in the dark, at room temperature. The obtained value was 0.37/ $\Omega$ .cm. This result show that Zn-Au co-doping, in addition to enlarge the band gap, improve also the electrical conductivity unlike the Zn doping.

## Conclusion

PbS thin films were synthesized at low temperature (60 °C) by a simple chemical bath deposition. The influence of Au nanoparticles, Cu and Zn doping on PbS thin films properties has been explored. The crystalline nature, optical and electrical properties of the prepared films were determined using the X-ray diffraction, UV–visible spectrometry and Hall Effect measuring method. XRD studies showed that the deposited PbS films were polycrystalline and exhibited cubic crystal structure. There was a decrease in the crystallite size from 102 nm to 73 nm with Zn doping and to 50 with Cu doping in the PbS films. Hall Effect measurements showed that all deposited films have p type electrical conductivity. This last decreased by Zn doping and, on the contrary, increase with Au nanoparticles doping. Optical study on the analyzed films revealed that Zn et Cu doping enlarge band gap confirming the PbS film applicability as an absorber in modern solar cell devices. The Au-Zn co-dopage allows to broaden PbS film band gap and to improve its electrical conductivity at the same time which can be useful to reduce the resistance series in solar cell.

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## The Importance of DNA Profiling from Teeth for Forensic Purposes – A Case Report

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**Abstract:** DNA profiling from teeth was used for the first time in Albania in 2022, for forensic purposes. The case has been resolved in collaboration with experts of the Institute of Scientific Police and academic staff of Albanian University. On April 3, 2022, some bones and a skull were revealed to surface after the locals have burnt some bushes, in Fushë Kuqe, Kurbin, meanwhile, on May 2015, a 16 years old boy has been declared missing from his family. The police were informed and investigations began for identification. A full DNA profile of the victim was yielded by an intact molar tooth present in the recovered mandibula. The putative mother has already submitted a DNA profile, which was stored in the database of the Institute of Scientific Police. The two profiles were analyzed and compared, and the results consisted in a high compatibility leading to identification. The aim of this study case was to evaluate for the first time in Albania DNA profiling from teeth and provide expertise in the field. In conclusion, genetic profiling from teeth resulted in an efficient method for forensic identification purposes opening new perspectives for our country.

**Keywords:** Forensic Dentistry, DNA Profiling, PrepFiler BTA, First Permanent Molar, Albania

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## Introduction

Identification of human remains and their returning to families is a moral and legal obligation which is defined in international humanitarian law as a “sign of respect for family life...”(ICRC 2005). Article 24 (3) of CED highlights the obligation to return the human remains of the disappeared to the surviving members of the families (OHCHR., 2010). Also, Principle 2(4) of International Norms 2019 specifies that "return [of human remains] should also include the means and procedures necessary to ensure a dignified burial in accordance with the cultural rituals of their families and communities." (ICMP Bournemouth Protocol on Mass Grave Protection and Investigation published, 2020). Such principles and norms apply not only in identification of mass graves or massive disasters but without any doubt also in individualized cases such as homicide, trauma, accidents, where human remains can be identified and should return to their afflicted families to bring some relief.

Many times, the process of human identification can be very complex because of the inability to recognize the person by the usual identification methods. Identification of human remains is realized based on 4 different methods such as: fingerprints, analyses of physical indicators, DNA profiling and dental examinations (Zajkowska AZ., & Zander HH., 2022]. Dental identifications have been used since ancient times, and nowadays have become a very valuable tool because of the positive results in human identification. This identification is usually made through comparison of dental records before death (*ante mortem*) and after (*post mortem*). Different prosthetic pieces, orthodontic appliances, fillings, implants in oral cavity or specific dental characteristics such as teeth morphology, position, and alignment and palatal rugae patterns, can help in the process of identification, since the dental formula and oral cavity are unique and specific dental treatments are so individualistic.

However, identification of human remains is highly influenced by the post mortem interval, the environmental conditions to which the remains have been exposed and other factors that might have contributed to their deterioration, destruction or missing. When usual dental methods of identification cannot be applied, DNA material extracted from teeth can provide a genetic profile that can be used for identification. Comparison of DNA preserved in and extracted from the teeth of an unidentified individual can be made to a known *ante mortem* sample (stored blood, hairbrush, clothing, cervical smear, biopsy, etc) or to a parent or sibling (Pretty IA & Sweet D., 2001). In this context teeth are considered an excellent source of DNA material because they present a resistant nature to environmental assaults, such as incineration, immersion, trauma, mutilation, and decomposition (Schwarz TR., *et al.* 1991). Teeth are highly mineralized structures, the most resistant tissues of the entire human body, well protected by bone and muscles, which have a reduced chance of being

contaminated. Besides providing a good source of DNA teeth can also help in sex and blood group determination and age estimation (Nandini DB., & Joji, JG., 2020).

The recommendations for genetic identification are the collection of intact and well-preserved teeth, with completely formed root apices, and free of dental restorations or caries. From all types of teeth, first molars are the most recommended ones followed by second molars and third molars whereas incisors are the least preferred (International Commission on Missing Persons, ICMP 2015).

In this study we present a case of successful human remains identification using a full genetic profile from an intact first mandibular molar, extracted from a partly incinerated mandibula. This form of forensic identification was the first one of its kind realized ever in Albania and was made possible by specialists of Institute of Scientific Police and academic staff and alumni of Albanian University, in 2022.

### **Case Report**

On May 18, 2015, 16-year-old M.GJ., woke up and told his mother that there was going to be an activity in the school and that he wouldn't be late. He left for school and was never seen again. His mother, after looking for him, asking relatives and neighbors all night long, went the next day to the police declaring her son missing. After some searching attempts for several months the police gave up, leaving the mother and familiars in expectation.



Figure 1. Photo from the place where the bones were found

On April 3, 2022, somewhere in Fushë-Kuqe, Kurbin, some bones and a skull were revealed after the locals burnt some bushes. The police were informed, the bones were recovered by them and the Prosecutor's Office of Kurbin immediately began investigations for their identification. After a few days, the Prosecutor's Office requested the DNA profile of the victim. The mother had already submitted a DNA profile which was stored in

the database of the Institute of Scientific Police. The two profiles were analyzed and compared, and the results consisted of a high compatibility. After 7 years the police confirmed that the victim has been identified as M.GJ. who was missing since 2015. Forensic experts have concluded that some of the bones found around Fushë-Kuqe, turned out to be damaged with strong tools. Specialists were not able to determine which were the tools used to hit the victim, but this fact has raised suspicions that M.Gj. was violated with hard objects before he was killed (www.panorama.al, 2022).

## Method

From the recovered bones, a femur and a mandibula with some intact teeth in it (Figure 2), were sent by the police to the Institute of Scientific Police for analysis. One intact tooth, a first mandibular molar, was pulled out of the alveolus and prepared for DNA extraction.



Figure 2. Recovered mandibula

### Preparation for sample extraction.

The first mandibular molar was cleaned by washing with Sodium Hypochloride 3%-5% for 5-10s 3 times, after the first wash scrubber with brush to clean the outer surface and washed twice, rinsed with saline water and washed with free DNA water. This first molar was dried in a fume cabinet for 4 - 5h at room temperature before cutting it into some pieces. The pieces of the first molar were powdered in the instrument “Analysette 3 Spartan pulverisette” (FRITSCH, Germany) with sieving time of 30 min twice. Regarding the quality of powder the process can be repeated till the fine powder is produced. Three samples were prepared for extraction with amounts of 50 mg, 120 mg and 180 mg of powder from the first molar. The same procedure was carried out for the femur and two samples of 120 mg and 180 mg were prepared.

### DNA extraction

The extraction of DNA was done with PrepFiler® BTA™ Forensic DNA Extraction Kit following the manufacture's protocol for the sample of 50mg powder (Thermo Fisher Scientific) in Automate Express equipment. Incubation for all three samples was the same 56°C for 2 hours, meanwhile different quantities of lysis buffer solution, DTT 1M and proteinase K were used according to the amount of powder. The total DNA extracts of 50 µl were obtained for all the tree samples, as well as for the bone samples. The isolated DNA can be stored at 4°C for up to one week, or at -20°C for a longer time.

### STR typing

The commercial STR kit used for this study is Applied Biosystem AmpFLSTR™ NGM SElect™ kit (Thermo Fisher) a five dyes kit which simultaneously amplifies 16 separate STRs: D3S1358, vWA, D16S539, D2S1338, D8S1179, D21S11, D18S51, D19S433, THO1, FGA, D10S1248, D22S1045, D2S441, D1S1656, D12S391 and SE33 and the sex determining marker Amelogenin. For all the samples, double pcr reactions were performed, so there were 6 pcr reactions in total. PCR reactions using mix and primers with maximum DNA extracted (10µl) and the final volume of PCR product is 25 µl performed in Veriti™96-Well Thermal Cycler according to manufacturer's guidelines.

### Electrophoresis and analysis

Fragment separation was performed using ABI PRISM® 3500 Genetic Analyzer (Applied Biosystems) using POP-4 polymer and the collection software Data Collection, version 2.0. Data was sized using GeneMapper™ID-X Software version 1.5 (Applied Biosystems).



Figure 3. a. Analysette 3 Spartan pulverisette, b. Automate Express, c.3500 Genetic Analyzer

### Results

All the processes described in this study were performed in the DNA forensic laboratory in the Institute of

Scientific Police in Tirana Albania. The same full DNA profile was obtained from the DNA extract of samples with 120 mg and 180 mg tooth powder from 4 pcr reactions. This profile is shown in Figure 4 and is a male DNA profile (Amelo X,Y). The DNA extract from the sample with 50 mg tooth powder gave a partial profile. All the positive loci in the three DNA profiles gave repeatability of the same results. As for the bone samples we couldn't get any genetic profile that we could analyze and compare.

The male DNA profile was compared with the DNA profile of a female which has spent several years searching for her missing son and her DNA profile was stored in the database of the Institute of Scientific Police. The DNA profile of the putative mother was obtained from a saliva swab, the extraction was performed manually, using QIAamp DNA Investigator Kit for extraction. For amplification was used the same kit as for the tooth and the sequencing was performed using ABI PRISM® 3500 Genetic Analyzer. The genetic profile of the putative mother is shown in Figure 5.

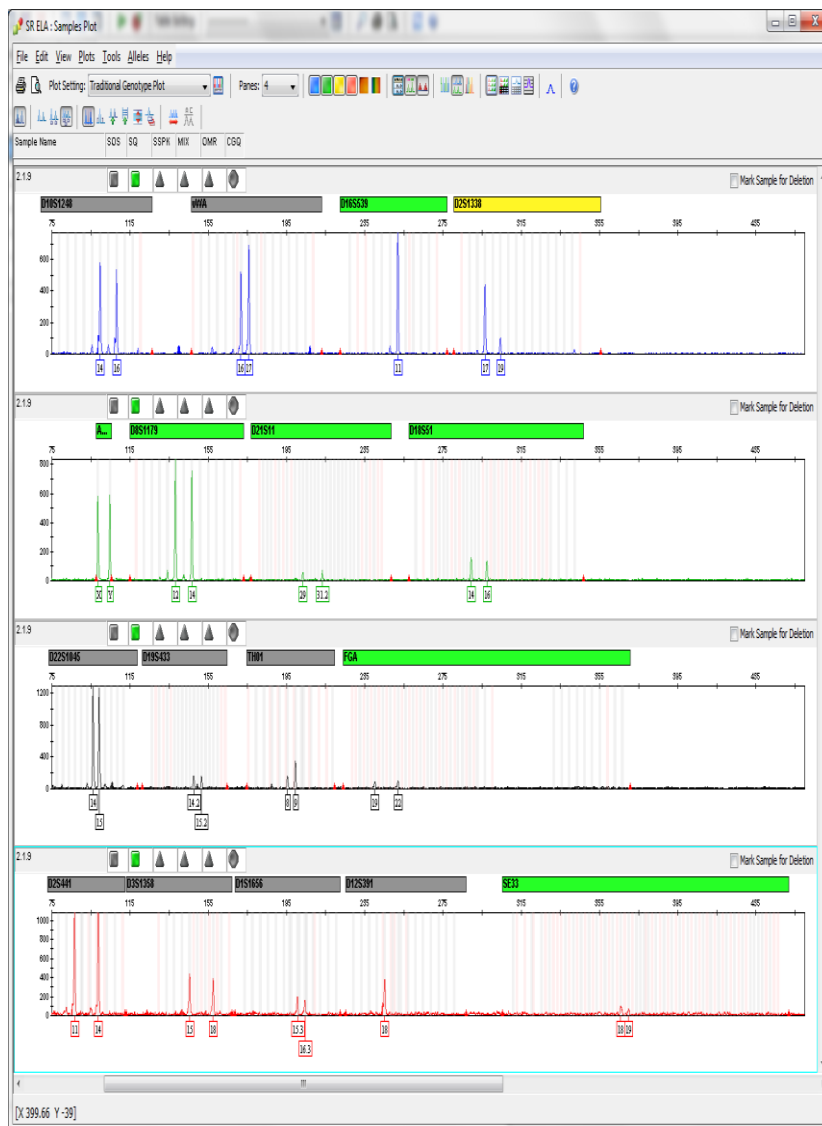


Figure 4. Full genetic profile from first mandibular molar



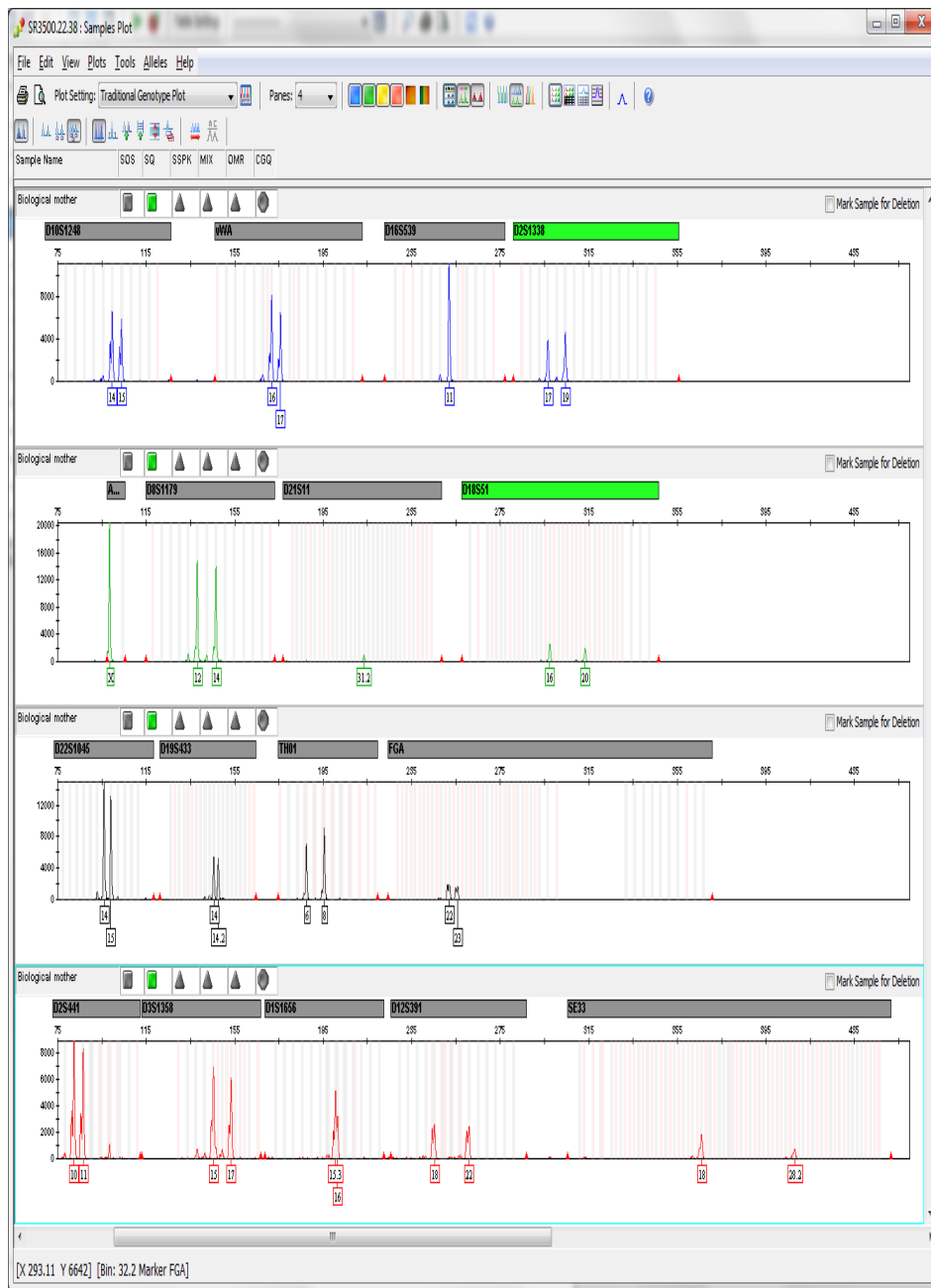


Figure 5. Full genetic profile from putative mother

By comparing these two DNA profiles we observed that for all the loci studied, one allele of the female DNA profile was present in the male DNA profile (see Table 1). This compatibility according to Mendel law for inheritance refers to the genetic relation biological mother- biological son. Statistical evaluation was performed with Familias software version 3 <http://www.familias.no>. Using the allele frequency of the Albanian population, the value for LR (likelihood ratio) is  $LR = 834267.4103$ . The LR is based on two hypotheses which are: hypothesis one - this female is the mother and hypothesis two - another female is the mother. This value of LR means that it is slightly more than 834267 times more likely that the putative mother is the biological mother of the profile obtained from the tooth than any other female chosen at random, from the Albanian population. This

led to the identification of the human remains and the identity of the missing person was confirmed.

Table 1. Allelic data of the two profiles

Genetic marker	Tooth	Putative mother
D10S1248	14-16	14-15
vWA	16-17	16-17
D16S539	11-11	11-11
D2S1338	17-19	17-19
D8S1179	12-14	12-14
D21S11	29-31.2	31.2-31.2
D18S51	14-16	16-20
D22S1045	14-15	14-15
D19S433	14.2-15.2	14-14.2
TH01	8-9	6-8
FGA	19-22	22-23
D2S441	11-14	10-11
D3S1358	15-18	15-17
D1S1656	15.3-16.3	15.3-16
D12S391	18-18	18-22
SE33	18-19	18-28.2
AMELO	X-Y	X-X

## Discussion

The results of this study confirm the fact that teeth play an important role in the identification of unidentified human remains and can be considered as reliable sources of DNA used for forensic cases. Teeth and bones are tissues that can preserve DNA for very long times due to their solid and very calcified structure, although

different environmental conditions, DNA extraction methods and DNA analysis seem to have an impact on the DNA concentration, quality and profiling success (Schwarz TR., *et al* 1991, Latham KE., *et al* 2018, Heathfield LJ., *et al* 2021, Lozano-Peral D., *et al* 2021). In our study samples from both femur and teeth underwent for analysis, but only teeth could provide a DNA profile useful for identification. We could not provide a successful DNA profile from the femur sample due to the highly destructive state caused by the burnt, even with greater amounts of bone powder (120mg and 180mg). Previous studies have shown that DNA extracted from burnt bone fragments may be highly degraded, making amplification of genetic markers difficult or even impossible (Schwark T., *et al*, 2011). In this case, bones were discovered after locals have been burning their lands and the fire must have degraded the bones entirely. As for the teeth, they were only partially burnt so DNA extraction was possible and genetic profiles could be generated.

In our study, three samples of 50 mg, 120 mg and 180 mg tooth powder were prepared. Although the PrepFiler® BTA Forensic DNA Extraction Kit protocol recommends a sample of up to 50 mg of tooth powder for DNA extraction (PrepFiler® and PrepFiler® BTA Forensic DNA Extraction Kits User Guide, 2012), we also prepared two other amounts of tooth powder, in order to compare the genetic profiles that could be yielded. The amount of DNA extracted from the larger samples of powder gave full genetic profiles compared to the 50 mg sample, which gave only a partial genetic profile. This result is consistent with those of Varrathyarom P., *et al*, (2022), who recommend greater amounts of powder for higher DNA yield.

According to Schwarz TR., *et al*. (1991), there are several factors affecting the amount of DNA in a tooth such as type of tooth (incisor, canine, premolar, molar), condition of teeth prior to extraction (degree of decay), condition of tooth following trauma, period of time from extraction to DNA isolation, and age of the individual. Regarding the type of tooth that can provide better results for genetic identification, Standard Operating Procedures of International Commission on Missing Persons (ICMP) (2015), recommend as first choice first permanent molars with closed apices and free of decay. Among all possible teeth candidates in the present study, the first mandibular molar was chosen for analysis and represented a very good candidate which provided sufficient amounts of powder for DNA extraction and profiling. However, there are other studies that suggest that premolars followed by canines perform better than molars in DNA profiling (Heathfield LJ. *et al*, 2021). We suggest that attempts with different types of teeth should be made in cases where there are no other choices, because they represent very good sources of DNA profile.

A study of Mansour H, *et al*. (2019), has shown that post mortem interval is the most important factor that influences DNA quantification. They demonstrated that 10 days after death the amount of dental DNA that could be yielded decreased dramatically. This observation is supported by the results of our study, where greater amounts of dental DNA were necessary to provide full genetic profiles, considering the long post mortem interval of 7 years.

In the literature there are several case reports of successful human identification from DNA profiling from teeth.

Sweet DJ, & Sweet CH, (1995) reported the identification of an entirely carbonized body from the DNA extracted from an unerupted third molar. Kaur S, *et al.* (2018) reported the identification of a severely decomposed body by dental DNA STR analysis. More recently, Kumar N, and Sharma A, (2021), used a powder - free method of dental DNA analysis, to successfully identify fragmented remains of a human skeleton, whereas Varrathyarom P., *et al.* (2022) demonstrated efficacy of bead-beating homogenization technique for DNA extraction in solving forensic casework by using teeth sample. There are cases also, where DNA profile cannot be generated due to very aggressive condition to which human remains are exposed to. Such a case was reported by Kumar *et al.* (2018) where DNA could not be extracted from molars and the premolars of a highly decomposed and badly charred body.

In Albania, forensic dentistry is at its beginnings since this was the first case of forensic identification that was resolved through DNA profile from teeth. The positive results of this study are very encouraging and create new opportunities for investigation of other difficult cases in our country, where usual techniques of identification fail. Regardless of harsh conditions or state of the human remains, efforts should be made to resolve those cases for legal and moral considerations.

## Conclusion

In the present study, DNA profiling from teeth (first mandibular molar) showed better results than DNA profiling from bones (femur). Genetic profile from teeth resulted in positive identification of human remains and identity of person was established. Extraction with the PrepFiler BTA protocol was a suitable method. In every case, it is important to take in consideration all factors that can influence the extraction, concentration, quality and the profile of DNA. Environmental conditions as well as post mortem interval are very influential factors to the final result. Also, increasing the amount of tooth powder influences DNA concentration to be yielded and so the results. The findings of this study are very encouraging, and genetic profiling from teeth should be considered in other cases of forensic identification.

## Recommendations

We recommend that the amount of dental material for DNA extraction should be at least 100 mg. The amounts of Lysis Buffer BTA, DTT 1M and proteinase K should be calculated depending on the initial amount of extracted DNA. We recommend DNA profiling from teeth as an important method of identification for forensic purposes when other identification methods fail.

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## Enhancing Root Canal Treatment Efficacy in Chronic Apical Periodontitis with Diode Laser Therapy

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**Abstract:** The eradication of microorganisms from the intricate anatomy of the root canal, microbial invasion of dentinal tubules, and formation of intracanal biofilm present significant challenges in endodontic treatment. However, the use of dental lasers has shown promising advancements in endodontic diagnoses. This study aims to assess the clinical and radiological efficacy of utilizing a diode laser for the treatment of chronic apical periodontitis. A total of 84 patients aged between 20 to 70 years participated in the study, with a combined total of 91 teeth. The patients were divided into two groups: the control group comprised 40 patients, with 30 monoradicular teeth and 11 multiradicular teeth, receiving the traditional chemo-mechanical processes. On the other hand, the study group consisted of 44 patients, with 36 monoradicular teeth and 14 multiradicular teeth, which underwent both chemo-mechanical processes and treatment with a diode laser operating at a wavelength of 980 nm. The cases were closely monitored clinically and radiologically for a period of 6 to 12 months to evaluate the efficacy of the treatments. The use of a diode laser resulted in a significantly lower number of complications compared to the control group. After 12 months, the study group exhibited an impressive success rate of 96% with a failure rate of only 4%. In contrast, the control group experienced several complications within the first 6 months, yielding a success rate of merely 78.1% after 12 months, along with a complication rate of 21.9%. These results strongly suggest that incorporating a diode laser in traditional chemo-mechanical processes may enhance the success rate of endodontic treatments in cases of chronic apical periodontitis. Moreover, diode laser processing has been found to effectively sterilize the root canals, leading to high-quality treatment outcomes. By modifying the traditional endodontic treatment protocol to include diode laser processing, the quality and effectiveness of root canal treatment can be significantly improved. This innovative approach has the potential to revolutionize the field of endodontics by ameliorating treatment success rates and minimizing complications. Further research and long-term studies are necessary to explore the full potential of diode lasers in endodontic therapy, but the preliminary findings of this study are promising and

provide a foundation for future advancements.

**Keywords:** Chronic apical periodontitis, Diode laser, Endodontic treatment, Periapical lesion, Microorganisms.

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## Introduction

Achieving an effective endodontic treatment heavily relies on ensuring a high-quality antiseptic treatment of the root canal. This crucial stage involves the removal of tissue remnants, the smear layer, and the thorough elimination of microorganisms (Haupt et al., 2020; Mancini et al., 2013). However, completely eradicating microorganisms from the root canal is challenging due to several factors. The complex anatomy of the canal, deep microbial invasion in the dentinal tubules, and the formation of an intraradicular biofilm, along with surface contamination at the root apex, contribute to the persistence of apical periodontitis (Siqueira et al., 2022; Abusrewil et al., 2020).

One of the most effective irrigants used in the chemical treatment of root canals is sodium hypochlorite (NaOCl) solution, typically ranging from 2.5% to 5.25%. This solution plays a crucial role in proteolysis of the pulp tissue and breakdown of organic components present in the softened dentine layer. Additionally, NaOCl exhibits strong antimicrobial properties (Haapasalo et al., 2014). To effectively target the inorganic components, a combination of NaOCl and 17% ethylenediaminetetraacetic acid (EDTA) is necessary. This combination allows for comprehensive cleaning and disinfection of the canals (Haapasalo et al., 2014). It is important to note that merely using mechanical instrumentation to eliminate bacterial microflora from the canals is insufficient. To address this, canal irrigation systems coupled with antiseptic medications have been employed (Haapasalo et al., 2014; Boutsoukis et al., 2022).

The application of laser technology in Endodontics has revolutionized the treatment of caries complications, introducing a wide range of characteristics that make it suitable for various sectors of dentistry (Bordea et al., 2020). The 980 nm laser diode operates by absorbing specific substances such as water, hemoglobin, and melanin, collectively referred to as "endochromophore substances." This absorption process leads to an increase in tissue temperature, known as the photothermal effect. Furthermore, the laser-induced plasma formation and tissue softening result in the photoacoustic effect. These effects initiate chemical reactions that break chemical bonds within molecules, demonstrating the photochemical effect (Fazlyab et al., 2021; Pelozo et al., 2023). It is important to note that neither laser treatment alone nor the use of hypochlorite irrigant can guarantee complete sterility of the root canal. The narrow diameter of dentinal tubules, measuring only



3 µm, along with the presence of lateral canals, limits the penetration depth of antiseptic solutions to a maximum of 100 µm (Virdee et al., 2020). In contrast, microorganisms can penetrate the dentin canals at depths ranging from 300 to 700 µm and beyond (Berkiten et al., 2000). Laser light exhibits potent bactericidal properties, enabling its action at depths of 500-1000 µm, depending on the power of the radiation source (Gutknecht et al., 2000).

The aim of this study is to demonstrate the efficacy of endodontic treatment, specifically in cases involving chronic apical periodontitis, by employing a diode laser with a wavelength of 980 nm and a laser power ranging from 0.8 to 1.0 W within the root canals. To achieve this, we will present radiological data that highlight the positive outcomes resulting from this laser-assisted approach.

## Method

### Study design

In this clinical study, a cohort of 84 patients, aged between 20 and 70 years, with a total of 91 teeth, was selected for treatment. Among these, 64 teeth were monoradicular, and 27 teeth were multiradicular, as detailed in Table 1. Prior to treatment, a comprehensive anamnesis was conducted, revealing that 21 patients had a diagnosis of chronic granular periodontitis affecting 24 teeth. Additionally, 48 patients presented with chronic granulomatous periodontitis involving 52 teeth, and 15 patients had reacute chronic periodontitis affecting 15 teeth.

Table 1. The distribution of patients and teeth based on the diagnosis.

Diagnosis		Number of patients	Number of teeth	Teeth	
				Monoradicular	Multiradicular
Chronic	granular	21	24	14	10
	periodontitis				
Chronic	granulomatous	48	52	40	12
	periodontitis				
	Cystic granuloma	15	15	10	5
	Total	84	91	64	27

The patients were divided into two groups, and informed consent was obtained from each participant after providing detailed information regarding the endodontic procedures, potential pain, and possible side effects.

### Endodontic treatment of the first group

The first group, known as the control group, consisted of 40 patients. Within this group, 30 monoradicular teeth and 11 multiradicular teeth were selected for treatment using the traditional method, which involved performing

chemo-mechanical processing.

Following the diagnosis, the standard endodontic protocol was implemented, starting with the placement of a rubber dam to isolate the treatment area. The next step involved cavity preparation using a suitable bur kit from Dentsply Maillefer (Ballaignes, Switzerland). Chemo-mechanical preparation of each tooth commenced with the examination of root canal entrances, employing manual Ni-Ti instruments sized 10-15 (Dentsply Maillefer, Ballaignes, Switzerland), and alternating with Mtwo<sup>®</sup> rotary instruments from VDW GmbH (Munich, Germany).

Canal preparation was accomplished utilizing the step-back technique. Following the use of each instrument, the canals were thoroughly irrigated with 5.25% sodium hypochlorite (NaOCl) solution from Cerkamed (Stalowa Wola, Poland), followed by the application of 17% EDTA gel, also from Cerkamed, to remove the smear layer. For irrigation, a volume of 10 mL of NaOCl solution was used for each canal, which was left in contact with the canal for 20 minutes.

Following the previous step, saline solution was initially applied, followed by 2% chlorhexidine gluconate (GLUCO-CHEX; Cerkamed, Stalowa Wola, Poland) using a NaviTip 30-G needle from Ultradent (South Jordan, UT, USA) with passive irrigation. Each canal was then gently dried using sterile paper absorbent from Meta Biomed (Colmar, PA, USA). Once dry, the canals were sealed using AH Plus<sup>®</sup> sealer paste from Dentsply Sirona (Italy) and gutta-percha with lateral condensation, extending up to the physiological apex of the tooth root. The final restoration of the tooth crowns was achieved using Competence Universal<sup>®</sup> composite material from WP GmbH (Barmstedt, Germany).

### **Laser diode treatment of the second group**

In the study group, which comprised the second group, a total of 44 patients were selected. Within this group, 36 monoradicular teeth with chronic periodontitis and periapical destruction, as well as 14 multiradicular teeth, were included. Similar to the control group, the endodontic protocol was applied to the study group. It commenced with the placement of a rubber dam to isolate the treatment area. Subsequently, the cavity was opened using an appropriate bur kit from Dentsply Maillefer. The chemo-mechanical preparation of each tooth began by examining the root canal entrances, utilizing manual Ni-Ti instruments with dimensions 10-15 from Dentsply Maillefer, in combination with Mtwo<sup>®</sup> rotary instruments from VDW GmbH.

The canal preparation was carried out using the step-back technique. After each instrument, the canals were thoroughly irrigated with 5.25% NaOCl solution from Cerkamed. Subsequently, a 17% EDTA gel from Cerkamed was applied to chelate and remove the smear layer. The NaOCl solution was used in a volume of 10 mL for each canal and left in contact with the canal for 20 minutes. Following the irrigation step, saline solution was applied, followed by the application of 2% GLUCO-CHEX from Cerkamed using a NaviTip 30-G needle from Ultradent, with passive irrigation.

In addition to the procedures described above, the study group underwent a laser therapy session. This session involved the presence of NaOCl irrigant inside the canal, followed by the insertion of a diode laser fiber optic (QuickLase Ltd, Canterbury, UK) with a wavelength of 980 nm and laser power ranging from 0.8-1.0 W. The fiber optic was applied with circular or spiral movements from the apex towards the crown for a duration of 30 seconds, with a frequency of 20 Hz and pulsed mode.

To disinfect the apical region, the optical fiber of the laser diode was securely fixed using a stopper at the appropriate working length. It was positioned at a distance of 1.5-2 mm away from the anatomical apex to prevent any potential damage to hard and soft tissues. The optical fiber had a diameter of 200  $\mu\text{m}$ , and the 30-second laser procedure was repeated three times in each canal during the session. Throughout the procedure, the patient was instructed to promptly indicate any pain or discomfort, including an unbearable sensation of warmth.

Subsequently, the canals of these patients were carefully dried using sterile paper absorbents from Meta Biomed. Once dry, the final canal obturation was performed using AH Plus<sup>®</sup> sealer paste from Dentsply Sirona and gutta-percha with lateral condensation, extending up to the physiological apex of the tooth root. The restoration of the tooth crowns was accomplished using Competence Universal<sup>®</sup>, composite material from WP GmbH.

Both groups were closely monitored during a short-term follow-up period of 6 months and a long-term follow-up period of 12 months following the completion of the treatment.

## Results

### Radiological assessment of the control group

Following the completion of the definitive endodontic treatment, clinical complications were observed within the initial 6-month and 12-month periods. The overall outcome indicated a success rate of 78.1%, while complications accounted for 21.9% of the cases (Figure 1).

Shortly after the completion of the treatment, we conducted an assessment that included the following aspects:

*i. Evaluation of pain:*

We assessed the presence and intensity of pain experienced by the patients after the endodontic treatment. This included determining the occurrence of severe and persistent pain, as well as the reduction of pain, sensitivity, and discomfort during biting. Patients reported pain sensitivity that lasted from 1-2, 3-5, and even up to 6 or more days.

*ii. Assessment of periodontal inflammation:*

We examined the presence of signs indicating inflammation of the periodontium. These signs included changes in facial configuration, hyperemia (redness), and edema of the mucous membrane in the region of the

transitional fold. Additionally, we observed any pain experienced during biting, which could indicate inflammation in the affected area.

During subsequent follow-up appointments, we also evaluated the presence of persistent symptoms, objective signs of periodontal inflammation, and any changes in the periapical tissues. These assessments were made through radiographic examination to detect any abnormalities or changes in the affected area.

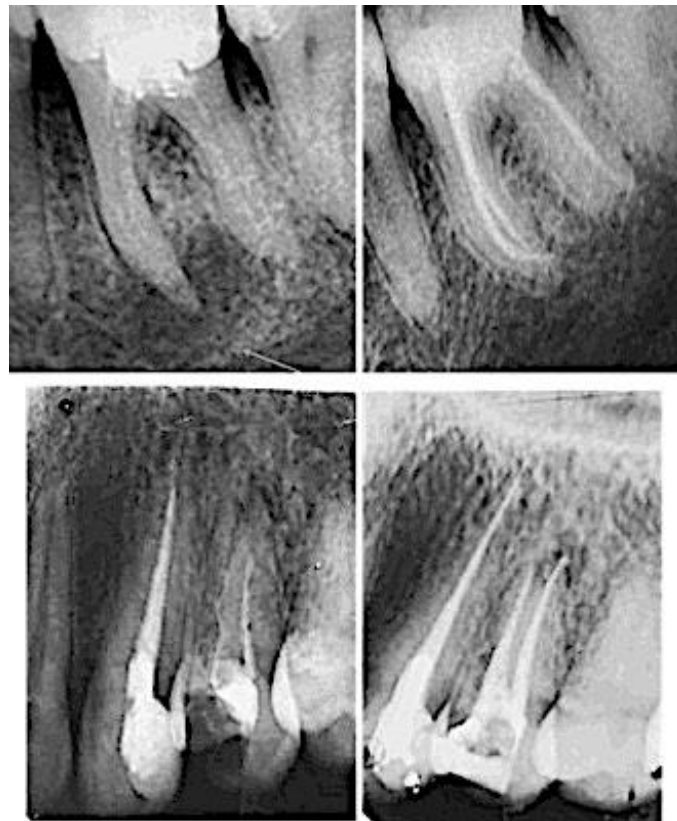


Figure 1. Radiographic presentation of chronic apical periodontitis cases from the control group:

In the upper panel, molar no. 46 is depicted before the treatment and after a 12-month follow-up period. Meanwhile, the lower panel displays the canine (no. 23) and premolar (no. 24) before the treatment and after a 12-month follow-up period. These cases demonstrate evidence of partial bone regeneration.

### Radiological assessment of the study group

The laser endodontic treatment demonstrated its effectiveness over a period of 12 months. Notably, no patient reported suffering, and there were no clinical indications of periodontal inflammation. Furthermore, radiographic examinations revealed the absence of bone tissue destruction and instead displayed a positive regenerative trend.

During the long-term follow-up period, following the radiological control (as depicted in Figure 2), a significant decrease in the number of clinical complications was observed. The success rate reached an impressive 96%, with only a 4% failure rate after 12 months.

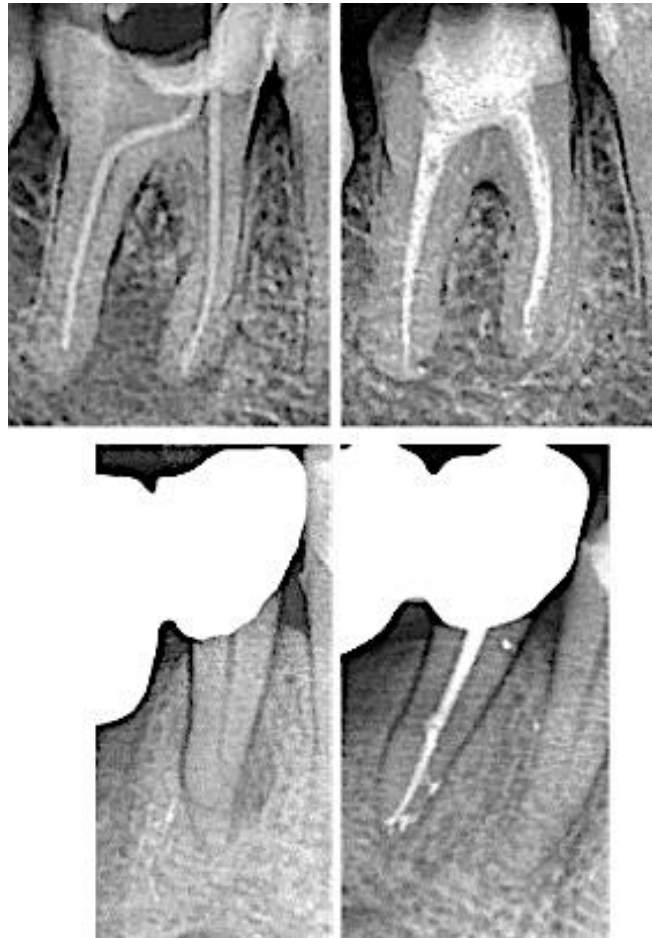


Figure 2: Radiographic evaluation of chronic apical periodontitis cases from the study group.

In the upper panel, molar no. 36 is displayed before the treatment and after a 12-month follow-up period. Meanwhile, the lower panel showcases the premolar (no. 45) before the treatment and after a 12-month follow-up period. In both cases, a remarkable and complete bone regeneration is clearly observed.

## Discussion

The primary objective of this study was to demonstrate the effectiveness of endodontic treatment using a 980 nm diode laser in cases of chronic apical periodontitis. In order to minimize undesired heating caused by the photothermal effect during the laser procedure, a pre-irrigation step with NaOCl solution was implemented during the endodontic treatment of our clinical cases. Previous studies have highlighted that the propagation characteristics of laser light and the ability to penetrate energy into the dentin walls of the canal have contributed to a significantly higher disinfection efficacy compared to traditional chemical irrigation methods (Mishra et al., 2022; Silva et al., 2012).

During our study, we observed a notable acceleration in the stimulation and regeneration of destructive foci in the periapical bone tissue in the study group, particularly among young patients, who exhibited a faster

regenerative response. In contrast, the control group, treated with the traditional method, showed a deceleration in the regenerative processes of periapical foci, particularly in patients over 50 years of age. This observation suggests a decline in the body's immune response and a slower stimulation of regeneration in older individuals. These findings support the assertion that the modified endodontic protocol utilizing a diode laser in combination with NaOCl and EDTA can be safely and successfully applied, surpassing the efficacy of other traditional methods. Several authors have provided evidence in support of this claim, demonstrating that the utilization of a diode laser in conjunction with NaOCl irrigant and EDTA chelant significantly reduces the bacterial population in the endodontic system, including *Enterococcus faecalis*, in up to 99.9% of cases (Borges et al., 2017; Preethee et al., 2012).

Furthermore, we observed a significant reduction in post-operative complications associated with chronic apical periodontitis in the study group, achieving a success rate of 96% and a failure rate of 4% after 12 months. In contrast, patients in the control group experienced complications both within the first 6 months and after 12 months, resulting in a success rate of 78.1% and a complication rate of 21.9%. Mandras et al. demonstrated the effective decontamination capability of the laser in the presence of NaOCl, reaching a depth of 130  $\mu\text{m}$  within the dentinal walls of the root canal (Mandras et al., 2020). It is worth highlighting that various authors have recommended the combination of laser with NaOCl irrigant for intracanal procedures to achieve optimal removal of the softened dentin layer (Sarda et al., 2019; Amin et al., 2016; Rajakumaran et al., 2019). On the other hand, the combination of laser with distilled water did not result in complete removal of necrotic tissue from dentin canals or the softened dentin layer. These findings emphasize the importance of utilizing the laser in conjunction with NaOCl irrigant for efficient disinfection and removal of infected tissue in the root canal, leading to improved treatment outcomes in cases of chronic apical periodontitis.

The combination of the diode laser with NaOCl has demonstrated strong bactericidal action, leading to the destruction of bacterial membranes and subsequent absorption (Sarda et al., 2019; Amin et al., 2016; Rajakumaran et al., 2019). Understanding the mechanism of action of the diode laser during endodontic treatments is crucial to comprehend its favorable results. The thermal energy generated by the diode laser induces changes in the intensity of penetration into the dentin walls, causing significant structural alterations in bacterial cells. The process starts with the destruction of the bacterial cell membrane, which disrupts the osmotic gradient and leads to changes, swelling, and ultimately, the destruction of the cells. The fundamental goals of endodontic treatment are to eliminate and stimulate the infected canal system, focusing on key stages such as preparation, disinfection, and intracanal obturation (Sarda et al., 2019). The photothermal effect of laser wavelengths damages cell membranes, and it should be noted that gram-negative bacteria are more easily destroyed compared to gram-positive bacteria, even with lower energy levels (Jambagi et al., 2021). These differences in bacterial susceptibility can be attributed to the structural characteristics of the cell membranes. Overall, the use of diode laser in combination with NaOCl irrigation provides effective bactericidal action in endodontic treatments, achieving the goals of preparing and disinfecting the infected canal system. The destruction of bacterial cell membranes through the photothermal effect is an essential mechanism by which laser therapy contributes to successful outcomes in endodontic procedures.

In addition to its bactericidal action, laser has been found to effectively remove the smear layer from the walls of root canals. This is achieved through the high temperature generated by the laser, which causes splitting and cracking of hard tissues, as well as the sealing of the main canal's foramina (Amin et al., 2016; Rajakumaran et al., 2019). It is worth noting that short-range laser does not get absorbed by hard dentinal tissue and does not have an ablating effect on the dentin surface (Alves et al., 2022).

The effect of laser treatment on the outer surface temperature of the root, depending on the thickness of the canal walls, has been the subject of limited research. However, some studies have reported on this aspect and have found that the change in temperature on the outer surface of the root during laser treatment is minimal (Beer et al., 2017).

It is important to acknowledge that this pilot study had limitations, including a small number of clinical cases considered. Despite the limited sample size, the use of laser treatment in cases of destructive chronic periodontitis showed promising results in stimulating the regeneration of periapical bone structure compared to traditional treatment methods. Laser therapy in endodontics is considered a safe alternative for disinfecting root canals with pulpal pathology.

## Conclusions

The findings from our radiological study strongly suggest that the conventional protocol for endodontic treatment, with its traditional root canal processing, is insufficient to achieve long-lasting clinical effects. However, the modification of the root canal processing protocol using diode laser, specifically with a wavelength of 980 nm and a laser power of 1 W, demonstrated a significant improvement in canal disinfection and a rapid reduction in destructive foci through the stimulation of osteogenesis.

The potential of diode laser therapy highlights as a valuable addition to the field of endodontics, offering enhanced disinfection capabilities and promoting more efficient healing processes, facilitating better disinfection and stimulating osteogenesis.

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## Design and Development of IoT Based Smart Farming for Plant Disease Detection


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**Abstract:** This research will examine the many kinds of plants and the various diseases that could harm them before developing a technique to detect plant ailments. Farmers should emphasize the diagnosis of plant diseases when planting in the garden. The procedure of identifying plant illnesses takes a long time if the garden space is too large. Arduino cameras were used to communicate with a system as a result of the development of new technologies like the Internet of Things (IoT). IoT-based Smart Farming for Plant Disease Detection's objectives are to explore plant disease detection with an object-oriented methodology, create a system that includes plant disease classification with machine learning techniques and assess the system. The Agile software development process consists of the following steps: planning, designing, developing, testing, releasing, and receiving feedback. The project was created using Python as the programming language, Flask as the Python web framework, MySQL as the database, Jupyter Notebook for creating model classification, and Visual Studio Code as the code editor. Customers will be able to use both the newly developed system and IoT cameras. This method may therefore more accurately boost evaluation efficacy and efficiency.

**Keywords:** Internet of things, Plant disease detection, Agile, Smart farming, Convolutional neural network

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## Introduction

Numerous nations have focused on the agriculture industry as a new kind of technology, especially interested on farming. Southeast Asian country Malaysia is mostly dependent on agriculture to combat poverty and maintain stability. Additionally, as the population increases, the company is under increasing pressure to meet client demand. Due to these two elements, agricultural practices must be productive, efficient and optimized. In Malaysia, IoT-based smart agriculture aims to increase the agricultural industry while also reducing poverty.

Developed technology that addresses planting, irrigation, harvesting and crop health components. Utilizing smart farming while developing IoT-connected equipment, applications, or websites for agriculture. IoT developments might potentially contribute to the development of more advanced agricultural practices. In terms of currently unattainable efficiency, cost and resource savings, automation and data-driven operations, the Internet of Things, like other industries, holds promise for agriculture. These advantages, however, don't contribute anything to agriculture; rather, they treat an entire industry that is struggling with a variety of grave issues. Farmers can now monitor their produce and the environment in real-time thanks to IoT-enabled agriculture. They are incredibly effective, have quick insights, can see problems coming before they happen, and can decide wisely how to prevent them.

IoT solutions for agriculture also include automation, such as demand-based irrigation, fertilization and robot harvesting. Short food supply chains are possible with IoT-based smart agriculture and hydroponic systems and they should be able to feed most people. Food can be cultivated in supermarkets, on the walls and rooftops of buildings, in cargo containers and everyone's convenience at home thanks to inventive closed-cycle agricultural systems. IoT relates to improved operational agility in agriculture. Farmers can respond quickly to any significant changes in the weather, humidity, air quality, or the state of each crop or soil on the field thanks to real-time monitoring and forecasting systems. New technologies support agricultural professionals in their efforts to safeguard crops from extreme weather fluctuations.

Farmers and agricultural professionals must constantly be able to recognize plant diseases. The suggested system's primary goal is to use IoT to find plant diseases. The disease typically starts on the plant's leaves. We have thus included leaf disease detection in the proposed study. Images are a vital source of data and information in the agricultural sciences. In recent years, Rosenblum stated photography has been the only method utilized to reproduce and communicate such as data (Rosenblum, 2020). However, quantitative analysis or quantification of photographic data may be challenging.

Thanks to improvements in computers and microelectronics connected to traditional photography, digital image analysis and image processing technologies enable to circumvent these issues. These technologies support the

enhancement of pictures from the microscopic to the telescopic visual range as well as the understanding of such images. Several image-processing programs have been created especially for agricultural applications. These apps employ devices with cameras or color scanners to enter the images. As computing technology advances regularly, computer-based image processing obviously changes. Specialized imaging systems on the market are not particularly customizable and more significantly, are extremely expensive.

Thus, it is imperative to create a highly efficient approach for identifying symptoms of illness utilizing scientific knowledge and skill. Images of the harvested fruit and vegetable leaves are first collected into datasets. The photos may be captured with a high-resolution mobile phone camera or a standard digital camera. After being picked, the leaves of the fruits and vegetables are image-processed. Wanjale (2017) started to find plant illnesses, a variety of image processing techniques are utilized, such as capture, pre-processing, restoration, segmentation, augmentation, feature extraction and classification. The pre-processing approach converts raw input leaf image datasets into appropriate process datasets format to improve leaf image quality and remove obtrusive areas from the photos.

To properly diagnose leaf disease, image augmentation is utilized to enhance and facilitate the representation of the leaf picture. By flipping, cutting and rotating the original leaf picture collection, more photos are added. As part of the augmentation process, the leaf images are also transformed to RGB via color transformation. The upgraded leaf photos, on the other hand, were developed to preserve a balance between image size and quality in the healthy and unhealthy leaf databases. It is also possible to detect diseases in colored images by using the categorization approach. This paper uses convolutional neural network (CNN) models, a classification technique. Even though some plant leaf diseases may be detected using several current agricultural technologies, no preventative action is offered. A graphical user interface is utilized to develop a system that can identify illnesses and provide a preventative strategy.

### **Deep Learning Algorithm**

A subset of machine learning called deep learning focuses on how people really learn specific sorts of information. These feature learning algorithms construct several layers of representation by constructing simple but non-linear modules that convert the representation at one level into a higher and more abstract one (Lecun et al., 2015). Deep learning has two phases: inferring and training. During the training phase, enormous volumes of data must be classified and matched with their suitable attributes. The algorithm then contrasts and keeps track of those characteristics to make the proper judgements the next time it encounters data of a similar nature. The model organizes discovered data and draws conclusions from previously collected data during the inferring phase.

The technique of utilizing software tools to evaluate data to uncover patterns and consistency in very big datasets is known as data mining. It managed to find patterns in enormous amounts of data by determining the essential principles and qualities. Modern industry and research demand an ever-increasing amount of data,

necessitating the development of increasingly complicated and sophisticated instruments (Han & Kamber, 2000). Among the important data mining techniques that have been created and are now in use include classification, clustering, prediction, association, sequential patterns and regression. Each type of unhealthy plant is classified using a CNN model via an IoT-based smart farming technology.

### **Convolutional Neural Network**

An example of a neural network used for image processing, classification, segmentation and other auto-correlated data processing is the convolutional neural network (CNN). CNN is a cutting-edge approach to adaptive image processing that serves as a link between generic feed-forward neural networks and adaptive filters (Browne & Ghidary, 2003). CNN is built on the premise that it can record or learn significant qualities from an image or video on several levels, much like the human brain can. CNN records the spatial elements of a picture. The connections between and arrangements of the pixels in an image are referred to as spatial characteristics. It facilitates precise item identification and aids in comprehending an object's position and relationship to other things in a picture.

### **Smart Farming**

The IoT has drastically changed how people see agriculture thanks to smart farming. Modern agriculture now relies heavily on data to aid farmers in making critical decisions and smart farming innovations are becoming more and more popular because of better data management (Saiz-Rubio & Rovira-Más, 2020). Precision agriculture reduces overall costs while boosting product quality and quantity, agricultural sustainability and customer experience through expanding farming's connectedness and intelligence. Smart farming facilitates decision-making for effective farm management in their industry. An optimization system is essential to the production output of agricultural operations of all sizes while concentrating on the preservation of properties. Arduino is used in most smart farming projects to provide a concept for smart farming that tremendously benefits farmers.

### *Comparing System Existing*

As an explanation of how each existing system related to and contrasted with the features of the suggested system. These details the capabilities of IoT-based plant disease detection. The findings of the comparisons are shown in Table 1.

The system would be utilized on a web-based and have numerous modules to include in the system, according to a synopsis of the three existing systems and the proposed system. Most of the algorithms classified the illness based on the leaf using classification as a data mining approach. The hardware for all current operating systems is created by taking a leaf picture with camera hardware and integrating it into the system.

Table 1. System's comparison

Features/System	Plant Leaf Diseases Identification using Convolutional Neural Network with Treatment Handling System	Brown Spot Disease Severity Level Detection using Binary- RGB Image Masking	Paddy Disease Detection System Using Image Processing	IoT Based Smart Farming for Plant Disease Detection
<b>System Platform</b>	Web-Based	Web-Based	Web-Based	Web-Based
<b>Login / Registration Administrator login</b>	No	No	No	Yes
<b>Software Development</b>	MATLAB R2019a	-	MATLAB 7.0	Jupyter Notebook, Visual Studio Code
<b>Data Mining Technique</b>	Classification, Clustering	Classification	Classification	Classification
<b>Database</b>	No	No	No	Yes
<b>Live-Chat</b>	No	No	No	Yes
<b>Dashboard</b>	No	No	No	Yes
<b>Type of Disease</b>	Bacteria Disease, Septoria Leaf Spot, Alternaria (Early Blight)	Brown Spot (BS)	Brown Spot Disease, Narrow Brown Spot Disease, Blast Disease	Paddy: Brown Spot, Hispa, Leaf Blast Chillli: Leaf Curl, Leaf Spot, Whitefly, Yellowish
<b>Internet of Things (IoT) hardware</b>	No	No	Yes	Yes

## Method

Project development was decided to use the agile modelling methodology. This plan necessitates constant level-by-level growth as well as stakeholder discussions. This lifecycle model started with a variety of techniques to accelerate development to hasten the delivery of new software. Figure 1 below shows the agile paradigm as a project development method.

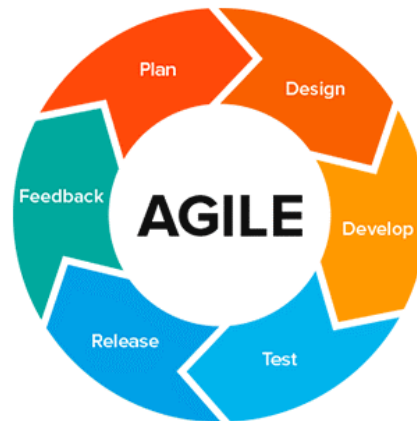


Figure 1. Agile methodology model

### *Planning Phase*

Through this initiative, IoT devices are integrated into the system. The system should include a dashboard for tracking plant disease detection and IoT devices should be able to do so. The plant disease crop should be improved, or its relevant data should be gathered using image processing technology.

### *Designing Phase*

Using Draw.io, an online application that makes it simple to create diagrams, the design process was started. It is a resource that is available for free and has several benefits, such as various trustworthy collaboration capabilities and an approachable design that makes it easier to grasp, especially for beginners.

### *Developing Phase*

Using the code editor Microsoft Visual Studio Code, one may construct web apps. It is a free piece of software that supports several programming languages. The free relational database MySQL satisfies all needs for application development. For a training and testing model that must be utilized with a Jupyter Notebook and the Anaconda environment. A Wi-Fi connection will be made between the IoT hardware and the web system to enable the system to display the camera through the Arduino camera.

### *Testing Phase*

Instead of waiting for development to be finished before testing, new features are introduced as they are made. If all stakeholders are to work together closely during the testing process, questions and responses are crucial. The system should be ready for the following stage if the stakeholders are satisfied.

### *Release Phase*

When the deployment phase begins, end customers will be the ones to use it. During these first stages, keep an eye out for any weaknesses or errors that were overlooked during testing. With enough training, the production and support workers should transfer. The system's designers should make sure it functions properly and instruct users on how to utilize it. During this stage, the system's documentation will be finished and sent to production employees and end users.

### *Feedback Phase*

A feedback phase begins once the system has been made available to end users. This stage will analyse the online system to get user feedback so that it may be improved. At this stage, the engineers learn how the web system will impact the goals.

## **Results**

The results discussed the flow of IoT Based Smart Farming for Plant Disease Detection system, implementation of IoT hardware and retrieve the accuracy of model deep learning from image processing.

## **System Architecture**

System architecture, a kind of software that offers fundamental operations and automation, establishes the structural layout of systems. Figure 2 depicts the system architecture of IoT-Based Smart Farming for Plant Disease Detection.

## **Main Flowchart**

The system design displays the overall flowchart of IoT-Based Smart Farming for Plant Disease Detection. A flowchart is a diagram that shows how information flows through a system. A flowchart with all modules and operations shown is shown in Figure 3.

## **Main Menu Page**

Figure 4 below displays the home interface following a successful login. The system will display the user's name at the top right of this screen. If the user is not yet logged in, the crop disease feature option will not be available.



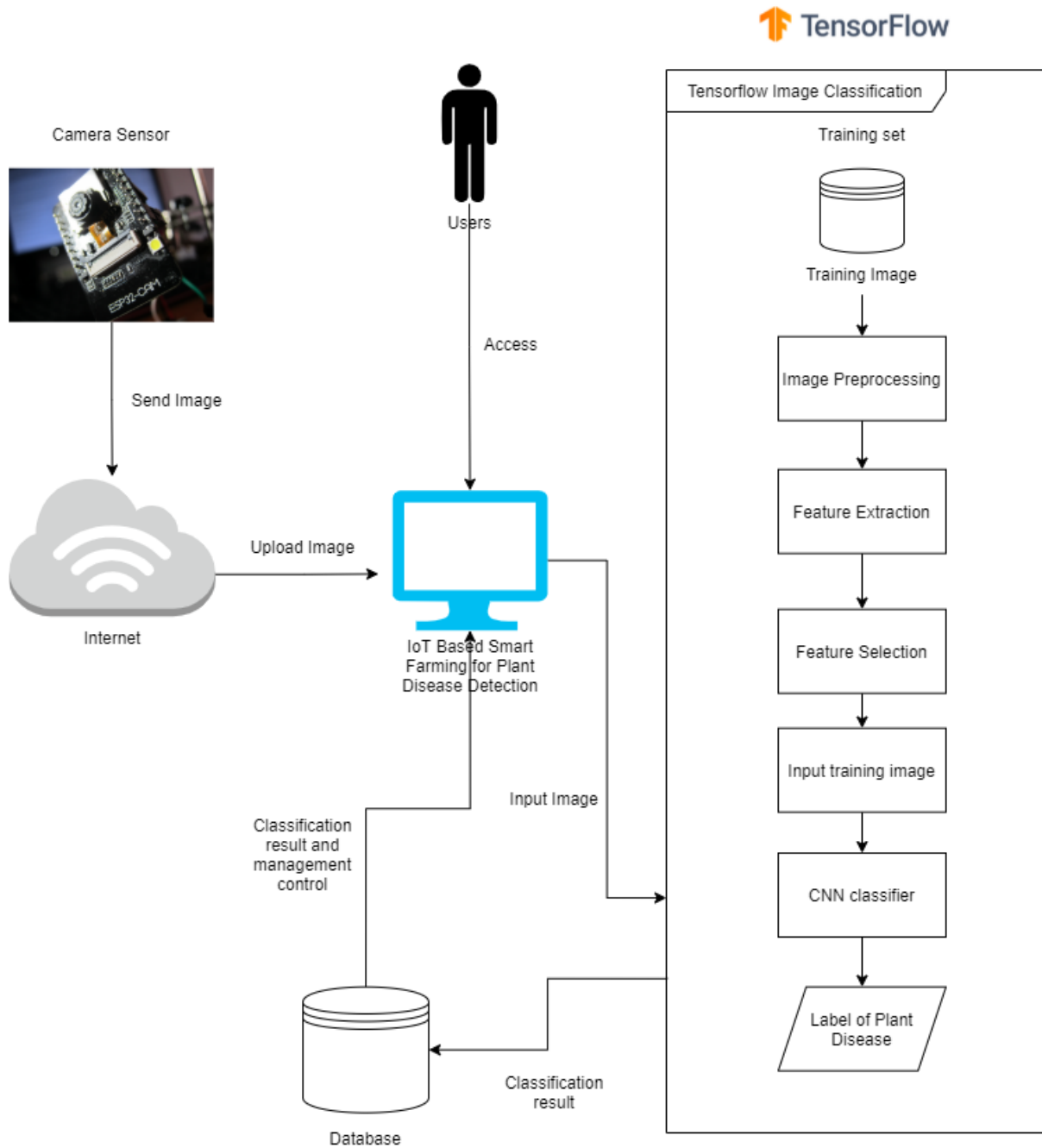


Figure 2. System architecture

### Crop Disease Page

The crop disease interface shown in Figure 5 below uses Internet of Things (IoT) technology to allow users to upload or capture pictures to classify various plant diseases. The results will then indicate a plant disease, symptom and disease prevention.

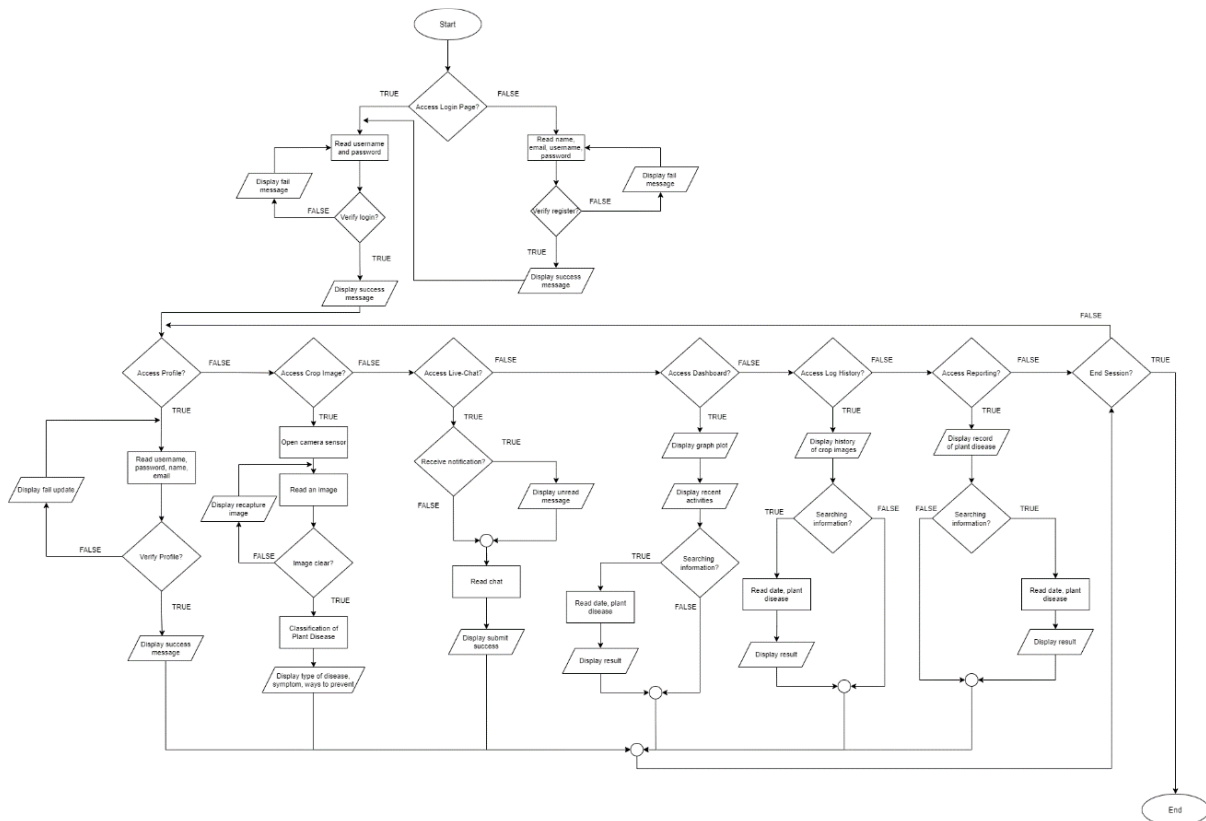


Figure 3. User flowchart

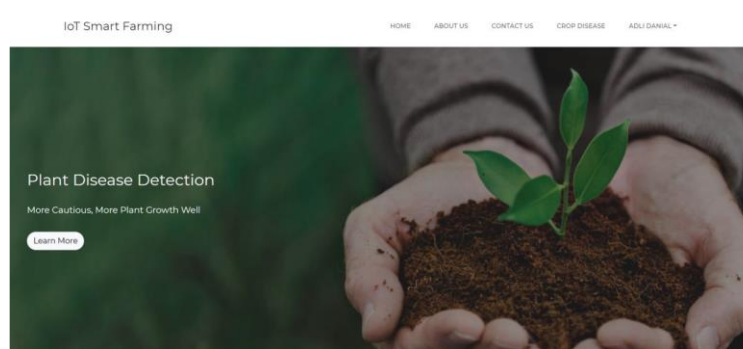


Figure 4. Home page

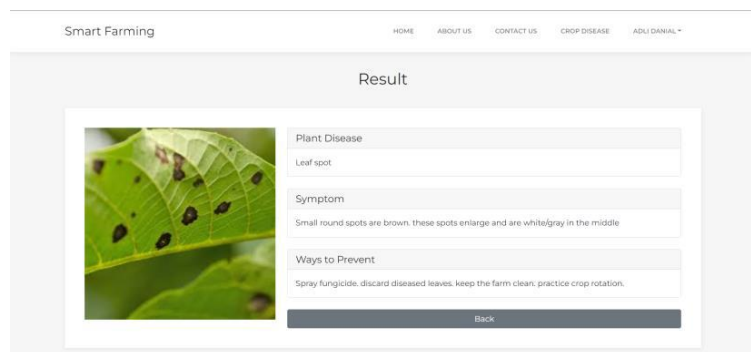


Figure 5. Crop disease page

## Accuracy Result

Figure 6 below displays the accuracy prediction output from the CNN model using TensorFlow. Deep learning is used in the processing of image recognition to establish the classification of plant disease. Following model training, the accuracy prediction is 0.60, or 60%.

```
#model = load_model('../output/kaggle/working/model.h5')
final_loss, final_accuracy = model.evaluate(X_val, Y_val)
print('Final Loss: {}, Final Accuracy: {}'.format(final_loss, final_accuracy))

5/5 [=====] - 1s 156ms/step - loss: 1.5008 - accuracy: 0.6042
Final Loss: 1.5007842779159546, Final Accuracy: 0.6041666865348816
```

Figure 6. Accuracy result

## Discussion

Before the development system is approved for distribution or before it goes live online, user acceptability testing is often conducted. Figure 7 depicts the leaf being captured using ESP32-CAM as IoT hardware and Figure 8 depicts the illness's effects as detected by the IoT-based smart farming system for plant disease detection.

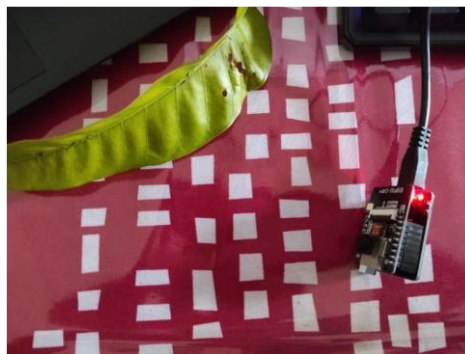


Figure 7. Captured using ESP-32 CAM

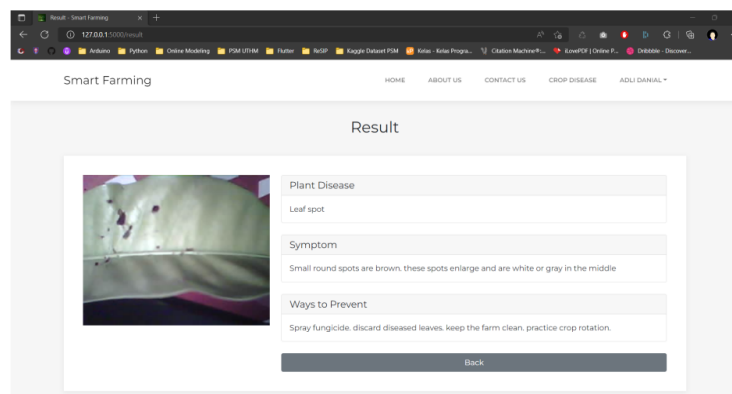


Figure 8. Result of disease

The ESP32-CAM is used in the simulation of this IoT hardware to capture any leaf, identify it using a deep learning model, identify the type of plant illness and display the results in the system. The outcome of the user acceptability testing form based on input from the respondents is shown in Figure 9. According to the findings, most respondents gave the system a rating between 3 and 5 on a scale. The IoT Based Smart Farming for Plant Disease Detection system's user-friendly layout and ability capture this input.

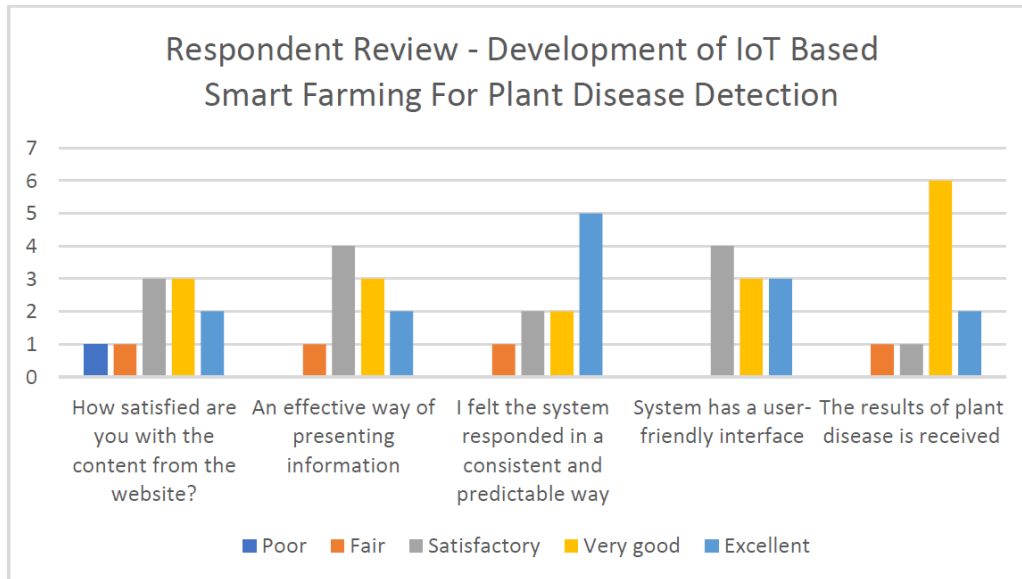


Figure 9. User acceptance testing form result

The IoT Based Smart Farming for Plant Disease Detection's deployment and testing phases have been explored and clarified. It is making sure the system is reliable and simple to use without any difficulties. Additionally, the testing process contains test cases for user acceptability testing and functional testing to gather input from users and enhance the system.

**Conclusion**

Thanks to modern technology, IoT-based smart farming for plant disease detection may aid farmers in quicker plant disease diagnosis. The benefits of this approach include stressing the pattern that covers disease zones on the leaves and introducing the farmer to plant care techniques based on disease categories. Thanks to new features like live chat, information exchanges about plants are becoming more linked. It will be easier to use and give rapid access to features and actions that are often performed.

**Recommendations**

It is possible to implement some ideas to enhance the system. The recommendations are training additional

datasets of plant disease photos to increase the deep learning model's accuracy, users are notified by chat-live when a new message is received and based on the specified elements, such as the form, button, header, colour and picture, the system should maintain consistency.

## Acknowledgements

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## Design and Development of Service Desk Management System

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**Abstract:** A lot of organizations are implementing various advanced technologies as part of their daily operations. A lot of individuals will not be aware of coping up with these advancements, so this will place heavy demands on the IT team responsible for handling these systems. Hence a viable solution to assist the IT team in taking care of these issues is by implementing a "Service Desk System". Many organizations in modern times rely on IT ticketing systems to provide fast and effective customer service to ensure satisfied employees and increased efficiency in the operations of an IT department. A documented agreement is involved in identifying the services required by the customer and the level of service that can be expected of the service provider. This documented agreement is known as an SLA. The purpose of this study is to understand the various components involved in creating a Service desk management system. This project is being built for Protocol Systems. Protocol Systems has a Servicedesk system, but due to many redundant fields, it is become a lot more tedious to use thereby resulting in longer wait times to solve issues. To solve this issue, the project will be set up as a web-based system to curb the installation process. The project will also feature only the essential fields to reduce wait times. Database space is also wasted in the process of having many redundant fields, so having the necessary fields makes data retrieval faster as well. It is also designed to be scalable to accommodate processes that an IT expert would consider as a requirement for the future. This is also a way of collecting information about the IT problems that multiple employees encounter on a day-to-day basis. These problems will then be solved by the IT expert who has the necessary skills to solve these problems thereby allowing the workload to be systematically delegated to the experts responsibly while achieving effective customer service. The system is being designed by using a MERN Stack, a popular web stack that is used abundantly to develop user-friendly web applications while a potential solution is to host the application is MongoDB Realm, which is mostly used for mobile applications but can also be used for PC-based web applications.

**Keywords:** Servicedesk System, IT, SLA, MERN Stack, MongoDB Realm

**Citation:** Palit, S., Sinha Roy, C., & VK, P (2023). Design and Development of Service Desk Management System. In M. Koc, O. T. Ozturk & M. L. Ciddi (Eds.), *Proceedings of ICRES 2023-- International Conference*

on *Research in Education and Science* (pp. 2504-2518), Cappadocia, Turkiye. ISTES Organization.

## Literature

A Servicedesk is a support management service that handles queries of company's internal and external contacts. It provides information on issues that are frequently asked about and aims to successfully resolve customers queries in an efficient manner. The complaint resolution task is automated using a ticket management system that transfers the complaint to the agent responsible for handling the issue (Ameyo Servicedesk, 2023).

There are various Servicedesks available based on business size and its target customers. These are:

- Web Servicedesk
  - Cloud-hosted or SaaS (Software-as-a-service)
  - Companies can rent these solutions to save up on cost.
- On-Premises Servicedesk
  - Company owns and hosts the system.
  - Company has complete control over it and is also responsible for its maintenance.
- Enterprise Servicedesk
  - Advanced features and highest level of customer service to address customer queries at a faster rate.
  - The advanced features also enable the company to improve overall efficiency.
- Open Source Servicedesk
  - No user licenses or permissions required to modify source code.
  - This makes it easier to modify according to the services the company plans to offer.

Servicedesks are very important as you can address employee and customer concerns as early as possible rather than having them wait and leave them dissatisfied. The following point highlight the important aspects of a Servicedesk:

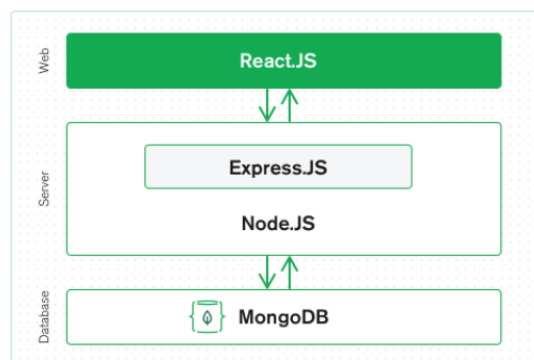
- Customer Satisfaction
  - Issues resolved with quick and minimum effort.
  - FCR - First Contact Resolution
  - Status updates on their complaints.
  - Various modes of contact available to customers.
  - Ticket system generates ticket regardless of platform.
- Agent Productivity
  - Automation of repetitive tasks.
  - Agents can use repository of information available in knowledge base to help customers effectively.
  - Unified interface to enable support executives to maximize service to customer.

- Business Operations
  - Prioritize some actions and meet SLAs to streamline operational activities.
  - Providing easy-to-read details to supervisor in the form of graphs and data points to monitor contact center.
  - Supervisors can make informed decisions based upon data that is generated through the operations taking place.

ServiceDesk systems are generally more effective when ticket management system is integrated into the ServiceDesk application itself. Tickets help enhance customer interactions by providing faster solutions to problems from creation of the ticket to merging them when the problem is similar. The following points highlight the importance of ticketing system for ServiceDesks:

- No Missed Tickets
  - A ticket is created for every customer query so that the agent can attend to every customer using the system.
  - Ensures that the supervisor leaves no interaction unattended and monitor all the queries that are received by the application.
- Scalable Application
  - A smart application that assigns the tasks automatically to the respective agents allows the remaining agents to attend to other high-level tasks that are a part of daily office activities.
  - Thus, it allows for efficient progress in work while contributing to overall business growth and improving customer relations with problems be dealt more effectively.
- Ticket Prioritization
  - A key aspect of an automated ticketing system should be the ability to differentiate between high priority and low priority tasks.
  - This way problems with higher priority can be dealt with more quickly ensuring that the customers receive excellent customer service.

**MERN Stack**



*Fig. 1.1 MERN Stack*



The MERN architecture is a popular web stack that is used extensively in building websites. It is a 3-tier architecture that is built entirely using JavaScript and JSON. We will be using MERN Stack to build our Servicedesk application but first let us understand what the MERN Stack is. Let us split the 3 components and discuss the MERN Stack (MongoDB, 2023).

## Frontend – ReactJS

A JavaScript framework that allows developers to create dynamic client-side applications in HTML. It makes use of components (simple reusable bits of code) that allows one to create sophisticated interfaces, connect to data on the backend server and finally render them as HTML. It is particularly useful for the fact that it can handle stateful and data-driven interfaces with minimum coding.

## JSX

For XML/HTML-like text to co-exist with JavaScript code, React uses an XML/HTML-like syntax that extends the ECMAScript.

With the help of JSX, you can write DOM like tree structures (HTML/XML) in the same JavaScript code. Babel transforms the HTML/XML parts into actual JavaScript code (Codecademy, 2023).

JSX allows us to integrate applications with HTML inside of JavaScript unlike the past where we could create webpages by integrating JavaScript inside of HTML.

```
var nav = (
  <ul id="nav">
    <li><a href="#">Home</a></li>
    <li><a href="#">About</a></li>
    <li><a href="#">Clients</a></li>
    <li><a href="#">Contact Us</a></li>
  </ul>
);
```

Fig. 1.2 JSX Example Code

## Virtual DOM

Most JavaScript frameworks perform DOM manipulation and in fact it performs unnecessary operations. Let us consider that an application has a list of 4 items as an example. You only update one item off the list. But most

JavaScript frameworks will rebuild the entire list even though no operations were performed on the other 3 items. This is where Virtual DOM comes into the picture. React has a virtual DOM object for every DOM object. A virtual DOM object is a representation of a DOM object. Manipulating DOM is slower than updating Virtual DOM as the Virtual DOM only updates the copy of the tree and will perform the necessary updates through a process called diffing (React Enlightenment, 2023). This process brings about a major performance boost as React only updates the required parts of the DOM rather than rebuilding the entire DOM. A summary of updating the DOM in React is:

- Update to entire Virtual DOM
- Virtual DOM gets compared to snapshot of the pre-updated virtual DOM. React uses the diff algorithm to figure out the changes made.
- Only the changed objects are updated on the real DOM.
- Site refreshes to process these changes and update the view.

### **Backend – Express.js and Node.js**

The backend features Express.js as a server-side framework which runs inside of a Node.js server. Let us look at some of the features of Node.js that make it a valuable choice for this application:

- Non-blocking I/O.
- Event driven.
- Multiple libraries that allow interfacing with OS, etc.
- Single-threaded

Express.js functions as a great web-framework for Node.js as it has powerful models for handling HTTP requests and responses and URL routing. We use this to make HTTP Requests/GETs/POSTs to connect to functions that enable users to explore the features of the application while these functions access and update data in the MongoDB database based on the user's choice of actions.

### **Database - MongoDB**

Like any other database, it is used to store data that will be used by your application. In simple terms, it works by creation of JSON documents in the React.js frontend and sent to the Express.js server. The data is then processed at the Express.js server and stored into MongoDB. MongoDB offers a cloud solution which is known as MongoDB Atlas. Unlike SQL, it does not have any tables and rows and stores data in a field-value pair format. MongoDB is a NoSQL Database (MongoDB, 2023). The reasons why MongoDB is the preferred choice of database for cloud-based applications is due to:

- Rich Query Language
- High Performance
- Horizontal Scalability

## Design And Development Methodologies

### Sdlc – Modified Waterfall Model

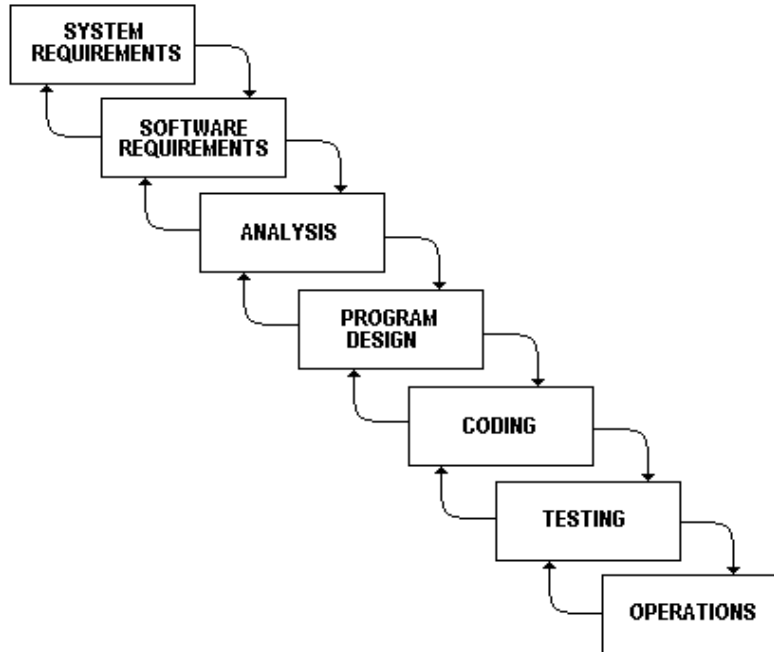


Fig. 2.1 Modified Waterfall Model

For the course of the development of our Servicedesk application, we will be using the modified waterfall model, where we will be gathering requirements and implementing the features in the application. To begin this process, we have developed a CRUD app that will function as a foundation for the application. The initial set of requirements that are a part of the application are to be implemented as part of the CRUD app and feature the Customer, Contact and Employee details. Below is the proposed layout based on the initial set of requirements.

Sample Screen Layout				
Customer Name :	<input type="text"/>	Q		
<i>List Down the Customers Below with pagination</i>				
Customer Name	Customer Primary Contact Na	Customer Phone	Customer Em	Primary Handled

Fig. 2.2 Sample Screen Layout for Customer Module

## Design of Application

### Backend

As we can see in the backend diagram, there are 4 parts to the backend that we will speak briefly on:

- **Model**
  - This holds the database schema that has been defined based on the requirements provided. It also allows interaction with MongoDB.
- **Controller**
  - Implements functions that processes API URL to retrieve requested data and display the data as well.
- **Router**
  - Receives HTTP requests and forwards request to appropriate controller.
- **Express**
  - Used for building REST APIs in Node.js application.

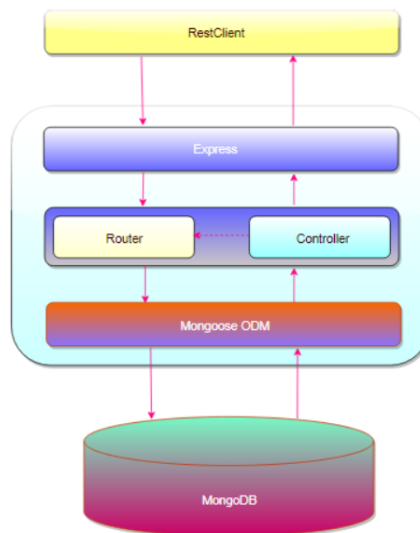


Fig. 2.3 Backend of MERN Stack

### Backend – Server Setup

The backend can be setup in 2 possible ways; Either you can use the local database (must install local version of MongoDB on system) or we can connect to database using MongoDB Atlas (cloud-native database). The following setup below is to setup the database locally. For cloud-native database we can skip step 2, but we will have to adjust our backend code to connect to database hosted on MongoDB Atlas.

Open connection to MongoDB. (Should mention “Waiting for connections” at the end)

```

{"t":{"$date":"2021-05-04T22:39:03.558+04:00"},"s":"I", "c":"STORAGE", "id":20536, "ctx":"initandlisten","msg":"Flow
Control is enabled on this deployment"}
{"t":{"$date":"2021-05-04T22:39:08.306+04:00"},"s":"I", "c":"FTDC", "id":20625, "ctx":"initandlisten","msg":"Init
ializing full-time diagnostic data capture","attr":{"dataDirectory":"c:/data/db/diagnostic.data"}}
{"t":{"$date":"2021-05-04T22:39:08.349+04:00"},"s":"I", "c":"NETWORK", "id":23015, "ctx":"listener","msg":"Listening
on","attr":{"address":"127.0.0.1"}}
{"t":{"$date":"2021-05-04T22:39:08.350+04:00"},"s":"I", "c":"NETWORK", "id":23016, "ctx":"listener","msg":"Waiting f
or connections","attr":{"port":27017,"ssl":"off"}}
    
```

Fig. 2.4 Connection to MongoDB

## Connect to database

```

C:\Program Files\MongoDB\Server\4.4\bin>mongo.exe
(c) Microsoft Corporation. All rights reserved.

C:\Users\leone>cd backend
C:\Users\leone\backend>"C:\Program Files\MongoDB\Server\4.4\bin\mongo.exe"
MongoDB shell version v4.4.4
connecting to: mongodb://127.0.0.1:27017/?compressors=disabled&gssapiServiceName=mongod
Implicit session: session { "id" : UUID("742409a3-d3d1-4a25-a90e-211ef6d279f4") }
MongoDB server version: 4.4.4
---
The server generated these startup warnings when booting:
  2021-05-04T22:39:03.544+04:00: Access control is not enabled for the database. Read and write access to data and
  configuration is unrestricted
  2021-05-04T22:39:03.545+04:00: This server is bound to localhost. Remote systems will be unable to connect to th
  is server. Start the server with --bind_ip <address> to specify which IP addresses it should serve responses from, or wi
  th --bind_ip_all to bind to all interfaces. If this behavior is desired, start the server with --bind_ip 127.0.0.1 to di
  sable this warning
---
---
  Enable MongoDB's free cloud-based monitoring service, which will then receive and display
  metrics about your deployment (disk utilization, CPU, operation statistics, etc).

  The monitoring data will be available on a MongoDB website with a unique URL accessible to you
  and anyone you share the URL with. MongoDB may use this information to make product
  improvements and to suggest MongoDB products and deployment options to you.

  To enable free monitoring, run the following command: db.enableFreeMonitoring()
  To permanently disable this reminder, run the following command: db.disableFreeMonitoring()
---
>
  
```

Fig. 2.5 Database connection

## Use Postman to test API

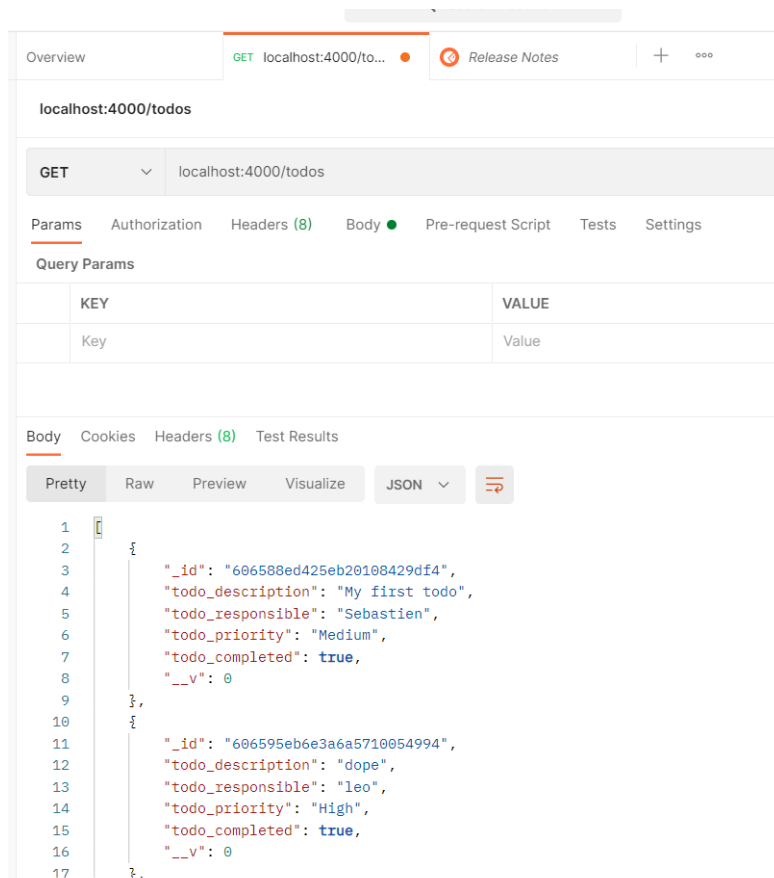


Fig. 2.6 API testing using Postman

**Frontend**

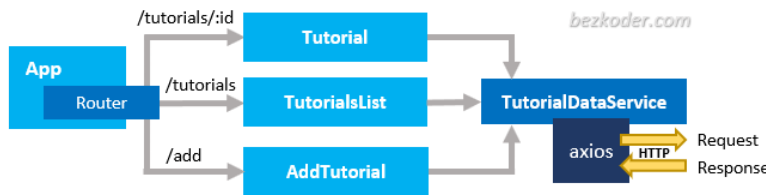


Fig. 2.7 Frontend of MERN Stack

The frontend has 3 parts to it that we will speak briefly on:

**Axios**

Library that enables us to make HTTP requests to external resources.

**Components**

These are small and independent bits of code. The advantage of having components in React is the fact that they are reusable and reduces redundant coding in the application.

**App**

This serves as the view for the user of the application. App is often a web browser that has a GUI for the user to interact and make use of the features available to the user.

**CRUD App**

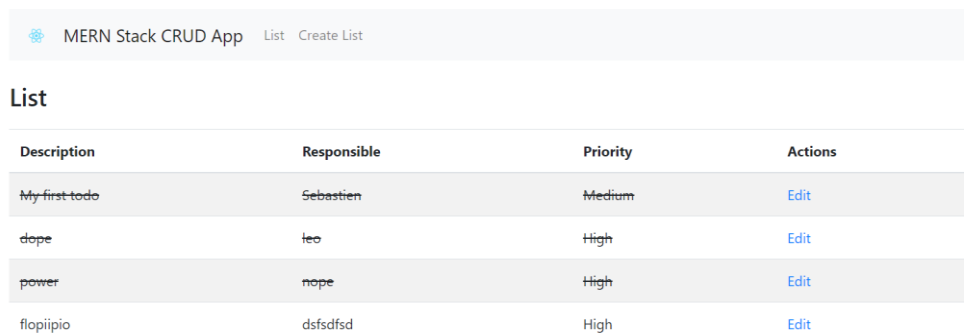
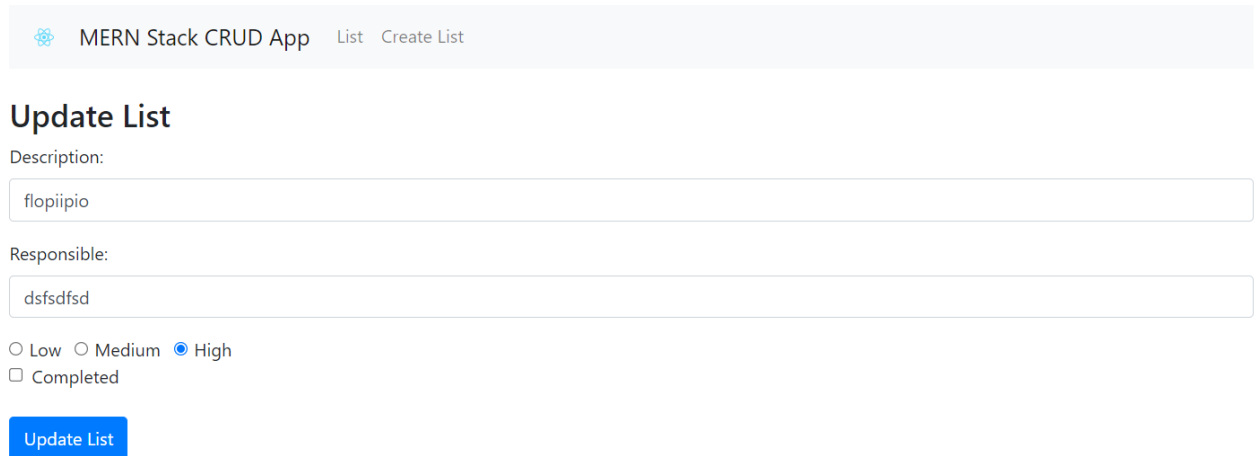


Fig. 2.8 CRUD app front page

Figure 5.8 above displays the CRUD app that I have created to work upon and implement the modules that will be assigned to me in the user requirements. CRUD is an acronym for Create, Read, Update and Delete. Using these 4 functions, I will implement the modules in the Servicedesk application to make it user-friendly while also improvising on the GUI. Figure 5.9 below depicts one of the functions which is Update. When we click on Edit, we can update an entry and once its completed, we can click the completed checkbox and it will strike the item on the list. This is like a scenario where you successfully resolve a client’s problem and click on completed to close the ticket.



MERN Stack CRUD App [List](#) [Create List](#)

### Update List

Description:

Responsible:

Low
  Medium
  High

Completed

[Update List](#)

Fig. 2.9 Update function of CRUD app

## Technologies Used

There are various technologies used for software development and a few of these technologies were used for development of the Servicedesk application. The following categories below will highlight the significant technologies that I have explored in brief:

## Frameworks for Development

Frameworks generally refers to a platform used for application development. Frameworks are generally used for Full Stack development of applications. Frameworks provide the necessary tools to code and successfully build the application that caters to your requirements or the customer's requirements. Through research ,3 frameworks were explored, that could potentially be used for the Servicedesk application. The 3 frameworks are .NET Framework, MEAN and MERN. From the choice of 3 frameworks, shortlisted, 2 frameworks to build a CRUD app and test it out. Since MEAN and MERN are similar, after research and comparison of the 2 frameworks (FreeCodeCamp, 2023). MERN was the better choice for the Servicedesk application because of the component aspect of ReactJS. Components are small reusable bits of code that can be used for various functionalities. Hence, I chose to develop a CRUD app using MERN. Having built 2 separate CRUD apps using both ASP .NET with SQL as database and MERN stack, MERN was the best option to develop the Servicedesk application. The following are the reasons as to why MERN for the Servicedesk application is more effective:

- Since it is a cloud-based application, MERN is potentially better than ASP .NET due to MongoDB being the database for MERN.
- All the components MERN Stack comprises of, requires knowledge only 1 language and that is JavaScript. ASP .NET requires knowledge of both C# and JavaScript which makes it easier to work with the syntax for coding in MERN.
- Although ASP .NET can be used for developing the Servicedesk application, MERN is

prominently used in the market for web application development in the current market hence increasing the overall marketability of the product.

### **Online IDE**

Any online IDE is essential for any developer who wants to run their code in an environment that is external to the developer's own PC. An online IDE is generally used to develop any programs without the need to install any software. To collaborate team member who is responsible to build separate modules as well, we decided to explore some of the online IDE's available and build our CRUD apps on them. We decided to use 3 different online IDE's; Replit, CodeSandbox and StackBlitz. An online IDE is a potential solution collaborating and building the app in real time so that it becomes easier to build and connect the modules together to build the Servicedesk application in a more efficient manner. Although there are very few online IDEs that support ReactJS application development. Replit allows you to code the app from scratch while allowing you to import and download any dependencies that you might require.

Unfortunately, due to limitations in the memory size, the CRUD app was not fully functional on Replit. CodeSandbox and StackBlitz had storage issues as it only allowed a select amount files to be uploaded on the IDE thereby limiting the ability to build the CRUD app on the online IDEs. These limitations were the result of a limited free plan that we had used to test the development of our application. The paid plan offers more storage and memory to work with, hence making them great online IDEs provided you pay the subscription fees. To fix this issue, we had no choice but to collaborate through online calling platforms such as Zoom and Google Meet and develop modules locally.

### **Web Hosting**

The penultimate step in the process of successfully delivering the application to the customers is hosting the website and testing the application itself. Web hosting is crucial to any developer who wats to publish their application and it involves a cost as the website will need resources assigned to it so that it can be allocated space and published on the web server. We found a collaborative solution that would allow us to host our application and test it out. The solution we came across is MongoDB Realm (MongoDB, 2023); this is an excellent solution to host small applications and test your application on a generous free plan. MongoDB Realm allows you to build an application with a serverless backend. An added advantage is that it allows you to even host your application and provides a domain so that your application can be used in public.

But there are limitations to MongoDB Realm, and this is because it was built for hosting mobile applications rather than PC based web applications. It started to support PC based web applications from 2018 onwards, so support is limited as far a large-scale application is concerned. Nevertheless, it is a potential solution for large scale applications in the upcoming years, hence we chose this platform to host our application.



## Tasks Accomplished

The following points below outline the main tasks completed through project and as well as other crucial tasks that are a part of any office environment:

- Research various Servicedesks such as:
  - ManageEngine
  - ZOHO Desk
  - Freshdesk
  - Ameyo
- Research on different frameworks and learn about them. The following are the frameworks have been researched upon:
  - MERN Stack
  - MEAN Stack
  - ASP .Net with SQL
- Development of a basic CRUD app to understand CRUD functions.
- Work using online IDEs to test out the app in environments external to the local PC.
- Online integration of CRUD App onto MongoDB Realm.
- Fully understand requirements provided and plan out activities that will help to design and implement the requirements as part of the software to provide the solutions in accordance with the specified requirements.
- Successful development of Employee Master module.
- Successful completion of tasks before the given deadline.
- Gain real-time knowledge of various problems and solve them in an effective manner as part of a work-based environment.

## Results and Discussion

[🔗 Employees](#) [Employee List](#) [New Employee Record](#)

### Employees List

ID Number	Employee Number	First Name	Last Name	Designation	Mobile Number	Email	Joining Date	Visa Expiry Date	Salary	
1	1234	Leonel	Carvalho	Developer	0504229609	leonel-carvalho@live.com	21/02/2022	23/05/2022	12500	<a href="#">Edit</a>
2	1334	Danyal	Ahmed	Developer	0501234567	danyal_ahmed@gmail.com	24/02/2022	12/10/2023	12500	<a href="#">Edit</a>
3	1404	Syed	Adnan	Developer	0501234789	syed_adnan@gmail.com	22/05/2022	30/11/2022	12500	<a href="#">Edit</a>

Fig. 5.1 Employee Master Front Page

Using the technologies, I experimented with and knowledge I had attained, I built a simple webpage for the Employees Master module. It follows the same CRUD principle that has been used in CRUD app. The development of this module took slightly longer since the backend and frontend require extensive code changes compared to the CRUD app. Figure 5.1 displays the list of employees that are already entered into the database. If one was to add a new record, then they can just click on New Employee Record, and this will redirect you to a new window as shown in Figure 5.2. The Edit at the side of each record will redirect you to a new window as shown in Figure 5.3 and allow you to update the Employee Details with the necessary changes. Contact Master has been developed as well in a similar manner.

First Name:

Last Name:

Designation:

Mobile Number:

Email:

Joining Date:

Visa Expiry Date:

Salary (in DHS):

[Create List](#)

Fig. 5.2 Employee Master Create Function

Figure 5.2 displays the empty fields that you can enter data into. Once you have successfully entered all the necessary details, you can click on *Create List*, and it will add the record to the table. To view the list, you can click on *Employee List*, and this will redirect you to the window as shown in Figure 5.1.

Figure 5.3 displays the fields with the data you can modify (You cannot modify ID Number as it has no function assigned to and is meant to only be auto-incremented every time you enter a new record). Once you have successfully modified the data and made the necessary changes, you can click on *Update List* (The button is like *Create List* and is not displayed as this is the maximum size of the screenshot), and it will modify and display the record on the table. To view the list, you can click on *Employee List*, and this will redirect you to the window as shown in Figure 5.1.

[Employees](#)
[Employee List](#)
[New Employee Record](#)

### Update Employee Record

ID Number:

Employee Number:

First Name:

Last Name:

Designation:

Mobile Number:

Email:

Joining Date:

Fig. 5.3 Employee Master Update Function

## Conclusion

The role of a Software Developer is to gather requirements and design and implement solutions as per the specified requirements. Due to this, it was possible to design and implement modules that were specified in the requirements. It is required to communicate and work effectively with team members while attaining knowledge from technical supervisor on various aspects that were a part of the development process. While teamwork and gaining knowledge are essential, improving personal skillset and continuously learning about the project assigned, is a major factor in improving resources as an individual and a developer. This experience has enhanced overall strengths and minimize weaknesses while also facilitated being more confident in a workplace environment. Overall, this experience will help to prepare for the future challenges of any organization.

- Different frameworks that are used in the field of software development.
- Current and potential technologies that can be used to develop software products in a more effective and efficient manner.
- Further improvement in problem solving skills and communication skills.

## Acknowledgements


I would like to congratulate all teams members who have put extensive efforts in design and development of the enterprise system.

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## Exploring the Intersection of Climate, Finance, and Digital Technology: A Conceptual Review of Climate FinTech

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**Abstract:** Climate change poses enormous economic and political hazards to the global economy. Climate FinTech has become an essential component in digital transformation as the world has realized the urgency of climate change in protecting the environment. Many financial and non-financial organizations are increasingly partnering with FinTech firms to create FinTech initiatives that benefit people and the environment. The growing number of climate FinTech companies has helped to facilitate and expedite the global financial sector's transition toward a more sustainable future and greener world. The main objective of this conceptual paper is to review the past literature to discuss the issues concerning climate FinTech including the challenges and key opportunities for climate FinTech to contribute to sustainable development. The study's findings suggest that climate FinTech is essential in helping businesses migrate to more sustainable business models and more resilient to climate risks that will better integrate circular economy practices and a greener world.

**Keywords:** Climate, FinTech, Sustainability, Regulation

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### Introduction

The climate is a large-scale, complicated process representing the average of several decades of weather occurrences, including off-planet factors, ocean, atmosphere, land, and biological interactions (Rivera-Collazo,

2022). Climate change is a global issue involving many dimensions, including economic, political, financial, and technological (D'Orazio & Thole, 2022; Tamasiga, Onyeaka & Ouassou, 2022). Climate change will affect the earth's temperature and bring negative impacts such as frequent severe snowstorms, melting ice, or disrupting the balance of the oceans. Thus, small changes in the earth's temperature could have a significant effect. Climate change has started since the industrial revolution as human activity has caused global temperature and weather changes. Climate change is often associated with the emissions of greenhouse gases such as carbon dioxide, which can increase the average global temperature (Pee & Pan, 2022). Climate change and environmental concerns are causing worry among many banks, financial regulators, and finance ministries as the traditional ways do not always consider the environment's health. As a result, we need practical steps to limit susceptibility to the consequences of climate change.

Climate FinTech is the convergence between finance, sustainability, and technology. Climate FinTech, also known as Sustainable FinTech or Green FinTech, is a digital financial technology that promotes carbon reduction. Previously, the term Climate FinTech was not widely known, but today many countries have begun to take numerous initiatives to support the various activities in their implementation (Murinde, Rizopoulos & Zachariadis, 2022). Climate and financial technology collide when both sectors have seen massive growth and increased demand for climate action and accountability across financial services from customers, employees, corporations, and investors (Chen et al., 2023).

Climate FinTech is critical to attaining environmental sustainability by delivering digital technologies, applications, and platforms that aid organizations and individuals in spending, saving, and investing in environmentally beneficial ways. The FinTech business is a greener option for the traditional financial industry and may increase financial institution sustainability by promoting green financing (Tamasiga, Onyeaka & Ouassou, 2022; Chen, Teng & Chen, 2022). Many climate FinTech business models are emerging nationally and internationally due to supportive policies and government initiatives. In a well-structured digital finance ecosystem, initiatives in traditional finance could be directed toward green digital finance (Coskun & Unalmis, 2022). By connecting banks, insurers, financial institutions, big tech firms, technology providers, regulators, and consumers, digital technologies and financial product innovations can help overcome climate finance challenges.

## Literature Review

The public awareness of the global warming effect has caused many companies to adopt climate-positive operations. People's interest has increased to see the latest innovation in the financial and non-financial sectors that can create a greener world. The invention of climate technology will lead to more scalability and cost-effectiveness. The development of technologies through online platforms and the internet has enriched financial data and created alternatives to financial services for everyone (Murinde et al., 2023). The importance of sustainable finance and digital transformation has begun to be recognized worldwide. Concerns about the

environment have spurred various new trends in technology and financial management, with FinTech developing as a rival to established financial institutions. Chen et al. (2023) suggest that the efficiency of traditional financial services has improved by using FinTech. Climate FinTech is an essential intermediary in financial services, mobilizing resources and changing behavior. As a result, collaboration and partnership between fintech startups and financial institutions have grown and have become the future of financial services.

Climate FinTech solutions are digital technologies, applications, and platforms that help organizations and individuals save, spend, and invest in ecologically responsible ways. Jiang & Ma (2019) supported the positive effect of mitigating financial development. The recent technological advancement allows FinTech firms to offer various solutions to enable people to access financial services. FinTech gives people and businesses access to traditional financial services in novel ways previously unavailable in conventional economic methods. Customers, for example, may utilize mobile bank apps to examine their balance, transfer payments, or deposit a check online without visiting the bank in the new revolutionary digital banking environment. FinTech is already tapping into the customers' demand for greener products. Therefore companies should continue to invest in green projects to increase their competitive value in the industry.

The climate FinTech industry has enormous potential as it covers many aspects such as green payment, digital payments, investments, and green regtech to enhance the regulatory processes of digital data analytics. FinTech is one of the most promising breakthroughs to address unfairness, poverty, and financial services inaccessible (Banna et al., 2022). Climate FinTech companies and numerous organizations have emerged globally to reshape essential financial system functions that can tackle environmental issues. Climate FinTech helps customers make more conscious shopping decisions, verifying carbon credit quality across blockchains. The increased awareness among investors has changed their attitude toward climate-related financial risk. Investments are shifted towards greener assets and more climate-focused portfolios. Additionally, insurance companies can better analyze weather perils and underwrite climate risks better while assisting regulators in measuring missions from the largest corporations.

These digital innovations, applications, and platforms are critical intermediaries between stakeholders interested in advancing decarbonization solutions. Companies also can protect themselves against climate risks that can disrupt business operations. Companies are actively involved in climate FinTech projects because it will provide businesses with better tools for monitoring, measuring, mitigating their environmental impact, and minimizing losses. Digital technologies will drive capital, improve data analysis for greenhouse gas reduction projects, and maximize innovation for increased productivity, efficiency, and customer experience. Due to consumers' growing reliance on digital financial services, there has been an increase in partnership and collaboration between tech firms and traditional financial and non-financial institutions. Those who refuse to adapt face falling behind in today's market.

Climate-related risks can bring destabilizing effects on the global financial system. As one of the most regulated industries in the world, the financial sector needs to operate within the regulatory framework to safeguard

people's money and investment (Murinde, Rizopoulos & Zachariadis, 2022; Tok & Heng, 2022). It is challenging to comply with the increasing complexity and demand of the financial system, which will finally become a heavy burden. The FinTech industry is constantly changing, and regulatory bodies and policymakers are becoming more concerned about data privacy and working to keep up with the various risk management strategies. Therefore, the augmented in the core banking system toward digitalization can bring risks and opportunities.

Digital financial services will risk financial services and challenge financial stability. The systematic risk will rise with the growth of FinTech financial services. According to Banna et al. (2022), technological transformation is vital to promote a healthy financial stability system and reduce risk-taking behavior. However, the potential for fraudulent operations and cybercrime will also increase as technology advances. Cyberattacks, such as computer scams and vulnerabilities, often cause significant losses. Additionally, Murinde et al. (2022) argued that, even though the banking industry plays a pivotal role in the progress of society as it signals economic and financial strength, sometimes it is a challenge for companies to maintain transparency and traceability of technological innovations. As a result, collaboration among governments, regulators, and technology businesses will drive tremendous innovation and hasten sustainability adoption in everyday life.

### **Climate FinTech: The Way Forward**

Climate FinTech concentrates on the mixture of finance, climate & digital tech (Climate Fintech, n.d.). It uses digital finance options to encourage decarbonization and work as financial intermediaries between those chasing that purpose (Mulwa, 2022). Though Climate FinTech is still in its infancy, interest in the bond between climate change & money is growing. For instance, the University of Cambridge will open a new center for finance & sustainability in February 2021 (Clancy, 2022). Future research into the interrelationship of climate, money & digital technology could extend in various ways. Researchers could ask questions about the ability of mobile & digital tech to modify climate finances, review innovative & untested solutions for climate change and business models, along with analyzing the role of financial intermediaries & pathways regarding decarbonization plans. Additionally, they could enquire into the regulation & legislation elements of Climate FinTech and consider possible impediments and struggles related to implementation.

Further research into this subject matter might assist in speeding up the move to a low-carbon, sustainable future. Exploration into the potentials of digital tech to upgrade climate risk assessment & management could take place, introducing novel methods for data collection, analysis & visualization - which might improve accuracy - along with examining insurtech & other FinTech inventions that can help with access & affordability when it comes to climate risk insurance. Other areas may include developing new Climate Fintech business models, analyzing the job lawmakers and regulators have in helping its development and appreciating ethical and social issues that come with this technology, as propounded by Akhtar&Nosheen (2022) and Yi et al. (2020).



## Conclusion

Climate FinTech has entered the mainstream and becomes the new way to pursue decarbonization by nurturing an emerging digital ecosystem of climate capital catalysts. Climate Fintech has both downstream and upstream benefits, as it improves the environment, people's daily lives, and the actions of the largest financial institutions. Fintech-driven innovations have the potential to reshape the financial system to meet the demands of sustainable development better. Climate FinTech provides consumers with energy and banking infrastructure that can improve their quality of life. At the same time, companies will be incentivized to run their operations while considering the environmental impact. Financial product innovation and deployment are critical components of capital mobilization for decarbonization. Slowing down decarbonization will expedite the energy transition toward a sustainable future. A sustainable future can only be built on a financial system that allows for the rapid growth of crucial industries to green practices while accelerating the innovation of new market makers defining game-changing business models.

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# A Scalable Healthcare Data Science Framework Based on Service-Oriented Architecture

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**Abstract:** The aim of the research presented in this paper is to propose a conceptual model and architecture of a service-oriented scalable framework, ensuring the implementation and verification of methods and algorithms for the integration, management, analysis, and visualization of biomedical data and the implementation of scientific research for the needs of precision medicine. The system architecture for big biomedical data analytics and discovering useful knowledge from data consists of the following components: biomedical data sources, data storage, data integration and preprocessing, real-time data flow, stream processing, analytical data storage, data modeling and analysis, and results visualization. A feed-forward artificial neural network is designed for data analysis, and during the training process, the input data is divided into training data and test data. The training error and its distribution over the weights of the neurons in the network are determined. A reduced set of statistical records related to cardiovascular disease analysis has been used as experimental data. The original database contains 76 attributes, and 14 of them have been used for the study. In addition, the data is split in a ratio of 0.8 to 0.2. The first 80% of the data was used to train the neural network and the remaining 20% to test the trained network. The calculated accuracy increases with increasing epochs and is higher for the training data and lower for the validation test data. Thus, the trained model can be saved, and loaded on another system, as well as available for review of the weight values. The trained model is applied in the system to calculate new input parameters that were not used either in training or validation.

**Keywords:** Healthcare, Biomedical data, Neural networks, Artificial intelligence, Data analytics

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## Introduction

A significant amount of heterogeneous data has accumulated as a result of the development of new biomedical technologies that produce biomedical data, including genomics, medical generation - sequencers that produce

genetic data, and imaging tools such as computed tomography (CT) imaging, nuclear magnetic resonance imaging (MRI), multilayer microscopic imaging in cell analysis, and more. Due to the quick development of high-throughput sequencing studies, we have seen an explosion in the amount of bioinformatics data that is currently available over the past ten years. Clinical reports, genetic sequences, gene expression profiles, biomedical literature reports, medical imaging, and sensor data are all produced in unprecedented quantities every day.

Large amounts of biomedical data are gathered and made available to the medical research community with the development of new technologies in the medical sector (Raghupathi, W., Raghupathi, V., 2014). However, one of the most fascinating and difficult tasks for medical professionals is making an accurate prediction of a disease's course. Medical researchers frequently use artificial intelligence techniques because they enable the discovery and identification of models of complicated datasets and interactions between them, successfully predicting future outcomes of a disease type. These changes present researchers and clinicians with three main challenges: scalability, security, and interoperability (Bahmani, A., Alavi, A., Buerger, T. et al. 2021).

Utilizing modern techniques to derive meaning from massive amounts of data has the potential to lead to meaningful change in clinical practice, from population screening to electronic health record mining to individualized therapy and intelligent medication creation (Hulsen, et al, 2019), (Avila K, Sanmartin P, Jabba D, Jimeno M., 2017). The requirement for standardized data content, structure, and clinical criteria as well as a greater demand for collaborative networks with knowledge exchange are the main issues. Many existing healthcare information systems are composed of a number of heterogeneous systems and face the important problem of system scalability (Yang TH, Sun YS, Lai F., 2011). The use of emerging data management approaches along with open source technologies such as Hadoop can be used to create integrated data lakes to store large data sets in real time (McPadden J. et al, 2018).

Precision medicine has rapidly expanded as a result of the development of new tools and technology for Big Data analysis and visualization (Ow, G. S. and Kuznetsov, V. A., 2016). According to precision medicine, disease diagnosis, medical decisions, treatment, and therapy should be personalized to the unique characteristics of each patient, particularly based on genetic testing of the patient in question (Ginsburg G. S. and Phillips K. A., 2018). Large and comprehensive databases of genomic, transcriptomics, proteomics, or metabolomics variables, as well as conventional clinical patient characteristics and treatment records, have emerged at an increasingly rapid rate in the era of big data and with the development of electronic healthcare records (Panahiazar M., Taslimitehrani V., Jadhav A. and J. Pathak, 2014).

However, when used directly in a clinical setting for accurate diagnostic and illness outcome prediction, such data are frequently extremely heterogeneous, high dimensional, noisy, and difficult to understand (Viceconti M., Hunter P. and Hose R., 2015). Additionally, the data quality is frequently constrained by a small sample size, flawed technology, variations in clinical trials, a variety of patient groups, and the design of the healthcare system. Patient quality of life and health care outcomes can be improved with the implementation of Internet of

Medical Things as healthcare professionals can monitor conditions; have access to electronic medical records. Remote monitoring and consultations lead to a reduction in frequent hospitalizations (Balasubramanian V, Jolfaei A. 2020).

The study discussed in this paper is a part of a project that provides a scientific framework for intelligent management and analysis of big biomedical data streams in a way that supports both precision medicine and biomedical research. The main benefit is the automatic development of hypotheses and possibilities for decisions, as well as validation and verification using a biomedical data set and scientific competence. The objective is to develop an integrated open technology platform for intelligent solutions for multidimensional large-scale biomedical data analysis based on cutting-edge and successful techniques, tools, and algorithms for discovering, integrating, storing, and analysing biomedical data, as well as for knowledge discovery and decision-making for the needs of medicine. The purpose of the research is to propose scalable framework based on service-oriented architecture for integration, management, analysis and visualization of big biomedical data streams. The goal is to offer an integrated, service-based, scalable workflow development environment consisting of a set of software tools for implementing methods and algorithms for realizing scientific research in the field of medicine and bioinformatics.

## Method

### Scalable Framework Architecture for Big Biomedical Data Analytics

The architecture consists of modules and provides the necessary flexibility and interoperability of the systems, tools and services that are provided to the users of the platform in order to facilitate a secure and transparent sharing of data and functionality. The modular architecture is service-based and provides the ability to efficiently integrate several software tools that are developed using multiple technologies and tools. Figure 1 illustrates the framework architecture, and the following paragraphs provide a brief overview of the components.

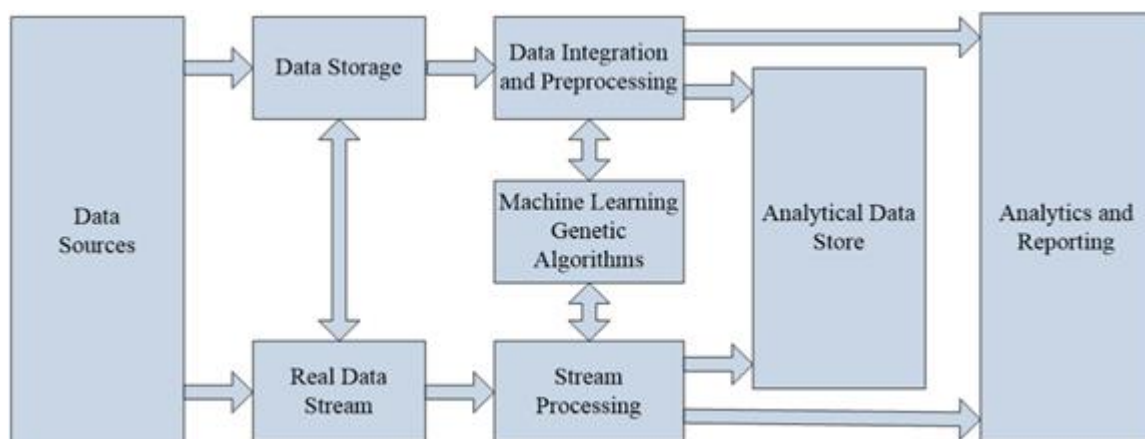


Figure 1. Architecture of a scalable framework for big biomedical data analysis

The system architecture for big biomedical data analytics and discovering useful knowledge from data consists of the following components: biomedical data sources, data storage, data integration and preprocessing, real-time data flow, stream processing, analytical data storage, data modeling and analysis, and results visualization. The technologies of streaming and parallel processing are applied. The research data warehouse has the capability to update multiple data for analysis and visualization. Data sources represent different sets of biological or medical data related to patients: digital records that include demographic data, medical history, laboratory test results, clinical data, genetic data, environmental factors, individual lifestyle parameters, etc. Data sets are usually distributed in large files in various formats. Real-time data streaming technology enables the collection and processing of data from multiple sources in real-time to extract insights. As a result, decisions can be made more quickly and with greater knowledge because data can be analyzed as soon as it is generated.

Large heterogeneous data sets that are represented in various formats, such as relational, NoSQL, and flat files, can be managed quickly with the aid of searching and integration services. The integration system is made up of services for integrating data in various formats and from multiple sources, translating a general request into a request in a particular language for each local database according to its nature. The prevalence of vast, varied, and complicated data sets in the public databases makes the need for scalable data integration systems for modern biology irrefutable.

Software tools for biological sequence alignment, multiple sequence alignment, feature extraction, and data set reduction are all included in data preprocessing services. Data management services include data discovery engines, data visualization tools, and software for pattern analysis. The data discovery engine is made up of modules that may process data in a variety of ways, including classification, clustering, genetic algorithms, and prediction. To avoid the complexity of important data sources, the query engine enables the establishment of data services. Servers for database/data warehouses are in charge of managing the required data. All produced patterns are stored in the knowledge repository. A pattern is produced as a result of the big data analytics process and is saved in the pattern repository. In particular, for evaluating the interest of the findings models or addressing demand, the knowledge base is helpful throughout the entire process of knowledge discovery from data.

The framework enables interoperability between different applications and sources based on standard interfaces, data sharing and information exchange. Each service is independent and includes business logic and data associated with it. Services are distributed, connected to others, and together form automated business logic. The solution consists of modules for accessing different types of data from different data sources, integration, data pre-processing, data analysis, knowledge interpretation and visualization of results. The proposed framework allows scientists an easy, fast and flexible approach to data processing. They can select the services they wish to be performed, use available software tools and database datasets, or enter their own data to be processed.

The framework architecture follows the processing pipeline for discovering useful knowledge from a collection of data and covers the following: data preparation, cleansing and selection; data processing and analyses, and

knowledge representation and visualization. The adaptability of the software architecture is accomplished by scalable experimental framework supporting various models and methods applied and scalability. The framework architecture includes knowledge representation and visualization in addition to data preparation, cleansing, and selection. Scalable experimental frameworks that support diverse models and application-specific methodologies enable adaptability of the framework architecture.

### Software Environments and Tools of Framework for Big Biomedical Data Analytics

Software environments and tools of framework for big biomedical data analytics are presented in Figure 2. *Data stream processing and workflows* environment is based on Apache Spark. Apache Spark is a cloud-based open source framework supporting programming languages such as Java, Scala, SQL, Python, and R. The University of California created it to function in a clustered big data environment where two or more Spark applications might operate concurrently as distinct and independent processes. Apache Spark also comes with extra research tools like MLlib, which supports deep learning libraries based on deep learning pipeline structures and machine learning libraries.



Figure 2. Software environments and tools of framework for big biomedical data analytics

*Biomedical data integration* is based on the software integration tool Talend Open Studio. Talend Open Studio is an open source software for processing big data using a graphical user interface. Moreover, its functional architecture allows data analysis and review of analysis results and query when working with: databases based

on Oracle, SQL Server, Postgre SQL; big data using Hive, Amazon-Redshift. In addition, Talend Open Studio enables data access and processing by connecting the Apache Hadoop big data platform. This empowers the user to process big data on a Hadoop cluster using big data jobs designed with Talend. Talend Open Studio have been used to implement a workflow model through which a method for integrating biomedical big data streams was validated. Rules used to execute the modules were developed based on the workflow efficiency requirements for biomedical purposes. The studies are described in (Vetova, S., Biomedical Data Integration and Innovations Concept, 2021).

Orange Data Mining is a component-based visual programming software package for data visualization, machine learning, data mining, and data analysis. Components range from simple data visualization, subset selection, and preprocessing to empirical evaluation of learning algorithms and predictive modeling. Visual programming is implemented through an interface where workflows are created by connecting predefined or user-designed tools. Orange can be used as a Python library for data manipulation and tool replacement. Through Orange, studies have been carried out for classification of images by clusters for positive and negative cases, assessment of the accuracy parameter for positive and negative Covid cases, calculation of an error matrix using the methods: Logistic regression, Random forest, Naïve Bayes. The results are described in (Gancheva, V., Platform for Big Biomedical Data Streams Management and Analytics, 2020) and (Gancheva, V., Todorova, V., 2022).

TensorFlow is a platform for implementing machine learning algorithms and the implementations to run such algorithms. Computations performed using TensorFlow can be performed on heterogeneous systems ranging from mobile devices to distributed systems of hundreds of machines and thousands of computing devices, such as GPU cards. The system is flexible and can be used to implement a variety of algorithms, including training algorithms for deep neural network models. TensorFlow computations are described by a directed graph consisting of a set of nodes. Typically, customers construct a computational graph using either C++ or Python.

Keras is a high-level neural network application built in the Python programming language. Keras can be run in combination with the deep learning platforms TensorFlow or Theano. It implements a program model of a convolutional or recurrent neural network. The Keras model is characterized by two modes: training mode and testing mode. The training losses represent the arithmetic mean of the training data losses. As the model changes over time, the losses on the first training data are higher than on the last. The TensorFlow platform is used to implement a feed-forward neural network model for cardiovascular data analysis. The results achieved are discussed in each section.

MATLAB supports object-oriented programming and various types of program constructions, as well as image processing and visualization in 2D or 3D formats. MATLAB can be used as both a computational and an analysis tool. Technologies such as machine learning, deep learning and computer vision can be implemented. Deep neural network layers can be created and connected, custom training loops and automatic differentiation training layers can be built. The MATLAB environment was used for the implementation of unsharp masking



with local adaptive contrast enhancement of medical images (Draganov I., Gancheva V. Unsharp Masking with Local Adaptive Contrast Enhancement of Medical Images, 2021), optimal bilateral filtering of CT images (Draganov I., Gancheva V. Optimal Bilateral Filtering of CT Images, 2021) and image classification using wavelet analysis (Vetova S., Wavelet Analysis for Biomedical Data, Applications of Mathematics in Engineering and Economics, 2021).

Anaconda is one of the most popular platforms for data analysis, artificial intelligence and neural networks. The platform is open and provides access to a huge number of tools, applications and libraries for visualization, transformation and analysis of input data. The Anaconda platform was used to develop a software tool for the management and analysis of large biomedical data. The software tool is implemented in Python programming language.

3D Slicer is a free, open source software developed primarily for scientific purposes that allows the import of various medical data and the construction of 3D reconstructions from them. A workflow has been developed that includes interprocessing of multidimensional medical images to create three-dimensional reconstruction and automated interactive stereoscopic visualization of biomedical data. Sources of medical images can be, for example, computed tomography or nuclear magnetic resonance.

OpenGL is a cross-language, cross-platform application programming interface for rendering 2D and 3D vector graphics. It is typically used to interface with a GPU to achieve hardware-accelerated rendering. OpenGL tools were used for the resulting spatial visualization of biological data (Gancheva V., Knowledge Discovery Based on Data Analytics and Visualization Supporting Precision Medicine, 2020).

Unity is a cross-platform for developing PC games and virtual reality applications, supporting various desktop, mobile, console and virtual reality platforms. Especially popular for iOS and Android. Unity can be used to create three-dimensional (3D) and two-dimensional (2D) interactive simulations and other experiences. The environment is used for verification of the method developed within the project for spatial visualization of multidimensional large biomedical data.

### **Experimental Data on Cardiovascular Disease**

The data used are a reduced set of statistical records of parameters related to cardiovascular disease analysis. The original database contains 76 different attributes, of which 14 are used. The data originates from Cleveland, USA, and can be freely downloaded from the Kaggle (Heart Disease Dataset <https://www.kaggle.com/datasets/johnsmith88/heart-disease-dataset>). The dataset is in .csv format, separated by semicolons.

Data parameters:

- Age - age in years
- Sex - gender (1 = male; 0 = female)

- CP - type of chest pain
- TRESTBPS – resting blood pressure measured in mm Hg on admission to the hospital
- CHOL – serum cholesterol in mg/dl
- FPS – blood sugar > 120 mg/dl) (1 = yes; 0 = no)
- RESTECH - resting electrocardiographic results
- THALACH – maximum heart rate
- EXANG – angina induced by angina pectoris (1 = yes; 0 = no))
- OLDPEAK - ST depression
- SLOPE – ST slope
- CA – saturation of stained major blood vessels (0-3)
- THAL – defect status (3 = normal; 6 = defect; 7 = reversible defect)
- TARGET – presence of disease (1 = yes; 0 = no)

## Results and Discussion

### Feed Forward Neural Network Model for Cardiovascular Data Analytics

A feed forward neural network was designed for data analysis using the Keras library (Figure 3). During the training of neural networks, it is necessary to separate the cardiovascular disease input data into training data and test data. The X vector takes the value of all 13 parameters from the input data. The 'target' parameter is extracted into the vector Y, which is used in the training process to compare with the output of the neural network. The vector Y is used to determine the training error and the inverse distribution of the error on the weights of the neurons in the network.

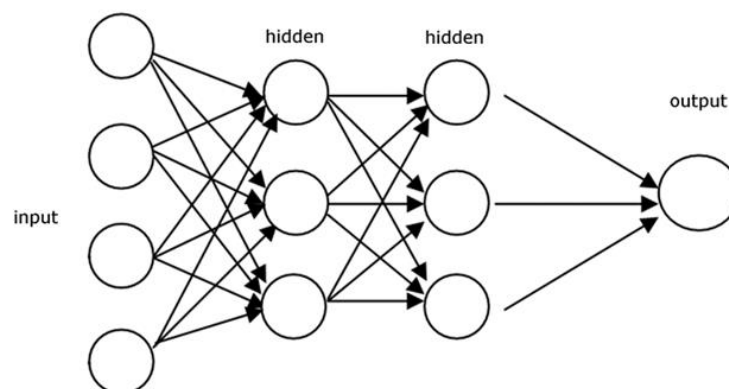


Figure 3. Feed forward neural network model with arbitrary number of layers and neurons

In addition to splitting the input 13 parameters and the output single parameter, the data is split once more in a ratio of 0.8 to 0.2. The first 80% of the data is used to train the neural network and the remaining 20% to test the already trained network. The vectors X\_train and X\_test contain the input data for training and testing, respectively, while the vectors y\_train and y\_test contain the output vectors for training and testing,

respectively.

### Workflow for Cardiovascular Data Analytics

A Workflow for cardiovascular data analytics is designed (Figure 4) and includes follows phases: cardiovascular data selection and pre-processing, model creation, model training, model validation and evaluation. Categorization is one of the approaches to preprocessing the source data. The output vectors are converted from digital to binary. The next step is creating the neural network model. The selected model is of sequential type feed forward neural network model with any number of levels/layers and neurons (Figure 5). In this case, 13 input neurons are selected, which is the number of input parameters from the database, a second layer with 16 neurons, a third with 8 neurons, and 2 output neurons that are activated for a patient with a disease and a patient without a disease, respectively. The outcome is probabilistic. The total number of parameters in the neural network is 378, and these are all the weights of the connections between neurons, as well as the standard deviations for each neuron (bias).

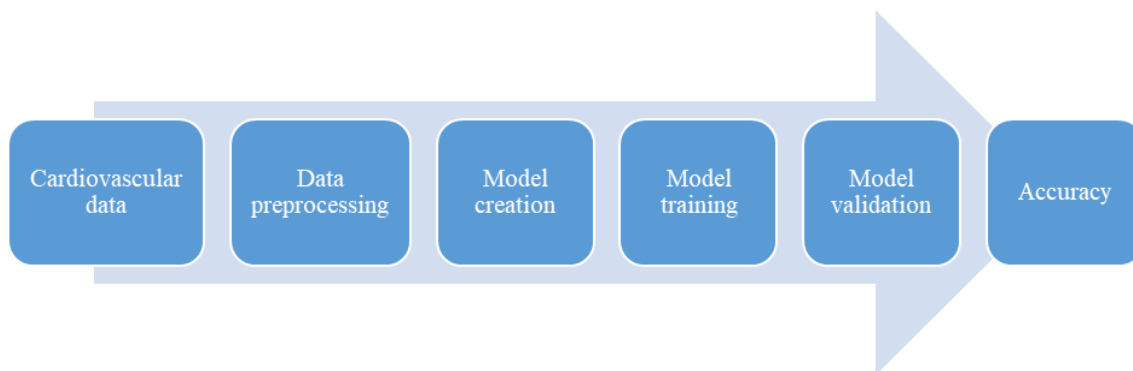


Figure 4. Workflow for cardiovascular data analytics

```
Model: "sequential"
```

Layer (type)	Output Shape	Param #
dense (Dense)	(None, 16)	224
dense_1 (Dense)	(None, 8)	136
dense_2 (Dense)	(None, 2)	18
Total params: 378		
Trainable params: 378		
Non-trainable params: 0		

None

Figure 5. Sequential feed forward neural network model

Next step is training the neural network. The training and test vectors are inputs to the neural network. The number of epochs is 200, which determines the number of complete training data passes to the model. The function takes the test 20% as validation data. Validation data is necessary to track the training process of the model, namely for the so-called 'underfitting' - a situation in which the model is not trained well enough and

'overfitting' - a situation in which the model is over-trained and does not generalize but simply memorizes the input data, leading to poor output results with new data.

After reading all training epochs, the accuracy of the model is plotted against the training data and the validation data (Figure 6). As expected, the accuracy increases with increasing epochs and is higher for the training data and lower for the validation test data. Thus, the trained model can be saved, loaded on another system, as well as available for review of the weight values (Figure 7).

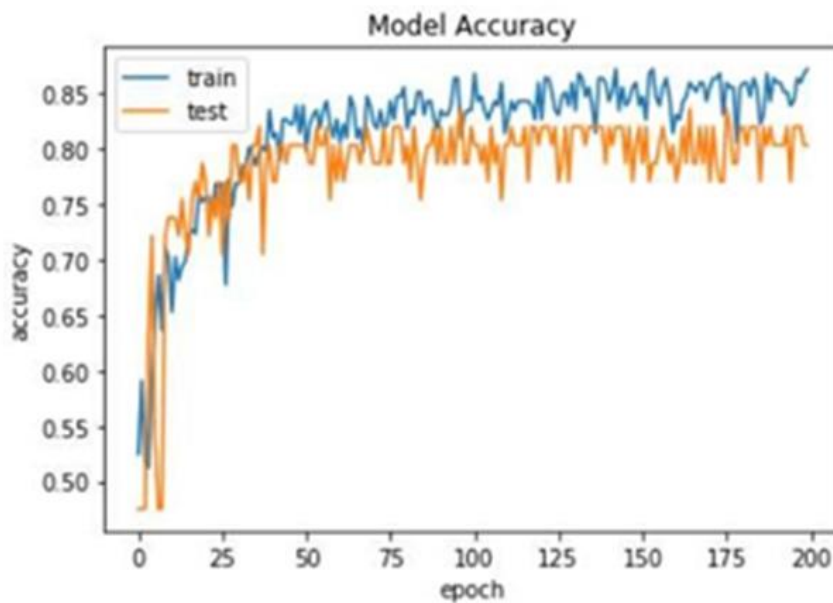


Figure 6. Feed forward neural network model accuracy

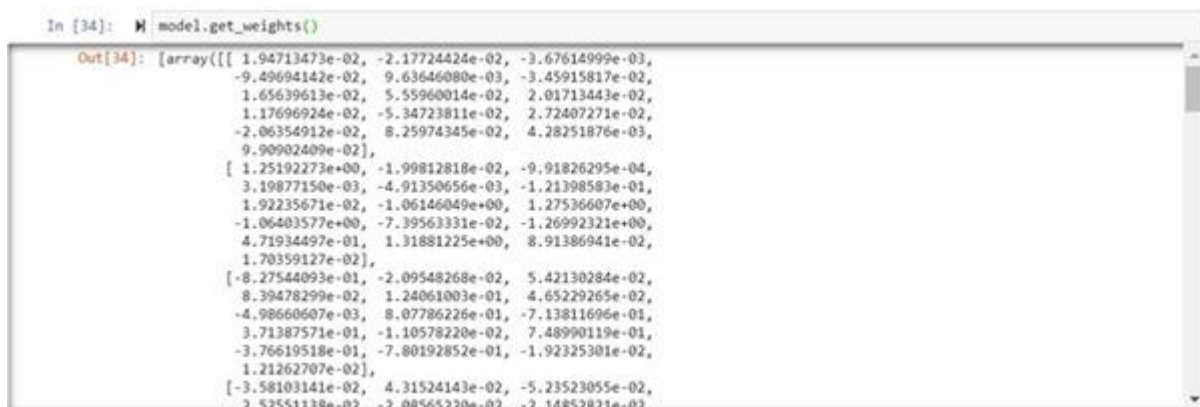


Figure 7. Trained feed forward neural network model

The purpose of the trained model is to use it to calculate input parameters that are new to the system and not used in training or validation. It is important to keep the order of the parameters in the vector in such a way that it matches the order of the training and validation data. The result is the probability distribution of the possibility that the patient has heart disease.

## Conclusion

The research described in this paper aims to propose a conceptual model and architecture of a service-oriented scalable framework, ensuring the application and verification of methods and algorithms for the integration, management, analysis, and visualization of biomedical data as well as the application of scientific research for the needs of precision medicine. Biomedical data sources, data storage, data integration and preprocessing, real-time data flow, stream processing, analytical data storage, data modeling and analysis, and results visualization make up the system architecture for big biomedical data analytics and extracting knowledge from data. Parallel processing and streaming technologies are used. Multiple data can be updated in the research data warehouse for analysis and visualization.

A feed-forward artificial neural network is designed for the case study of cardiovascular data analysis. The input data are separated into training data and test data during the training phase. The training error and how it affects the network's neuron weights are calculated. As experimental data, a condensed collection of statistics on cardiovascular disease analysis has been used. 14 of the 76 attributes in the original database were used for the study. The data is also divided in a ratio of 0.8 to 0.2. The neural network was trained using the first 80% of the data, and the trained network was tested using the final 20%. As epochs are added, the computed accuracy becomes higher. With more epochs, the computed accuracy grows and is higher for training data and lower for validation test data. As a result, the trained model can be saved, loaded onto a different machine, and reviewed to check the weight values. The system uses the trained model to compute new input parameters that weren't used during either training or validation.

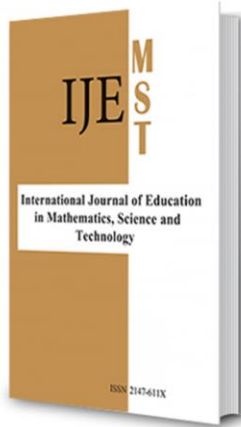
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