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NALI2024

PROCEEDING

EMPOWERING TEACHING & RESEARCH CONNECTION THROUGH INNOVATION

1st–3rd OCTOBER 2024

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FOREWORD FROM CHAIR OF NALI 2024

Chair NALI2024
Assoc. Prof. Dr. Nurbiha A. Shukor

Assalamualaikum Warahmatulahi Wabarakatuh and Greetings,

As we approach the New Academia Learning Innovation (NALI) 2024, it is with great pleasure that we invite you to join us in harnessing the power of innovation to bridge the realms of teaching and research. This year, our theme "Empowering Teaching & Research Connection through Innovation" underscores our commitment to redefining educational paradigms by integrating cutting-edge research into the classroom. This event is designed to spotlight innovative approaches that enhance pedagogical methods, foster significant research, and facilitate robust academic networks.

Scheduled from 1st to 3rd October 2024 at the Persada Johor International Convention Centre in Johor Bahru, NALI 2024 promises to be a cornerstone for educational and research professionals. The conference will feature a variety of workshops centered on integrating research into pedagogy, enhancing collaboration through technology, utilizing data-driven teaching techniques, and nurturing creativity in scholarly endeavors. These workshops are crafted not only to share knowledge but also to spark innovation in our educational approaches.

On behalf of the organizing committee, we express our deepest gratitude to all participants and contributors to the 7th e-Proceeding of New Academia Learning Innovation (NALI) 2024. It is our sincere hope that this conference will serve as a beacon of inspiration and a guide for the continuous evolution of our educational landscape towards greater adaptability, creativity, collaboration, and a deeper integration of research.

We look forward to your participation in what promises to be an enlightening and transformative experience at NALI 2024.

Thank you.

Assoc. Prof. Dr. Nurbiha A. Shukor
Chair
New Academia Learning Innovation (NALI) 2024

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ID 02: Metaflip Français: Transforming French Pronunciation and Reading Comprehension with Metacognitive Scaffolding

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Highlights: This study is the pioneering work to integrate metacognitive scaffolding within a flipped classroom model for French language instruction, intending to bridge gaps in current research and introduce an innovative teaching model for learning French. By applying this method, the research tends to improve French learners' pronunciation and reading comprehension.

Keywords: *Metacognitive Scaffolding (MS); Flipped Classroom (FC); French Language Learners; French Pronunciation; French Reading Comprehension*

Introduction

NALI (New Academia Learning Innovation) is a framework to promote innovative teaching and learning practices in education, including student-centered and blended learning philosophy, diverse learning modes, and materials to achieve entrepreneurial academia. The following section will explain in detail how this study is consistent with the NALI framework by combining the specific pedagogies and practices to achieve the core objectives of the framework.

Novelty of this study

This study proposed an innovative learning approach to French language education by integrating metacognitive scaffolding (Reingold, Rimor, & Kalay, 2008) into a flipped classroom (FC) model (Lo & Hew, 2017), named MetaFlip Français. Previously, metacognitive scaffolding and the flipped classroom model (FC) have been implemented in the education domain, especially in foreign language learning. However, these two strategies have not been combined to improve French language learning. The integration of metacognitive scaffolding supports students in developing self-reflection and self-regulation skills, enabling them to better organize and manage their learning. Moreover, this innovative combination will optimize the strengths of both methods to address the specific challenges faced by novice French learners in pronunciation (Wang, 2022) and reading comprehension (Al Adawiyah, 2023; Hashemifardnia, Namaziandost, & Shafiee, 2018).

Creativity (Design of MetaFlip Français)

The design of the MetaFlip Français learning environment refers to a well-structured integration of metacognitive scaffolding into the FC model. The instructional design includes:

- **Out-of-class Learning (Direct Instruction)**: Students learned instructional videos and online resources prepared by the instructor. This phase includes activities such as completing content notes, taking online quizzes, and participating in online discussions.
- **In-class Learning (Group Activities):** In-class learning is dedicated to group activities. This includes brief reviews, individual practice, and small group activities under the supervision of the instructor. The conceptual framework and a part of the learning environment of this study is outlined as follows:

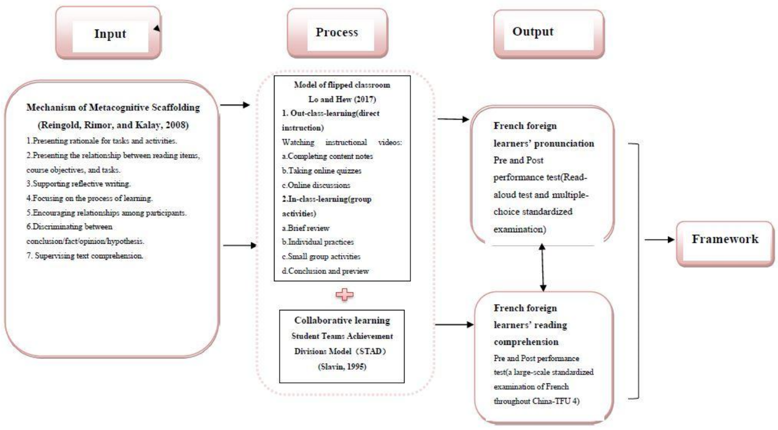

Figure 1 Conceptual Framework

Table 1: The example of the flipped classroom activity with metacognitive scaffolding in a French language classroom

Topic	Flipped classroom learning environment	Mechanism of metacognitive scaffolding by instructor
Topic 1) Introduction to French pronunciation 2) French vowel phonemes /a,ɛ,e, i/ and consonant phonemes/p,b,t, d,k,g/	Out of class: Watching instructional videos on the Superstar platform before in-class Activity 1: The teacher delivers the instructional content to the whole class Teacher instruction: Please refer to the lecture video on the Superstar platform about French vowel phonemes /a,ɛ,e, i/and consonant phonemes/p,b,t,d,k,g/ Online discussion Activity 2: Online discussion Teacher instruction: According to the course video, discuss the following questions and write down the answers in the blank space Online quizzes Activity 3: Test: All students are required to conduct separate tests on the materials, and at this time they cannot help each other. The quizzes are usually followed in the form of multiple-choice questions Teacher instruction: Multiple-choice question: Only one of the following questions is correct. Please choose the correct option	MS1 – Presenting rationale for tasks and activities The reason why we need to learn French pronunciation is that we should communicate well and we can read the French words by ourselves. MS2 – Presenting the relationship between reading items, course objectives and tasks What's the difference between English vowel phonemes/a/ and French vowel phonemes/a/? The English consonant phonemes/p/ and the French consonant phonemes/p/ are the same? MS3 – Supporting reflective writing Your pronunciation is perfect, Please continue to focus on what you have learned today. Your answer is correct, well done. Your answer is wrong, please refer carefully to the lecture video. Overall, the pronunciation is very good. Please note that the letter c in the word connaît should be voiced, and the consonant letter is generally not pronounced at the end of the word! Keep going! MS4 – Focusing on the process of learning How to pronounce French vowel phonemes /ɛ/ How to pronounce/t/?
	In-class: Brief review Activity 4: Brief review: The Instructor summarizes the content of the lecture video, and explains the common mistakes in online quizzes Teacher instruction: Today, we will learn together French vowel phonemes /a,ɛ,e, i/and consonant phonemes/p,b,t,d,k,g/. Individual practices Activity 5: Individual practices: The teacher asks students to do individual practices to deepen understanding, apply knowledge, and foster autonomous learning skills. Teacher instruction: Please mark the French words that appear in the PPT with phonetic symbols. Please have A and B two students come up to the blackboard to do it. Small group activities Activity 6: Small group activities aim to promote collaboration, critical thinking, and the application of pre-class activities Teacher instruction: In a group, please do the exercises in the textbook. Then we do the group competition. The group with the highest accuracy wins.	MS5 – Encouraging relationships among participants Please invite students C and D to help correct the work of students A and B MS6 – Discriminating between conclusion, fact, opinion and hypothesis Can we conclude that in French, consonant letters are not pronounced at the end of a word? If not, what is the difference? MS7 – Supervising text comprehension I think you should explain more about the pronunciation of consonant [k]. Do you think the pronunciation of /a/ in French is similar to in English?

This innovative instructional design ensures that students receive direct instructional content at their pace outside of class, while in-class time is optimized for interactive, collaborative learning activities that reinforce and expand upon the out-of-class content.

Applicability

- **Promoting Student-Centered Learning**: The FC model shifts the focus from teacher-centered instruction to student-centered learning, encouraging students to take charge of their learning process (Ali, 2019). In addition, by combining metacognitive scaffolding with a flipped classroom learning environment, this study aims to provide students with greater autonomy in their learning process and enhance their engagement and sense of ownership.
- **Technology integration**: In this study, the researcher implemented digital platforms- Superstar platform, videos, WeChat, etc. The integration of technology into education aligns with the demands of modern education (Yu, 2023) and the NALI framework which focuses on enhancing flexibility and personalization in learning.
- **Facilitating Active Learning**: By engaging students in active learning processes both inside and outside theclassroom, the design of the Metaflip Français in this study will boost students' critical thinking, collaboration, and practical application of knowledge which is also the core concept of the NALI framework (Blau & Shamir-Inbal, 2017).

Findings of the Project

The MetaFlip Français project was implemented among undergraduate students enrolled in French as a second foreign language. The findings are based on both quantitative data collected throughout the study.

Improvement in Pronunciation:

Pre-test and post-test scores indicated a significant improvement in students' French pronunciation. The read-aloud and perception tests showed that students who participated in the MetaFlip Français treatment had more consistent and precise improvement in pronunciation compared to those in French-flipped classrooms without metacognitive scaffolding.

Improvement in Reading Comprehension:

Pre-test and post-test scores also demonstrated notable progress in reading comprehension, as evidenced by their performance on standardized reading comprehension tests. The metacognitive scaffolding from instructors helped students comprehend and understand complex texts more effectively.

Relationship between French language learners' pronunciation and reading comprehension in the MetaFlip Français:

Spearman correlation analysis reveals Spearman's rank correlation coefficient is 1.000 which indicates a significant positive correlation between students' French pronunciation and students' French reading comprehension in the MetaFlip Français learning environment. In addition, Spearman's rho correlation coefficient is 0.503, also demonstrating a moderate positive relationship between these two variables. This result represents that students who have higher scores in pronunciation also are likely to have better performance in reading comprehension, and vice versa. It can be concluded that improving students' pronunciation skills could potentially enhance their reading comprehension abilities.

Table 2 Correlations among French Pronunciation and Reading Comprehension

			Reading Comprehension
Spearman's rho	Pronunciation	Correlation Coefficient	.503
		Sig. (2-tailed)	.003
		N	33

Discussion

Integrating metacognitive scaffolding within a French flipped classroom model has shown to be a highly effective approach to French mastery. The significant improvements in both pronunciation and reading comprehension can be attributed to the student-centered and interactive learning environment created by MetaFlip Français.

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ID 03: Online Inquiry-based Learning：Enhancing Students' Behavioral Engagement and Performance in Science Education

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Highlights: Recent studies are lacking in providing insights into student's behavioral engagement especially in learning Science subject. To fill this research gap，the researcher provided an innovative design which is online IBL activities through Superstar platform. This study examined the effectiveness of online IBL activities towards behavioral engagement and performance among secondary school students in science learning. The results revealed that behavioral engagement and performance of secondary school students were significantly improved through online IBL. This innovative design might contribute to provide basis for the practice of teachers and educators in developing online IBL activities applicable to science learning.

Keywords: online Inquiry-based learning; pedagogy strategy; science learning; secondary school tudents

Introduction

New Academia Learning Innovation Model" (NALIM) is an educational framework that focuses on transforming traditional teaching and learning practices to align with the demands of the 21st century. It emphasizes the integration of modern pedagogical strategies, digital tools, and innovative approaches to enhance student engagement, critical thinking, and collaborative learning.

Novelty of this study

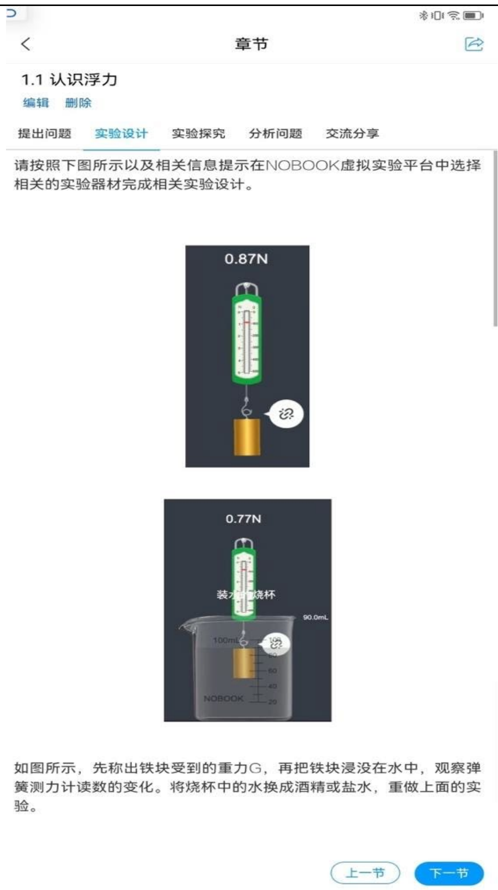
Inquiry-based learning is a student-centred constructivist pedagogical strategy that guides students to actively explore in problem situations to achieve inductive deduction and knowledge construction(Levy, et al., 2009; Pedaste, et al., 2015).Recently, scores of studies have shown that inquiry-based instruction strategy is applied in online learning has many potential benefits to the engagement of students(Ismailov, 2021;Husni, et al.,2022). Despite the potential of IBL as a learning strategy for enhancing students' engagement, however, there are lack of studies that look into student's behavioral engagement especially in learning Science subject. The innovation of this study is the design of a series of innovative online inquiry-based learning activities through the Superstar Learning Platform to enhance secondary school students' behavioral engagement and academic performance in science learning. Moreover, the online inquiry-based learning activities designed in depth around the process of scientific inquiry, such as establish a question or problem, decide on a method for inquiry, experimental investigation and collect data, analyse the problem and solution, communication. This specific design makes the inquiry activities more relevant and can effectively enhance students' behavioral engagement and performance in the field of science.

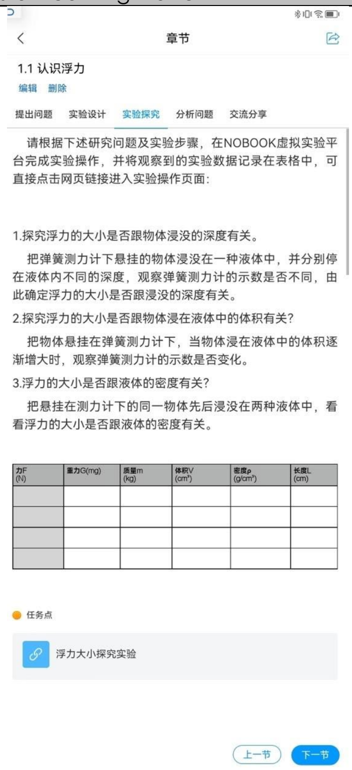
Creativity (Design of online IBL activities)

In current study, online IBL activity was created to teach students about science knowledge. The researcher designed online IBL science learning activity thought Superstar Learning platform (http://v3.chaoxing.com). Superstar learning is a well-known online education platform in China, which dedicated to providing students, teachers and educational institutions with rich and diverse online learning resources and services.

In addition, of the basic inquiry phases was used to shape the overall structure of it, which including five phases. These IBL phases were created by Levey (2010). Then, this IBL model was be implied into online by Daniel & Calandrino (2015) and they considered how these processes can be authentically replicated in online learning environments (Daniel & Calandrino,2015). IBL five phases include: 1) establish a question or problem, 2) decide on a direction or method for inquiry, 3) explore or collect data or evidence, 4) analyse the problem and solution, 5) communication and share result. In this study, "Mechanics" as a theme of science subject is the main focus of learning content. Under this main theme, five subtopics are included which are "Buoyancy", "Archimedes' Principle", "Sink and Float", "Lever", "Pulley", "Mechanical Efficiency". Example of an online IBL science learning activities of Buoyancy used in this study was showed.

Table 1: Phases of Online IBL activities of Buoyancy and the explanation of each phase in Superstar

Phase	Task	Display in Superstar Learning Platform
Establish a question or problem	Students watch a video about "Buoyancy" in Superstar platform. The purpose of this is through watching video to stimulate students' thinking about the question about buoyancy. Then students are asked to answer the following question according to this video.	 Translation: This large and heavy aircraft carrier not only doesn't sink but can also carry very heavy objects, mainly because of buoyancy. So, do objects immersed in water, such as iron blocks or stones, also experience buoyancy? What are your guesses about the magnitude and direction of the buoyant force?
Decide on a direction or method for inquiry.	All students are required to select relevant experimental equipment and complete experimental design through the NOBOOK virtual experiment platform web link provided in Superstar platform.	 Translation: Please select the relevant experimental equipment and complete the experimental design according to the diagram and the provided information in the link to verify your hypothesis

<table>
<tr><th>Phase</th><th>Task</th><th>Display in Superstar Learning Platform</th></tr>
<tr><td>Experimental investigation and collect data</td><td>All students are required to conduct online science inquiry experiment of “Investigate the Magnitude of Buoyancy” according to experimental steps. Then record the observed experimental data in a table. Online science inquiry experiment is completed through the NOBOOK virtual experiment platform web link provided in Superstar platform.</td><td>


Translation: Please read the following questions and experimental steps, complete the experiment on the NOBOOK online platform, and record the observed experimental data in the table. You can access the experiment operation page by clicking the online link</td></tr>
<tr><td>Analyse the problem and solution</td><td>Students observe and analyse the data in the table that they have completed and draw conclusions.</td><td>


Translation: What conclusions can you draw from the experimental operations and the observed experimental data</td></tr>
<tr><td>Communication and share result</td><td>Students are asked to share their opinion</td><td>


Translation: What factors are related to the magnitude of buoyancy?</td></tr>
</table>

Applicability

- **Promoting student-centered learning and the development of scientific inquiry ability**: The innovative design encourages students to establish questions, design experiments and conduct investigations on their own through online enquiry-based learning activities. This is highly compatible with the concept of self-directed learning and inquiry-based learning in NALI.
- **Technology integration:** This design provides a rich set of digital resources and tools through the Superstar platform, enabling students to access information, perform experimental simulations and data analysis in an

online environment. This digital learning environment is closely linked to the technology-driven learning model advocated by NALI, which helps students engage in science learning more effectively with the support of technology.

- **Enhancing Student Engagement:** This design uses challenging questions to guide students through experimentation, data analysis, and discussion to find answers. This kind of inquiry-based learning can stimulate students' curiosity and desire to investigate, prompting them to actively engage in the learning process. This aligns with NALI's goal of integrating modern teaching strategies, digital tools and innovative approaches to enhance student engagement.

Research Methodology

Research Design: To achieve the research objectives of this study, this research adapted a quasi-experimental design which involves quantitative and qualitative data. This quasi-experimental design used a non-equivalent control group design that involved a control group and experiment group that all be chosen purposive. In experimental group (Group A), students will study science knowledge in online IBL activities designed by instructors. While in control group (Group B), students will study in online learning without any special pedagogy strategy imposed for their learning environment. After the intervention, both groups will conduct a pre- test and post- test to determine the effect of this experiment. Each group was given the same time during the treatment.

Sample: The selected sample for current study involves two classes from one public secondary school in Shandong province. They are 90 2nd year secondary school students who are studying the Science Subject course during semester I of 2023/2024 academic year. Moreover, both classes are assigned as group A for experimental group(n=45) and group B for control groups(N=45) respectively.

Instruments: In this study, the researcher chose two instruments to answer the research questions, which mainly include online behavioral engagement questionnaire, performance test questionnaire. Students' behavioral engagement questionnaire: In current study, the researcher used the engagement questionnaire which developed by Miserandino (1996) and Wang, et al. (2016) to measure students' behavioral engagement in online science learning. Performance test questionnaire: Pre- and post- performance tests are the summative assessment was designed by researcher to test students' scientific knowledge. This test is created to represent the final examination questions in the science subject course which includes 12 questions. It evaluated using the grading criteria, with a maximum total score of 50 marks for the practical assessment.

Finding of the project

Improvement of Students' Behavioral Engagement: The behavioral engagement of all secondary school students shows their improvement in post-test compared with pre-test for experimental group. Specifically speaking, attention, persistence, participation and concentration all increased. However, the only exception was a slight decrease in homework completion, but the change was not significant. In regarding to negative behavioral engagement, avoidance, ignorance and helpless all decreased. Moreover, the experimental group was significantly higher than that of the control group, further supporting the effectiveness of the experimental intervention. Based on these, we can conclude that online IBL activity via Superstar platform is effective in improving students' behavioral engagement in science learning.

Improvement of Students' performance: From the result of data analysis, it can be seen that the improve of students' learning performance in the post-test for experiment is more significant than control group, indicating experimental interventions are effective. Therefore, it can be concluded that the effectiveness of online IBL activities on enhancing learning performance among secondary school students in science study.

Conclusion

The finding shows that online IBL activities have positive impact on secondary school students' behavioral engagement and performance in science learning. The innovative design might contribute to provide basis for the practice of teachers and educators in developing online IBL activities applicable to science learning.

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ID 08: Ethical Decision: Empowering Future Engineers through Harvard Dialogue Style Ethics Case Study Approach

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Highlights: This project focuses on using real-world case studies to teach ethical decision-making to first-year chemical engineering students. By emulating the Harvard Business School's case study method, this approach helps students grapple with real ethical dilemmas, encouraging critical thinking and dialogue. The innovative blend of case-based learning and structured dialogue allows students to explore complex ethical scenarios, enhancing their understanding of professional conduct and preparing them for real-world engineering challenges. The project demonstrates significant improvements in students' analytical skills, confidence, and ethical awareness, making it a valuable addition to engineering education.

Keywords: *Engineering Ethics; Harvard Case Study; First Year Engineering*

Introduction

Ethical dilemmas are the situations in which moral reasons come into conflicts, or in which the application of moral values is problematic and it is not immediately obvious what should be done (Martin, 2002). The definition of ethics is complex which involves moral principles and philosophy, while in engineering, engineers need to comply with engineering ethics code of conduct. Knowledge and practices of engineering ethics is necessary in engineering education as it was highlighted in the EAC Standard 2024 as one of engineering programme outcomes (EAC, 2024). However, students often interpret ethics narrowly (e.g., plagiarism) and may not understand broader implications. Thus, the need for broad awareness of ethical in sustainability pillars; social, economic, and environmental contexts should be emphasized in the classroom.

Harvard Business School pioneered the use of case studies to teach management in 1921 (Kantor, 2013). Cases expose students to real business dilemmas and decisions. Cases teach students to size up business problems quickly while considering the broader organizational, industry, and societal context. Students recall concepts better when they are set in a case, much as people remember words better when used in context. Cases teach students how to apply theory in practice and how to induce theory from practice. The case method cultivates the capacity for critical analysis, judgment, decision-making, and action.

Appreciating NALI model and objectives, this project emulating Harvard Business Case Study successful approach, a combination of the case-based learning design and dialogue class activity implementation was developed to design engineering ethics elements in Introduction to Engineering causes for first year chemical engineering students.

Project Objectives

This project aims to:

- To provide powerful learning opportunities by using of real-world case studies highlighting ethical failures
- To develop student's decision-making skill through dialogue session with real-world applications.
- To provide safe learning environments allow students to explore ethical implications without severe consequences.

NALI Approach Implemented

The implementation of the New Academia Learning Innovation (NALI) approach in this project is through the practice of student-centered learning pedagogy, which combines case-based learning and dialogue activity. The elements of novelty, innovativeness, applicability and were proposed in the project.

Crafting case studies based on real-world industrial incidents provides a fresh approach. These scenarios mirror the complexities engineers face, allowing students to grapple with imperfect information and ethical dilemmas faced by engineers. Emulating Harvard Business School's case study method in an engineering context is innovative. Applying this successful approach to ethics education bridges the gap between theory and practice. The applicability is shown through the real-World Relevance where the use of actual industrial incidents ensures direct applicability. Students encounter scenarios they might encounter in their future careers, making the learning experience practical and relevant. The project directly addresses the need for ethical decision-making, an essential skill applicable across engineering disciplines and industries. The case studies were crafted creatively by narrating real incidents into case studies involves storytelling and scenario design. It sparks curiosity and engages students. In addition, structuring dialogue sessions to encourage open discussion, reflection, and diverse viewpoints fosters creativity in problem-solving.

Methodology

Introduction to Engineering Course (SETK1523)

Introduction to Engineering is a three-hour credit course for first year chemical engineering undergraduates. The class size ranges from 30 to 40 students. The total number of weeks for instruction is 14 in one semester. The objective of ITE course is to introduce students to engineering and prepare students for learning engineering to become engineers of the future. One of the course learning outcomes is developing an overall view of engineering and engineering ethics, where students are expected to be able to explain engineering ethics codes in various ethical dilemma scenario.

Case Studies Crafting

A set of case studies were crafted by the ITE lecturers using real industrial incidents in Malaysia and other countries. The known world incidents were referred and narrated into each of the case studies to provide ethical dilemma related to each clause of engineering ethic codes. It provides a contextual basis for replicating a practical situation with all its conundrums, intricacies and dilemmas faced by engineers. The students assume the role of engineers who make decisions based on incomplete and imperfect information as would typically be the case in the real world. The students are also held accountable for the quality of their decisions.

Design and Implementation of Harvard Style Ethic Case Studies Dialogue

The design of the Harvard Style Ethic Case Studies Dialogue is presented in Figure 1. The week before the class, students were equipped with Board of Engineer Malaysia (BEM's Code of Professional Conduct and several articles about engineering ethics. Students need to read and prepare the note before the class.

In the classroom, the instructor explained the Ethic dialogue activity. Students need to present their name stand on their table throughout the class session to ease instructor's assessment. In their designated team, they were provided with a case study. In 20 minutes, they read and discuss the case in depth. To encourage them discuss in depth, several prompting questions were posted:

- What is/are the ethics code related to the situation? Justify
- What you will do if you are put in the situation
- Why you make the decision
- How you are going to execute your plan in the best possible way
- Look for more background information regarding the issue/case for you to make a more informed choice.

The dialogue session was conducted implying the practice used in Harvard Business School dialogue but to make sure all students can effectively involve in the discussion; the class was divided into two which consisted 15-20 students.

Q1: What is the case study all about? (team discussion)

Q2: What are the unethical acts or decisions made in each CS?

Q3: Which code(s) of ethics is/are applicable to these acts or decisions?

Q4: What are the consequences of the acts or decisions on different aspects (life, safety, properties, environment, social etc)?

Q5: What are the right or ethical ways of doing things in this CS?

Q6: What are the challenges or obstacles in taking the actions you suggested in Q5 and how can they overcome those to ensure unethical acts or decisions will never be committed?

Students were assessed through the team discussion and dialogue session as well as their 1-page report summary. The observation list was developed to assess students' participation, accountability and response towards questions during team discussion and dialogue. The rubric was developed to assess students' report summary assessing the judgement of engineering ethics' clauses, analysis and reflection on own decisions.

Data Collection

Students learning portfolio was collected in phases during the semester. Students reflected all the learning process throughout the semester. All the learning portfolios were read and screened for the comments related to the engineering ethic case study activity. The comments were analyzed to see the impact of the activity on students' learning and development.

a.

b.

c.

Figure 1: (a) Set of crafted engineering ethics case studies; (b) Design of engineering ethics case study dialogue; and (c) Team discussions and dialogue sessions in classroom

Finding and Discussion

The impacts and perceptions of your engineering ethics case study-dialogue project were presented based on the students' comments (Table 1). As we aimed for students' engagement and boost their confidence, student's shows their positive experience during the Harvard-style case study debate. They actively voiced their opinion, engaged in group discussions, and learned from different perspectives. The project encouraged student participation, boosted confidence, and fostered a sense of openness. The student acknowledges the difficulty of participating in group discussions. However, they persevered and improved their ability to express thoughts on ethics.

Diving into ethical dilemma by playing a role as an engineer, the project is able to enhance students' analytical skills. By discussing ethical dilemmas, they refined their ability to analyze complex situations. The project not only focused on ethics knowledge but also enhanced critical thinking.

This new type of learning environment, nature of case study debates provided to the students, it become an eye-opening insight into ethical decision-making. They gained a deeper understanding of professional conduct guidelines and the real-world impact of ethical decisions. The project broadened their perspective and instilled a strong sense of responsibility as a future engineer.

Table 1: Quotes from Students Learning Portfolio Related to Engineering Ethics Harvard Style Case Study

Impact	Students' Comment from Reflection Journal
Confidence Open-minded	In the first ITE class for week 3, we had an engineering ethics Harvard Style case study debate. It was very interesting as it was also the first time I was involved in it. I got to **voice out my opinion regarding the case study** to the group and **everyone was sharing their opinions** as well. We had a big discussion among each other**. I got to know different perspectives and opinions** from my groupmates. This opened my eyes a little. Since it was my first time being involved in the debate, I was a bit nervous but I think I did my best. In the future, I think I can be more confident and be more prepared to voice out my opinions to others.
Analytical skill Communication skill	I am optimistic that through this system, the activity not only **refine my analytical capabilities** but also improve my **communication and public speaking skills**, boost my **confidence to express my opinions** in open and public spaces
Awareness on engineering ethics	"Learning about engineering ethics through case study debates was really eye-opening for me. It helped me see how tough it can be to make moral choices in engineering. Not only did I get a better understanding of the Guidelines for Code of Professional Conduct, but I also saw how ethical decisions can affect a lot of people. It made me feel a strong sense of responsibility as a future engineer. I realized that the decisions I'll make in my career can have a big impact on society."
Listening skill	Talking in the big group discussion was tough at first, but my group and I pushed through. It helped me **get better at speaking up** and sharing my thoughts on ethics. Hearing different opinions showed me **how important it is to listen and learn from others.**

Conclusion

In summary, the project has positively influenced students by promoting engagement, confidence, analytical skills, active listening, and learning from diverse viewpoints and ethical awareness in the context of engineering. These outcomes align with the project's goals and demonstrate its effectiveness in shaping responsible engineers

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ID 10: Developing project-based learning module to promote critical thinking and cooperative skills among Chinese children

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Highlights: The Project-based Learning (PjBL) module developed in this research, designed for Chinese preschool science education, aims to enhance children's critical thinking and cooperative skills. It stimulates children's interest and initiative in learning through real-world problem situations and interdisciplinary project activities. Empirical research has shown that the module significantly improves children's thinking and teamwork skills, while promoting teachers' teaching practices and professional development. This PjBL module provides innovative teaching methods and practical teaching resources for preschool education.

Keywords: *Project-based learning (PjBL); Preschool science education; Critical thinking; Cooperative skills; 4-D model*

Introduction

With the ongoing global education reform, developing children's critical thinking and cooperative skills has become an important goal of preschool education. However, there is a relative lack of research on cooperative skills and critical thinking (Jin, 2018), especially in the field of preschool education, which has the smallest proportion of relevant research (Clements et al., 2022). Although Project-Based Learning (PjBL) has been widely used in higher education and primary and secondary schools, its application in preschool education remains sparse (Chen & Yang, 2019).

Teachers face many challenges in implementing PjBL in preschool education. On the one hand, teachers lack a complete PjBL module to refer to, leading to complexity and difficulty in their implementation (Larmer, 2016). On the other hand, it is also challenging to shift from a traditional teacher-centered to a child-centered teaching model (Zhenyu, 2012). In addition, traditional teaching methods limit children's enquiry-based and collaborative learning (Aksoy, 2020). Although PjBL has shown significant benefits at other educational stages, research on its application in early science education remains insufficient (Farida & Rasyid, 2019).

This research aims to develop a PjBL module suitable for use by Chinese preschool science teachers to address these issues. The module will provide new solutions through innovative teaching methods that stimulate children's interest and initiative in learning and enhance their critical thinking and cooperative skills. The development of the module will also fill the gap in research on PjBL in preschool education by providing teachers with systematic teaching guides and assessment instruments that will improve student learning outcomes and teacher effectiveness (Larmer, 2016).

Project or innovation objectives

The objective of this project is to develop Project-Based Learning (PjBL) modules to enhance the quality of teaching and learning in early science education in China, with specific project objectives including:

- Enhance children's critical thinking skills: Through the design and implementation of interdisciplinary project activities, children develop the ability to ask questions, analyze information and evaluate evidence, enabling them to form reasoned conclusions in their scientific investigations.
- Enhance children's cooperative skills: To promote effective communication, division of labor and joint problem-solving among children in teams through group work projects, to develop their team spirit and co-operation skills.
- Improving teachers' teaching practices: Provide detailed teaching guidelines and rich teaching resources to help teachers shift from traditional didactic teaching to a child-centered teaching mode and improve classroom interactivity and children's participation.

NALI approach implemented in the research

(i) Novelty

A specially designed Project-Based Learning (PjBL) module was developed for this research. The module was validated to improve children's critical thinking and cooperative skills. This PjBL module was designed with a conceptual breakthrough from the traditional teaching and learning model by focusing on bringing real-world problem situations into the classroom. Through project-based activities, it helps children understand and apply knowledge in the process of solving real-world problems. Compared with traditional teaching, the PjBL module is more capable of stimulating children's curiosity and spirit of exploration, prompting them to take the initiative to explore.

(ii) Creativity

In designing the PjBL modules, the creativity and interactivity of the project activities are emphasized. The content of the modules covers several themes, such as "Life Science" and "Earth Science", each of which contains a wealth of practical activities, such as experimental manipulation, data collection and presentation of results, to cultivate children's analytical skills, reasoning skills, critical thinking skills such as problem solving, etc. The PjBL modules focus on the following. The PjBL module focuses on the development of children's cooperative skills such as communication, task distribution and resource sharing through teamwork.

(iii) Innovativeness

The PjBL module has made significant improvements in teaching methods, adopting a child-centered teaching model instead of the traditional teacher-led approach. In this research, during the development of the PjBL module, systematic teacher training and support were provided to enhance teachers' project-based teaching competence and to ensure the smooth implementation and continuous improvement of the PjBL module. This multidimensional and innovative design has resulted in a significant improvement of the PjBL module in terms of teaching effectiveness and application scope.

(iv) Applicability

The PjBL module is highly relevant to the New Academic Learning Innovation (NALI) model, which emphasizes independent learning, collaborative learning and inquiry learning, and fits the direction of modern education reform. The module provides a detailed teaching guide and rich teaching resources to facilitate teachers' implementation in practical teaching. This PjBL module has wide applicability and promotion value. The module design is not only applicable to preschool science education in China, but can also be adapted and applied to different regions and cultural contexts. By providing detailed teaching guidelines and rich teaching resources, the PjBL module provides strong support for teachers to implement innovative teaching.

(v) Impact to Students' Learning

The implementation of the PjBL module significantly enhanced children's critical thinking and cooperative skills. The research data showed that children who participated in the PjBL programme showed significant improvement in both thinking skills and teamwork. At the same time, the interactive and hands-on nature of the PjBL modules greatly stimulated children's interest and engagement in learning, empowering them with a greater sense of independent learning and participation.

Research Methodology

A quasi-experimental design was used in this research to assess the effects of PjBL on children in the experimental and control groups. Quasi-experimental designs enhance the validity of causal inferences through matching methods and other control strategies that mimic the effects of random assignment (van Liempd et al., 2020). Specifically, this research used a non-equal-group pretest-posttest design (Cadorin et al., 2015) that included an experimental group trained in PjBL and a control group that did not receive training. Additionally, this study used a mixed-methods intervention design (Creswell & Guetterman, 2018), which emphasizes the integration of quantitative and qualitative data within an intervention study to assess the effectiveness of the intervention and to gain insight into the intervention process and participant experiences.

This research used a 4-D model to develop the PjBL module, which includes four phases: definition, design, development, and dissemination (Pratitis & Jama, 2020). In the definition phase, the scope and needs of science education were identified by analyzing professional and curriculum standards for early science education in China (Indriyani, 2017). In the design stage, selecting child-friendly science topics, using inquiry activities as the main teaching method, and designing interactive science experiments and inquiry tasks to promote children's interest and active participation (Indriyani, 2017). In the development stage, develop a range of PBL activities that stimulate the interest and curiosity of Chinese children, ensuring that the content and resources are appropriate to children's cognitive level and cultural characteristics (Indriyani, 2017). Design a series of interactive experiments and group projects with detailed teaching guides and resource lists. During the dissemination phase, implement the developed PBL modules in a real classroom setting, observe children's responses and participation, and record teachers' and children's performance in the project activities. The activities were adjusted and optimized based on children's feedback and teachers' observations (Indriyani, 2017). Table 1 shows an example of the PjBL module developed in this research.

Table 1: Project-Based Learning Module Example "The Lifecycle of Plants"

The Lifecycle of Plants	
Component	Details
Grade Level	Preschool
Duration	2 weeks
Module Overview	Introduces preschool students to the lifecycle of plants, fostering critical thinking and cooperative skills through hands-on activities, observations, and group projects.
Objectives	Understand the basic stages in the lifecycle of plants. Enhance critical thinking. Foster teamwork and collaboration.
Activities	Kickoff Storytime, Seed Planting Activity, Garden Visit, Growth Chart Project, Flower Pollination Art Seed, Dispersal Experiment, Project Showcase
Assessment	Evaluation based on engagement, teamwork, observation journals, and understanding of the plant lifecycle demonstrated during the showcase.
Materials Needed	a. Seeds, soil, clear planting containers b. Growth chart materials (paper, markers, rulers) c. Art supplies (paper, paint, cotton balls) d. Real plant specimens for observation

Teaching Guide	Preparation: Familiarize with module objectives and materials. Facilitation: Lead activities, encourage critical thinking. Observation & Documentation: Guide students in documenting plant growth. Discussion: Facilitate group discussions. Assessment: Observe students' participation and understanding.

Finding and discussion

This research developed a project-based learning (PjBL) module for use in Chinese preschool science education with significant results. Through quantitative and qualitative analyses, the research found that the PjBL module had significant advantages in enhancing children's critical thinking and cooperative skills. Data analyses revealed that children in the experimental group scored significantly higher on critical thinking and cooperative skills than the control group, indicating that the PjBL module was highly effective in developing these critical skills.

The PjBL module also facilitated teachers' professional development. Through training and practice, teachers mastered new teaching methods. The PjBL module was not only beneficial to the children, but also had a positive impact on the teachers' professional growth.

In summary, this research validated the effectiveness of the PjBL module in Chinese preschool science education and provided strong support for educational practice. The PjBL module significantly enhanced children's critical thinking and cooperative skills, improved teachers' teaching practice and professional development, and has a wide range of applications and dissemination value. Future research should continue to explore the adaptability and implementation effects of PjBL in different educational contexts to provide more empirical evidence and practical guidance to further improve the quality of preschool education.

Other relevant information

The successful application of the Project-based Learning (PjBL) module developed in this research to preschool science education in China demonstrates its significant commercialization potential.

Market Demand. With the continuous updating of educational concepts and the increasing demand of parents for high-quality preschool education, the market demand for innovative teaching methods and high-quality educational resources continues to grow. The PjBL module meets the expectations of parents and educational organizations for high-quality preschool education.

Educational Product Development. The PjBL module can be developed as a complete educational product, including teaching materials, teacher guides, student manuals, multimedia resource packs and lab equipment sets. Through standardization and modularization, these products can be rolled out nationwide into kindergartens and pre-schools for large-scale sales.

Teacher training and support services. effective implementation of PjBL modules requires teachers to have certain project management and teaching strategy skills. Therefore, professional training courses and online support platforms for teachers can be developed to provide systematic training and continuous teaching support. These training and support services can be sold not only as independent business projects, but also bundled with PjBL module products to form an integrated solution and enhance market competitiveness.

Digital Platform. Combined with modern information technology, a digital teaching platform for PjBL modules can be developed. The platform can include online courses, virtual labs, interactive learning communities and data analysis tools to help teachers implement PjBL projects more conveniently, and students can also engage in independent learning and project collaboration through the platform. Through subscription services and in-app purchases, the digital platform can be a stable source of revenue.

The PjBL module has significant commercialization potential in terms of educational product development, teacher training and support, and digital platforms. Through scientific market operation and continuous product innovation, the PjBL module is expected to become an important product in the preschool education market, promoting the improvement of education quality and the popularization of innovative education models.

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ID 11: Navigate-X 2.0

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Highlights: This innovation aims to cater to ADHD pupils who have difficulty in maintaining focus to carry out an activity. It is designed like a maze-game in order to maximize the ADHD pupils' attention. The innovation is heavily student-centered as students can complete this game by themselves. The advanced students can challenge themselves by playing on hard mode while the remedial students can look at clues (easy mode). Navigate-X 2.0 was constructed from recyclable materials and up-to-date technology which encompasses pedagogical principles and the enormous potential of mass commercialization. Moreover, the innovation is equipped with the coded Arduino Uno board that has sensors to detect right and wrong answers, a buzzer to indicate wrong answers and LED lights to distinguish pupils' answers. Therefore, the pupils are able to know the correct answer immediately when the sensors send a signal to the coded Arduino Uno board and the led lights light up, in response to the answers given. This aligns with the objectives of 21st century learning which is to inculcate technology as a means for automation and providing autonomy for the student. Navigate-X 2.0 is an inclusive innovation which would cater learning for pupils from diverse backgrounds in line with the Sustainable Development Goals (SDG) number 4 which is Quality Education.

Keywords: *Arduino Uno board; ADHD pupils; Immediate feedback; Learning autonomy; Diverse classroom*

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) poses unique challenges in educational settings, where traditional teaching methods often fall short in meeting the needs of these students. ADHD pupils often struggle with focus, engagement, and can disrupt the learning environment (Silver & Novotni, 2019). To address this, a student-centered maze game has been introduced, which stimulates cognitive skills and meets the specific needs of ADHD pupils, thereby enhancing classroom participation (Nagasharmila & Hema, 2018).

One of the promising innovations is Navigate-X 2.0, an educational tool that integrates an Arduino Uno board with motion sensors and automated lighting to provide immediate feedback. Immediate feedback is crucial for ADHD students as it helps correct errors promptly and reinforces learning (Ukwumaka et al., 2022). The system uses green lights for correct answers and red lights for incorrect ones, thereby boosting self-efficacy and motivation; essential components for successful learning (Bandura, 1986).

Navigate-X 2.0 offers several advantages over traditional teaching methods. Firstly, it enhances engagement by providing a dynamic and interactive learning experience that captures the interest of ADHD students. The immediate feedback mechanism helps maintain students' attention and encourages active participation. Secondly, the system streamlines assessment processes by automating feedback, which reduces teacher workload and minimizes the use of paper, aligning with eco-friendly educational practices (Astrero, 2024; Shum et al., 2023).

Navigate-X 2.0 stands out due to its novelty, creativity, and innovativeness. The integration of technology in the form of Arduino Uno boards and motion sensors represents a significant advancement in educational tools. By integrating technology and innovative feedback mechanisms, this tool enhances engagement, boosts motivation, and streamlines assessment processes. Its alignment with the New Academia Learning Innovation (NALI) model and its potential to transform the educational landscape highlight its importance in modern pedagogy. As educational institutions continue to seek for effective solutions for inclusive and engaging learning environments, innovations like Navigate-X 2.0 will play a crucial role in shaping the future of education.

Objectives of Navigate-X 2.0

Navigate-X 2.0 aims to enhance classroom engagement and cognitive skills among ADHD students through a student-centered maze game that fosters active participation and stimulates cognitive abilities. Furthermore, by integrating an Arduino Uno board with motion sensors and automated lighting, the system provides immediate feedback which helps correct errors promptly, boosts self-efficacy and motivation, and reduces teacher workload while minimizing paper use.

NALI approach implemented in the research

NavigateX 2.0 is a significantly improved model from its predecessor, NavigateX. It is equipped with technology such as an Arduino Uno board, motion sensors and LED lights to enhance learner autonomy through its game-based learning fundamentals. A tablet would be used to connect to the Arduino using a USB cable in order for the pupils to play the game. With that in mind, the novelty is seen through the learning elements that were added in order to cater to the needs of the ADHD pupils in the classroom. Combining the elements of game and education would amplify the engagement of the ADHD pupil with the model as they brave through the maze carefully putting the ball into the hole using the string. This also tests their motor and coordination skills which makes the model an all-rounded learning experience for the pupil.

The creativity could be showcased through the usage of discarded materials in creating the model from scratch while combining sophisticated technology to empower learning among ADHD pupils who suffer from distractions. This would expose and stimulate the necessity of being resourceful to the pupils so that they can adopt the lifestyle of creating things from unused or disposable items. The colourful display of the model would catch the attention of anyone and the practicality is what would keep the pupils engaged throughout the game. The model can be played by any student which underscores the varying and diverse learning styles that the model can be catered to.

The innovation has been upgraded from its original design, tapered for full individual learning autonomy. From integrating technology to using durable materials, it would suffice to say that the model is an exemplary learning tool. In order to answer the designated questions on the tablet, the pupils would have to insert a ball using a string into the hole. It provides an exciting challenge which also tests their cognitive and motor skills. In addition, pupils would receive immediate feedback from the model whether the question that they have answered is right or wrong, which enables maximum learning to take place which is an upgrade that has been made to the model.

One of the model's aims would be to deliver apt assistance to the teacher to teach his or her pupils without having the need to be physically present; and to understand the connection between the model's impact and the pupil's learning ability with sufficient backed-up data. With this, the aim can be strung together with this year's NALI theme, which is to empower teaching and to provide full learning autonomy into the hands of the pupils.

The model's impact is extraordinary in which it is able to provide immediate learning feedback and engage the pupils throughout the game. It provides full learning autonomy to the pupil without relying on any external factors such as the presence of a teacher or a classmate. The model emphasizes heavily on student-centered learning and empowers the pupil to make their own decisions. All the pupils need would be a tablet connected to the Arduino Uno board of the model using a USB cable to answer the questions. Consequently, paper wastage can also be reduced to a minimum. The innovation is also in line with the Sustainable Development Goals (SDGs), which proves the commitment to provide top-notch education for all regardless of race, religion and background of the individual.

Navigate-X 2.0 is programmed using an Arduino Uno board, which will be hidden inside of the model to make it look elegant and prevent it being tampered with. The innovation works in which a student will be looking at questions on a tablet and answer them by navigating the ball into the hole using a string. The tablet is connected to the Arduino using a USB Type-C cable. The Arduino Uno board will be coded using an app called Arduino IDE using a computer for it to receive the signals from the sensor when the ball goes through the hole. This will help the Arduino to send out the necessary signals to the LED light and the buzzer to light up green or red for either the right or wrong answer respectively, while a ping for the wrong answer. The entire circuit will be connected using wires. The interactivity of the entire model will increase student excitement and engagement exponentially, further deepening their understanding of a particular language focus that will be emphasized on.

Research Methodology

The study employed a mixed-method approach which included the qualitative and quantitative methods. A google form was created and used to conduct a survey to collect the relevant data from teachers regarding the effectiveness of the model. This will enable sufficient information to be obtained to vastly improve the model's shortcomings if there are any. A mixed-method approach would encompass a multitude of aspects such as the model's potency and pupil's autonomy in learning, enabling a deeper insight into the research model and information procured.

Finding and discussion of the project or innovation

Respondents in this pilot study include primary school teachers, special education teachers and teacher trainees. There were ten respondents, with 90% of them female and 10% male. Meanwhile, 60% of those polled had prior experience teaching in an inclusive classroom, while 40% had never taught in one before. Respondents who had taught in an inclusive classroom shared their insights. They remarked that it is difficult to get each student fully involved in the lesson. In general, special needs students are impulsive, easily distracted, restless, and hyperactive. As a result, these students require appropriate activities that address their needs. For example, activities centered on movement, music and creating arts and crafts. The activities designed for special needs pupils will help them cooperate and learn in the classroom. However, time and energy are the primary obstacles that prevent teachers from planning these activities for each lesson in an inclusive classroom.

Table 1 displays the 10 respondents' opinions about Navigate-X 2.0. 70% of respondents agree that the innovation is extremely effective at improving student learning outcomes in an inclusive classroom. The remaining 30% of respondents agree that this invention is suitable for use in an inclusive classroom. Next, 80% of respondents believed that this innovation is extremely successful at engaging children with varied needs and learning styles. The remaining 20% of respondents said that this innovation is beneficial for special needs students since it accommodates their requirements and learning styles. All respondents agreed that using LED lights in Navigate-X 2.0 is an excellent way to provide pupils with rapid feedback. Furthermore, responders agreed firmly on the use of motion sensors in Navigate-X 2.0 to help students understand the feedback offered. 50% of the respondents had given feedback and suggestions for improvements of Navigate-X 2.0. 20% of respondents suggested that the materials used to construct Navigate-X 2.0 be made waterproof to prevent students from ruining it due to water spills. 10% of respondents proposed changing the LED light to a larger bulb for easier visibility by students. 10% of respondents recommended changing the colour of the ball and students were instructed to insert the ball based on the colour of the hole. The remaining 10% of respondents complimented the idea for Navigate-X 2.0, and expressed enthusiasm for its implementation in schools to assist teachers and students.

Table 1: Respondents' perspectives towards Navigate-X 2.0

Participant	Has experience teaching in an inclusive classroom (Yes/No)	Effectiveness of Navigate-X 2.0 in enhancing the learning outcomes of students in inclusive classroom	Ability of Navigate-X 2.0 to engage students of diverse needs and learning styles	Usage of LED lights in Navigate-X 2.0 is effective to provide immediate feedback to students (Yes/No)	Motion sensors in Navigate-X 2.0 is effective to help students understand the feedback provided (green light for correct answers and red light for wrong answers) (Yes/No)	Feedback and suggestions for improvement
1	Yes	4 (Fairly effective)	4 (Good)	Yes	Yes	"Suggestions can vary the color of the ball. And the ball should be inserted according to color into the hole provided."
2	Yes	4 (Fairly effective)	5 (Very good)	Yes	Yes	"The materials used should be waterproof to avoid students destroying it from water spills etc."
3	No	5 (Extremely effective)	5 (Very good)	Yes	Yes	"The LED light can be changed to a larger colored Bulb light for easy viewing."
4	No	4 (Fairly effective)	5 (Very good)	Yes	Yes	"No."
5	Yes	5 (Extremely effective)	5 (Very good)	Yes	Yes	"Cannot wait to have this in my school, very exciting."
6	Yes	5 (Extremely effective)	5 (Very good)	Yes	Yes	"No."
7	Yes	5 (Extremely effective)	4 (Good)	Yes	Yes	"No."
8	Yes	5 (Extremely effective)	5 (Very good)	Yes	Yes	"No."
9	No	5 (Extremely effective)	5 (Very good)	Yes	Yes	"Can improve the materials used to be more durable such as hard plastic."
10	No	5 (Extremely effective)	5 (Very good)	Yes	Yes	"No."

Other relevant information

Navigate-X 2.0 is designed for ADHD pupils in primary schools who are unable to concentrate on the assigned tasks. However, the model could be programmed to be used in a plethora of educational institutions as it is powered by the Arduino Uno board which could be tailored to the liking of the educator; rendering it efficaciously flexible. The massive potential of commercialization of Navigate-X 2.0 would rely on the fact that it is made of recyclable materials which makes it cost effective and the integration of technology which is to provide immersive learning. Most importantly, this innovation's predecessor, NavigateX, won the gold medal for NALI 2023, bolstering the fundamentals of the product. Presently, we are in the process of obtaining an IPO for our invention.

Acknowledgement

We are grateful for the opportunity to represent Institut Pendidikan Guru Kampus Temenggong Ibrahim (IPGKTI) once again for this year's NALI, while also expressing immense gratitude to our team members, lecturers, parents and participants who had contributed to our research and development of our model.

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ID 13: From Pieces to Masterpieces: Elevating 'ToT' in Architectural BIM Course with Jigsaw Method

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Highlights: The Jigsaw method was applied in an Architectural BIM course to promote collaborative learning and knowledge sharing among students. Participants were organised into specialised "family module" groups, each focusing on distinct BIM-related aspects such as modelling different elements and visualisation techniques. Within these expert groups, students mastered their assigned topics and then shared their knowledge with peers in newly formed jigsaw groups. This innovative approach, which aligns with the 'Training of Trainers' (ToT) methodology, not only deepened students' understanding and honed their skills but also encouraged teamwork and effective communication. The novelty of this method lies in its ability to transform traditional teaching by integrating hands-on practice with peer-led instruction, resulting in a dynamic and engaging learning environment.

Keywords: *Students'-centered learning; Collaborative Learning; Jigsaw Method; Training of Trainers (ToT).*

Introduction

The Training of Trainers (ToT) is a strategic approach aimed at equipping students with teaching skills and subject matter expertise to train their peers effectively. This methodology emphasises a cascade model, where students are trained to become instructors and disseminate their knowledge and pedagogical techniques to fellow peers, creating a multiplier effect. The fundamentals of the ToT method involve interactive workshops, peer teaching sessions, and reflective practices, ensuring trainers not only master the content but also excel in delivering it (Putri et al., 2021). Studies have shown the diverse benefits of ToT, including enhanced learning outcomes, improved self-efficacy, and the development of critical thinking and leadership skills among students (Mormina & Pinder, 2018; Rippa et al., 2017). The ToT approach has been widely adopted in various educational contexts, including teacher training programs and professional development initiatives. The emphasis on hands-on practice, peer-to-peer learning, and reflective activities has been found to be effective in enhancing the competence of trainers and improving the overall quality of instruction. For example, a study on the implementation of the "Penguatan Profil Pelajar Pancasila" project in Indonesia found that the ToT training program led to a significant increase in teachers' understanding of the material, with average pre-test and post-test scores improving from 67 to 80 (Nuriya et al., 2023). The promising results of the ToT approach in these educational and training contexts suggest its potential applicability in the field of architecture education, where the need for effective knowledge dissemination and capacity building among students is paramount (Ahmed & Sayed, 2020; Nur Fakhira & Darusman, 2022).

One pedagogical approach that aligns well with the ToT collaborative and knowledge-sharing nature of BIM workflows is the Jigsaw Method, which was successfully implemented in the Architectural BIM course. The Jigsaw Method, which originated in social psychology, is a collaborative learning technique that encourages students to actively participate in their own learning and that of their peers. In the context of Architectural BIM education, this method can be leveraged to promote the development of essential skills such as communication, teamwork, and information sharing (Sampaio et al., 2023).

Project Objectives

The aim of implementing the Jigsaw Method in Architectural BIM course is to foster a deep, collaborative learning environment where students as future trainers not only master BIM concepts and skills but also develop the ability to effectively teach and mentor others. Therefore, three (3) objectives have been set to achieve the aim:

Building teaching skills where students need to develop the pedagogical skills needed to train others and preparing them for leadership roles in architecture practice.

Creating a cohesive learning experience which integrates different aspects of BIM into a unified learning experience, ensuring that students can see how various components fit together in real-world projects.

Enhancing collaboration where the Jigsaw method promotes teamwork and communication skills, essential for working in multi-disciplinary architectural environments.

Thus, the Jigsaw Method has been strategically integrated into the Architectural BIM course teaching and learning, aligning with the Theories of Transfer methodology which emphasizes the importance of enabling students to apply the knowledge and skills they have learned in one context to new situations, which is crucial for the success of BIM workflows in practice (Becerik-Gerber et al., 2012).

Application of Jigsaw Method

The architectural BIM Course offered teaching and learning of BIM modules using Revit software. To implement the Jigsaw method in the course, there are two (2) main steps to be applied which are (1) Step 1- Training of Modules and (2) Step 2 – Group Tasks. Students or participants were divided and assigned into few groups called as "jigsaw group" and each member of the group will be organized into specialized groups called "family module", each focusing on distinct BIM-related aspects such as modelling different elements and visualization techniques as Step 1 of the method. Within these expert groups of family modules, students mastered their assigned topics, then shared their knowledge with peers back in the jigsaw group as Step 2 to complete a specific task which is to build a complete Revit model of a selected project. Figure 1 explains the application of the Jigsaw method in Architectural BIM Course.

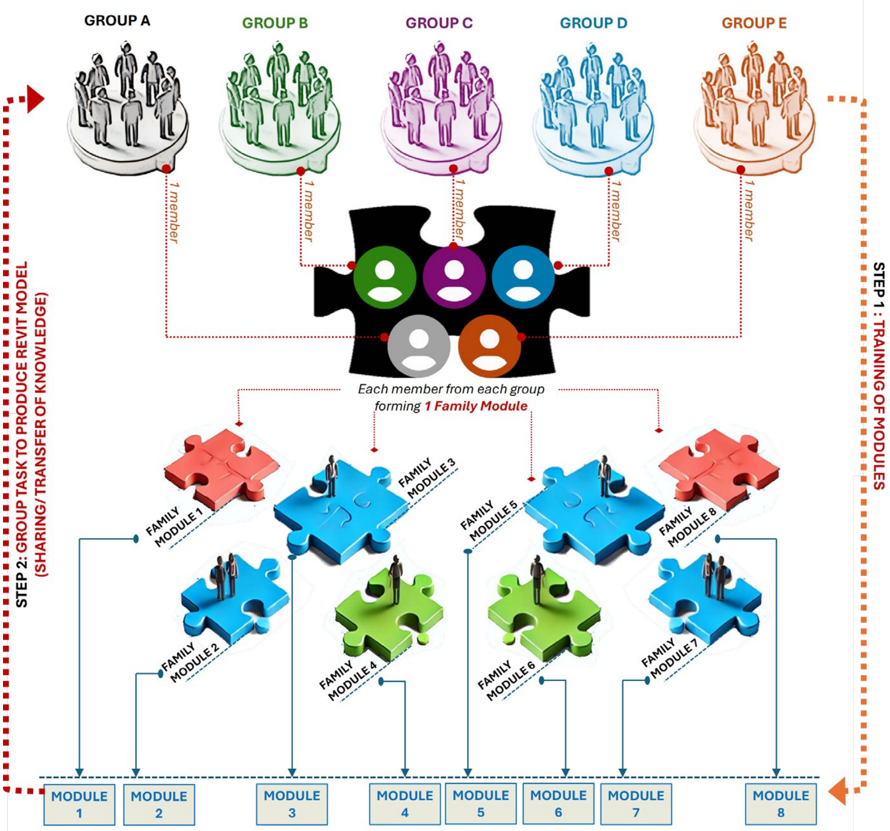

Figure 1: Application of the Jigsaw Method in Architectural BIM Course.

Details of Step 1 and Step 2 applications of the Jigsaw method were explained in Table 1 and Table 2 as follows:

Table 1: STEP 1- Training of Modules (Schedule of Module Tasks (Trainings)

FAMILY MODULE	MODULE NUMBER	SPECIFIC TASK FOR TRAINING (EXPERTISE)
Family Module (FM) 1	Module 1	Basic Modelling 1 (Wall, Openings, Dimension & Revit Tools)
Family Module (FM) 2	Module 2	Basic Modelling 2 (Structural Components, Level, Floor, Roof)
Family Module (FM) 3	Module 3	Basic Modelling 3 (Staircase, Ceiling, Materials, Site Components)
Family Module (FM) 4	Module 4	Advanced Modelling 1 (Revit Family, In-Place Components, Model Group, Advanced Wall)
Family Module (FM) 5	Module 5	Advanced Modelling 2 (In-Place Mass, Conceptual Mass, Model by Face)
Family Module (FM) 6	Module 6	Creating Drawings 1 (View, View Template, Detailing, Legend)
Family Module (FM) 7	Module 7	Creating Drawings 2 (Room Plan, Schedule, Sheet, Printing)
Family Module (FM) 8	Module 8	Visualisation & Coordination (Photorealistic Visualisation, Walkthrough, Phasing, Collaboration, Work Sharing and Template)

Table 2: STEP 2- Group tasks (Jigsaw Group)

JIGSAW GROUP	GROUP MEMBERS				GROUP TASK
GROUP A	1-FM 1 1-FM 5	1- FM 2 1- FM 6	1- FM 3 1- FM 7	1- FM 4 1- FM 8	CREATING 1 COMPLETE REVIT MODEL OF SELECTED PROJECT (Project A)
GROUP B	1-FM 1 1-FM 5	1- FM 2 1- FM 6	1- FM 3 1- FM 7	1- FM 4 1- FM 8	CREATING 1 COMPLETE REVIT MODEL OF SELECTED PROJECT (Project B)
GROUP C	1-FM 1 1-FM 5	1- FM 2 1- FM 6	1- FM 3 1- FM 7	1- FM 4 1- FM 8	CREATING 1 COMPLETE REVIT MODEL OF SELECTED PROJECT (Project C)

JIGSAW GROUP	GROUP MEMBERS				GROUP TASK
GROUP D	1-FM 1 1-FM 5	1- FM 2 1- FM 6	1- FM 3 1- FM 7	1- FM 4 1- FM 8	CREATING 1 COMPLETE REVIT MODEL OF SELECTED PROJECT (Project D)
GROUP E	1-FM 1 1-FM 5	1- FM 2 1- FM 6	1- FM 3 1- FM 7	1- FM 4 1- FM 8	CREATING 1 COMPLETE REVIT MODEL OF SELECTED PROJECT (Project E)

By the end of this course, each student group will create a comprehensive Revit model for a selected project, including a full set of working drawings. This collaborative group task would not be successfully completed if each group member did not share their knowledge and transfer their skills, as it requires the application of the learning objectives mastered in the earlier stages of the course (Step 1).

Creativity, Innovation and Commercialization Potential

The Jigsaw Method implemented in Architectural BIM education demonstrates remarkable creativity, innovation, and commercialization potential as follows:

Creativity:
Modular Learning Segments - Developing learning modules that are adaptable, engaging, and promote active participation from students.

Interactive Teaching Approach - Incorporating dynamic teaching methods that encourage student-faculty and student-student interaction, fostering a collaborative learning environment.

Adaptive Problem Solving - Equipping students with the skills to identify and tackle challenges flexibly, empowering them to navigate complex real-world scenarios.

Collaboration and Communication - Promoting teamwork and effective communication among students, mirroring the collaborative nature of architectural practice.

Innovation:
Transforming Traditional Teaching and Learning Models - Reimagining conventional pedagogical approaches to better align with the evolving needs of the architectural industry.

Empowering Student-Driven Learning - Fostering an educational environment that encourages students to take an active role in their own learning, becoming self-directed and lifelong learners.

Leveraging Technology for Enhanced Collaboration - Integrating cutting-edge technology to facilitate seamless knowledge-sharing and collaborative work among students.

Cultivating Future-Ready Educators - Preparing students to become effective trainers and leaders who can mentor and guide the next generation of architects.

Commercialisation Potential:
Educational Content and Resources: Developing comprehensive and adaptable educational materials, including digital resources, that can be widely disseminated.

Training and Certification Programs: Offering specialized training and certification programs to cater to the professional development needs of architects and students.

Publication of Training Modules: Sharing the innovative teaching and learning approaches, including the Jigsaw Method, through academic publications and industry channels.

Customized Learning Solutions: Providing tailored learning experiences and consultancy services to educational institutions and architectural firms, addressing their specific needs and requirements

Novelty

The jigsaw method's novelty extends beyond architectural education, as it can be applied to a wide range of disciplines. Key aspects of its significant novelty include 1) Dual-focused learning, where students master the subject matter and develop pedagogical skills to effectively teach and mentor others; 2) Active peer learning, which fosters collaborative knowledge sharing and transfer among students; and 3) Enhanced collaboration, as the method promotes essential teamwork and communication skills required in multi-disciplinary work environments.

Impact on Students' Learning

Implementing the Jigsaw Method in Architectural BIM education has proven to be a transformative teaching strategy that significantly enhances student learning. Students develop a more comprehensive understanding of the material by actively engaging with the course content and teaching it to their peers. Moreover, the interactive and collaborative nature of the Jigsaw Method creates an engaging in-class experience, making the learning of complex software like Revit more enjoyable and effective. This approach has also enabled struggling students to effectively catch up, as they can benefit from the knowledge-sharing among their classmates. Crucially, the Jigsaw Method not only helps students master the subject matter but also cultivates their pedagogical skills, equipping them with the expertise to become future leaders in the architectural industry.

Acknowledgement

We are grateful for the opportunity given by Programme of Architecture, Faculty of Built Environment and Surveying, UTM, to use and publish the teaching and learning materials of SBEA3623-Cad&BIM course for NALI2024 Exhibition & Competition.

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ID 14: An Application of Paraboloid in Depicting the Real Shape of a Charcoal Kiln based on Data from Terrestrial Laser Scanning

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Highlights: This project investigates a charcoal kiln located in Kubang Badak, Langkawi Island, using multivariable calculus and surveying technology. The charcoal kiln has only a partial section of its original construction remaining. Specifically, a paraboloid shaped object is defined in the three dimensional (3D) coordinate system to model the full form of the kiln based on the previously collected data from terrestrial laser scanning (TLS). The data consists of the 3D model of the incomplete kiln, along with its dimension. Therefore, by using the paraboloid, the surface area and the volume of the original complete charcoal kiln can also be estimated.

Keywords: *double integral; surface integral; MATLAB; CloudCompare; Langkawi Island*

Introduction

Langkawi Island was recognized as a UNESCO Global Geopark in 2007 and was the first in Southeast Asia to receive the award. Recently, in order to maintain this status, the Langkawi Development Authority (LADA) has been tasked with finding a new product to support the continuation of the recognition. One possible asset that can be highlighted is the charcoal kiln at the Kubang Badak BioGeo Trail which serves as evidence of the charcoal production industry in Langkawi, possibly dating back more than 100 years (Lim et al., 2023). While it was originally claimed that there were 12 charcoal kilns at Kubang Badak, only three remain currently, but each of them has degraded and lost many of its original structures. Therefore, if LADA wishes to reconstruct the complete form any of the kilns, LADA firstly needs to understand the original form of the kilns before any reconstruction planning can be done.

Therefore, this project proposes using surveying technology, specifically terrestrial laser scanning, along with mathematical methods to model the complete form of one of the remaining charcoal kilns in Kubang Badak. Specifically, the data collected from laser scanning, which includes a 3D model of the incomplete form of the kiln and its dimensions, will be used to construct a paraboloid shaped object that models the complete form of the kiln. Besides obtaining the 3D model of the complete form of the kiln, the volume and the surface area of the kiln can also be estimated based on the model, where. these parameters might be useful in the future for determining the amount of material needed to reconstruct the kiln or estimating the maximum amount of charcoal that could be produced by the complete kiln.

Methodology

This project applies some contents from the courses Mathematical Methods and Terrestrial Laser Scanning to reconstruct the complete form of an incomplete charcoal kiln in Kubang Badak, Langkawi (see the next figure).

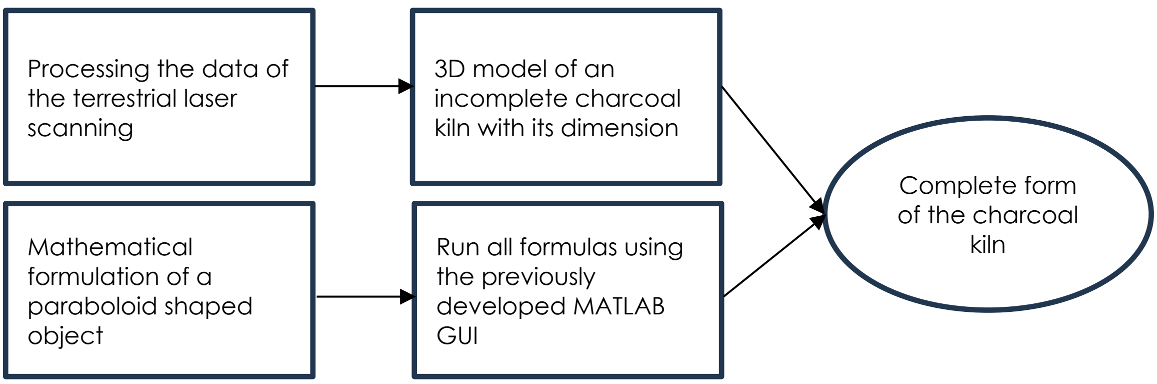

Figure 1: The research methodology of the project that consists of Terrestrial Laser Scanning and Mathematical Methods

a. Terrestrial Laser Scanning

In Majid et al. (2023), terrestrial laser scanning (TLS) technology was employed to create a 3D model of one of the remaining charcoal kilns in Kubang Badak, Langkawi. This model serves as a digital record of the historical kiln for educational purposes. Should the physical kiln be damaged or destroyed by a natural disaster, the digitally preserved model remains intact and can be analysed for historical study. Figure 2 shows the process of recording the incomplete charcoal kiln into a 3D model using the TLS. The 3D model also can then be further analysed to obtain some structures and the related dimension that can be used to reconstruct the complete charcoal kiln.

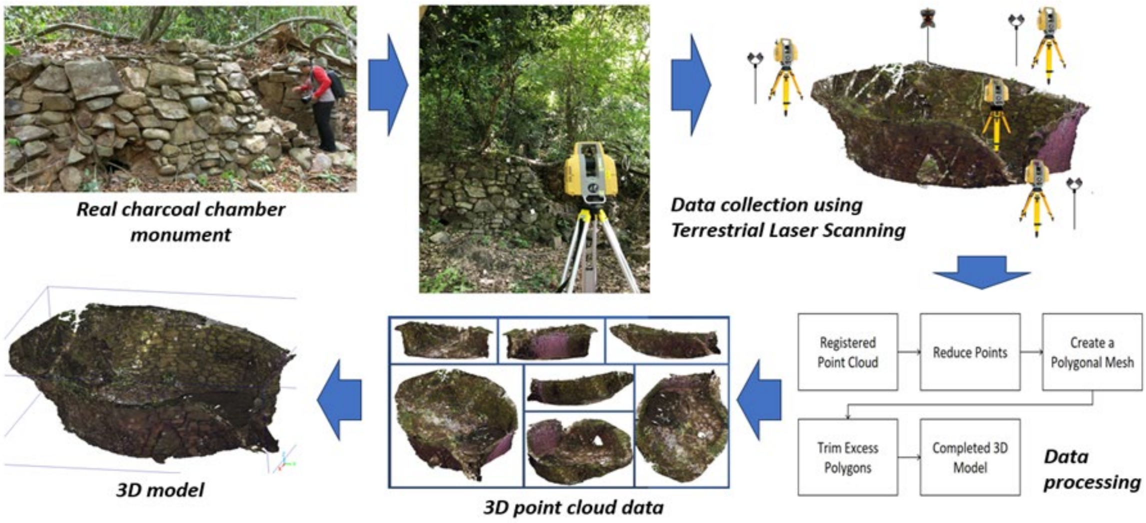

Figure 2: The process of obtaining the 3D model of the incomplete charcoal kiln (picture on the right) using terrestrial laser scanning (TLS)

b. Mathematical Methods

Based on the 3D model in Figure 2 and the study by Lim et al. (2023), it is now assumed that the complete charcoal kiln is a paraboloid shaped object with circular base. This assumption is based on local explanations that the kiln has physical properties similar to an igloo. While there are many shapes that can be used to construct a dome similar to an igloo, this project chooses the paraboloid due to its favorable mathematical properties.

Using multivariable functions, a solid is firstly defined to model the complete shape of the kiln. In the 3D coordinate system, the solid is above the xy −plane and bounded by

$$z = -\frac{h}{r^2}(x^2 + y^2) + h, \quad (1)$$

where, both h and r are positive constants. For convenience, the center of the circular base is set at the origin. The above equation represents the general equation of the paraboloid shaped object with radius, r and height, h, as given in Figure 3.

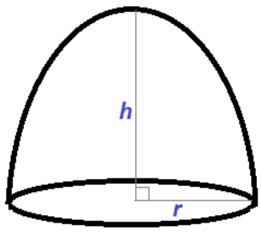

Figure 3: A schematic diagram of a circular paraboloid shaped object with height, h and radius, r

If G is the paraboloid shaped object, the volume, V of the object can be obtained by using the triple integrals, given by the following equation

$$V = \iiint_G 1\, dV,$$

$$= \frac{\pi r^2 h}{2}. \quad (2)$$

On other hand, if S is the paraboloid shaped object, the surface area, A of the object can be obtained by using the surface integral

$$A = \iiint_S 1\, dS,$$

$$= \frac{\pi r}{6h^2}\left[\left(4h^2 + r^2\right)^{\frac{3}{2}} - r^3\right]. \tag{3}$$

These two formulas can actually be obtained by following the steps presented in any book of multivariable calculus, such as in Osman and Yaacob (2008).

NALI in the Project

At Universiti Teknologi Malaysia, the course Mathematical Methods is typically taught under the Faculty of Science, while the course Terrestrial Laser Scanning is offered by the Faculty of Built Environment and Surveying. Additionally, Mathematical Methods is also taught to all engineering faculties at UTM, divided into two courses, which are Engineering Mathematics 1 and Engineering Mathematics 2. Therefore, this project also incorporates cross disciplinary knowledge among the researchers.

In addition, based on the literatures, the incomplete charcoal kiln at Kubang Badak was firstly modelled in 3D after it was scanned using the terrestrial laser scanning (TLS). Thus, using mathematical methods to further model the complete charcoal kiln based on the data from TLS is actually a novel approach. Furthermore, the innovativeness of this project can also be seen through the strong collaboration between surveyors and mathematicians, where, the data from surveying technology, which is the TLS, is applied by mathematicians to model the charcoal kiln. With this collaboration, surveyors can obtain a complete form of the charcoal kiln before conducting further investigations with their technologies. Meanwhile, mathematicians have the opportunity to tackle real world problems instead of focusing solely on theoretical mathematics.

Results

The next figure shows additional analysis of the 3D model of the charcoal chamber (the incomplete charcoal kiln) to obtain several parameters related to the model. This analysis was performed using the software CloudCompare. Actually, this software was also used by Majid et al. (2023) to generate the 3D model of the incomplete charcoal kiln based on data from the TLS.

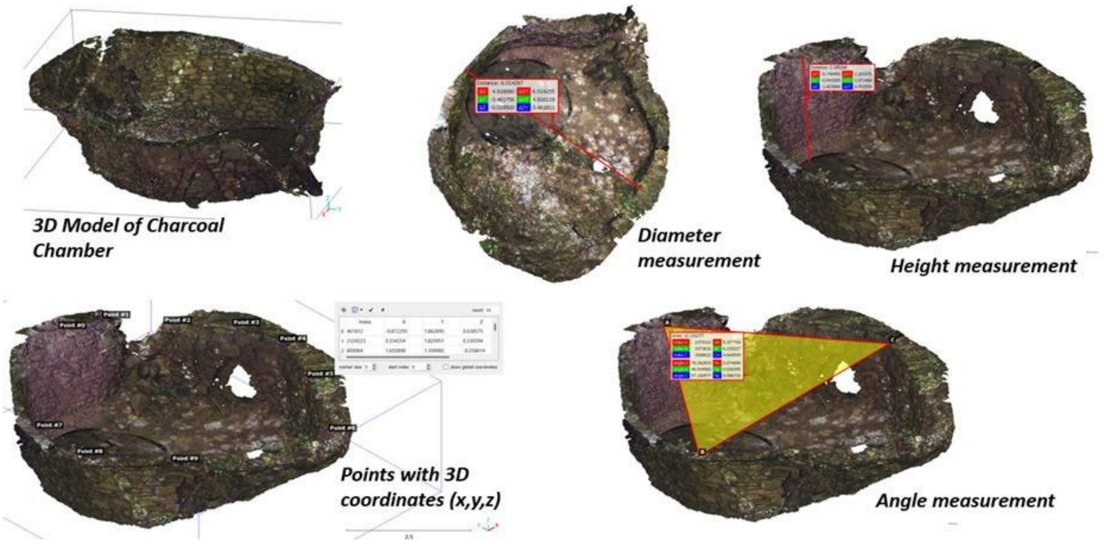

Figure 4: Additional analysis on the 3D model of the incomplete charcoal kiln (top left) using CloudCompare software to obtain several parameters of the model

As shown in Figure 4 (bottom left), the 3D coordinates of any points on the model can be generated. Therefore, several parameters, such as the diameter, height, and some angles related to the 3D model of the incomplete charcoal kiln, can be obtained. Without loss of generality, these parameters represent those of the original incomplete charcoal kiln at Kubang Badak.

In this study, in order to obtain the complete charcoal kiln from the 3D model using the solid defined previously with Eq. (1), the values of r and h have been set to 3 and 4, respectively. The radius r is set to 3 based on the diameter of 6 shown in Figure 3. Meanwhile, the height h is set to 4, which is twice the height of the 3D model in Figure 4 and this adjustment is based on the information from local people at Kubang Badak, who indicated that the height of the complete kiln is twice that of the current incomplete kiln. Thus, the complete charcoal kiln considered in this study can be modelled by a solid that is above the xy-plane and bounded by the paraboloid

$$z = -\frac{4}{9}(x^2 + y^2) + 4. \tag{4}$$

After that, the volume and the surface area of the model can be obtained using Eq. (2) and Eq. (3), respectively.

For displaying the model as well as easily computing both volume and the surface area for the model of the complete charcoal kiln, a MATLAB GUI developed during our previous project will be used. The GUI originally was developed to visualize and describe any paraboloid shaped object (as in Figure 3) when the values of r and h are specified. Figure 5 shows the inputs and the outputs of the MATLAB GUI after the button 'RUN' is clicked which displays the 3D model of the desired charcoal kiln.

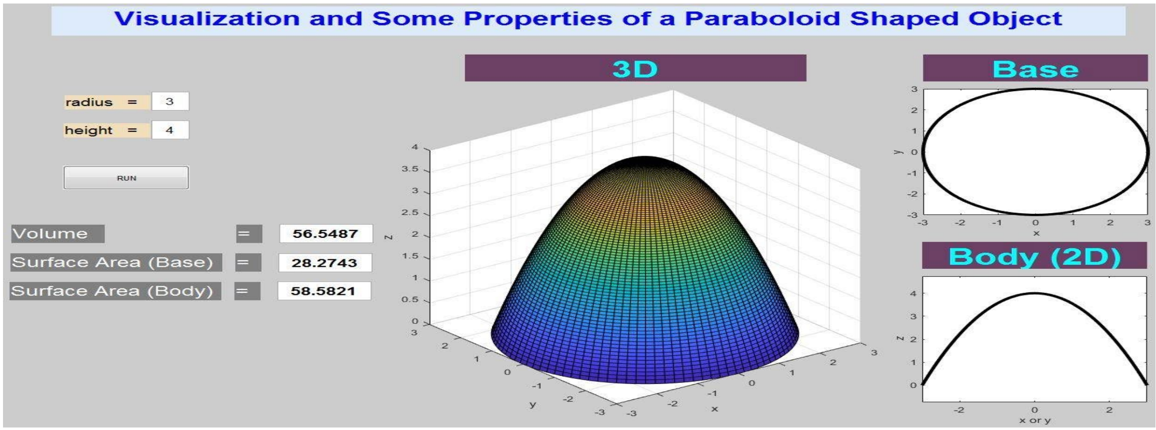

Figure 5: The inputs and outputs of the previously developed MATLAB GUI, which displays the model of a complete charcoal kiln along with its volume and surface area

For convenience, besides providing the 3D graph for the mathematical model, the GUI also displays graph showing the object from above, which represents the circular base. Additionally, the GUI offers graph depicting the object from the side or the front. Consequently, the values for the surface area of the base and the surface area of the body are separated because not all paraboloid shaped objects are open from below. This means that the user will need to add both areas if the paraboloid shaped object is closed. Meanwhile, the value for the volume remains unchanged regardless of whether the object is opened or closed. Furthermore, note that the GUI requires input for both the radius and the volume before any graphs or calculations is displayed. Thus, these inputs for the charcoal kiln can easily be updated if new information about the dimensions is provided.

Potential Commercialization

This project, which integrates the academic disciplines of surveying and mathematics, holds substantial commercialization potential. It can be incorporated into teaching and learning materials at higher education institutions to deepen students' understanding of the related subjects. Additionally, it could be developed into a tourism product, contributing not only to Langkawi Island but also to the country's economic growth.

Summary and Impacts of the Innovation

In this project, the TLS and the CloudCompare software have been combined with mathematical methods and the MATLAB software to model the complete form of the charcoal kiln at Kubang Badak. The innovative aspects of this project can be leveraged during the teaching and learning process to the related students for increasing students' knowledge about the technologies involved. If this is also done, surveying, engineering and mathematics students can additionally enhance their understanding on the advanced applications of the subjects. This aligns with the country's intention to encourage STEM in education. Besides, if this project is commercialized and expanded through the collaboration with industries, community will also receive benefits especially with the continuing recognition of Langkawi Island as UNESCO Global Geopark that can boost revenue from tourism activities. Local residents will also gain a deeper understanding of the kiln's historical significance, potentially fostering greater patriotism. Moreover, modeling the kiln will assist in its preservation, ensuring that historical techniques and structures are preserved for future generations.

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ID 16: Developing An Early Science Learning Module (MyPraSains) to Promote Preschoolers' Motivation in Learning Science

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Highlights: Malaysia is currently facing a deficit of science students in secondary schools. This predicament occurred due to the challenging nature of science classes and the educator's lack of capabilities in 21st-century teaching. Thus, an educational innovation called MyPraSains Module has been developed specifically for preschoolers to cultivate their interest in science. The development of this module has undergone five design phases as outlined by the ADDIE Instructional Module. This module establishes an outline for cultivating children's initial enthusiasm in science from an early age. Furthermore, it promotes their enthusiasm for science topics once they embark on the next level of education.

Keywords: *Early Science Learning Module; Preschoolers' Motivation; Learning Science*

Introduction

Proficiency in STEM disciplines is currently regarded as a standard for numerous countries worldwide to enhance the caliber of their future workforce (Jafarov, 2023). From an analysis of the present economic outlook, it is evident that Malaysia is experiencing a deficit in the number of engineers and scientists. As to the report by the National Council for Scientific Development and Research (MKPSB), our country would require around 500,000 scientists and engineers by 2020 in order to attain a technologically advanced and developed status. Currently, the number of registered engineers stands at approximately 70,000 individuals, which accounts for only 17 percent of the MKPSB target (Ahmad, 2024). Furthermore, from an educational standpoint, Malaysia first implemented a policy favoring science stream students over literary stream students at a ratio of 60:40. Nevertheless, the Malaysian Ministry of Education has yet to effectively deliver this policy (Ahmad, 2023). There are other challenges that prevent the implementation of this strategy in a systematic and clear manner, and one of them pertains to the teacher's perception and attitude concerning science education. Bers (2008) asserted that not only do teachers lack proficiency in the science curriculum, but they also lack a robust methodology for delivering high-quality science instruction. Furthermore, the teacher's reluctance to utilize technological teaching tools perpetuates the usage of conventional instructional methods in science education. Furthermore, the difficulty in engaging learners with science instruction can be attributed to a multitude of causes, including both internal and external influences. A study conducted by Novianti et al. (2022) found that various problems related to schooling, including limited student-teacher connections, a disorganized science education curriculum, and inadequate teaching methods, contribute to students perceiving science as uninteresting.

In order to address these challenges effectively, researchers have explored strategies to revitalize science education in Malaysia by enhancing the fundamental principle of science education at the pre-school level. Consequently, researchers have reached mutual agreement to develop a preliminary science education module named "MyPraSains". Prior research has demonstrated that the utilization of interactive and digital learning modules can effectively stimulate children's enthusiasm for science and enhance their overall cognitive growth. This assertion is supported by a study conducted by Ahmad and Iksan (2021), wherein they demonstrated that the utilization of interactive science modules through digital activities in the classroom is appropriate for children's development. This approach enables children to effectively exhibit various science skills, including observation, prediction, hypothesis formation, classification, identification of variables, experimentation, data recording, and inference making. Furthermore, the modules developed place significant emphasis on ideas that can enhance activities orientated upon Project-based Learning (PBL). A study conducted by Rahman et al. (2018) found that utilizing the PBL strategy to engage children in science issues can enhance their critical thinking skills, aligning with the principles of 21st century education. Furthermore, this approach has the potential to foster children's scientific thinking, which is crucial to promote children's scientific thinking by 2050. Considering the development of this module, the science curriculum in Malaysia has the potential to be improved at an earlier stage, then motivating children to nurture an interest in STEM subjects as they progress to higher education levels.

Research Objectives

- To analyze the needs of developing the MyPraSains learning module for preschoolers.
- To examine the consensus among experts on the design prototype of the MyPraSains learning module.
- To examine the consensus among experts on the development of the MyPraSains learning module.
- To evaluate the scores of treatment and control groups regarding children's motivation towards learning early science.
- To assess the teacher's evaluation of the effectiveness of the MyPraSains learning module.

NALI Approach

One of the most significant contributions of this project is the uniqueness of the module itself. In terms of novelty, this MyPraSains learning module was developed using Perkins's (2023) PBL Process Model. This model emphasizes goal-oriented learning, in which children have to comprehend each science topic in accordance with Bloom's (1956) hierarchical ordering of cognitive processes.

Furthermore, this module fosters creativity by presenting users (children) with practical learning concepts and providing guidelines on each page. The emphasis on colorful components allows children to understand the content of each project, and they can use the provided QR Code to complete tasks digitally. In addition, there are ten intriguing projects that can pique children's interest in science. All the projects developed are aligned with children's developments encompassing social interaction, creative thinking, and their present level of motivation.

In terms of innovativeness, the process of developing this learning module includes two main elements: collaboration, and ideation. In terms of collaboration, advancing this module necessitates greater openness. Researchers not only created this module through bilateral cooperation with the Malaysian Ministry of Education and Malaysian institutions of higher education, but we also collaborated with international parties, obtaining direct consultation from experts at the University of Cape Town. Additionally, regarding the generation of ideas, researchers have acquired concepts for the development of this learning module by gathering insight from experts in the field of education through participation in pitching competitions. Prior to officially developing this module, we have actively sought thoughts from experts. Subsequently, their perspectives have been noted in order to refine the ideas during the development of this module.

Furthermore, researchers have specifically targeted preschool and kindergarten children in Malaysia in terms of the applicability of this module. This is primarily due to the fact that the content constructed for this module adheres to the guidelines outlined in the National Preschool Standard Document 2017, as recommended by the Malaysian Ministry of Education. Based on a pilot study conducted on 25 children and a subsequent study on 25 Malaysian preschool children, it has been demonstrated that the activities developed are effective in enhancing children's comprehension of science in a meaningful and experiential manner. As a result of this accomplishment, this module will be distributed to preschool and kindergarten educators in Malaysia, either in digital or printed format, to support their teaching and facilitating methods.

Last but not least, Lastly, when considering the impacts of research on the development of the MyPraSains module, two distinct impacts have been recognized: direct impact and indirect impact. After an 8-week intervention program conducted by researchers, preschool teacher has acknowledged that the given tasks effectively enhance the three primary aspects of children's development when engaging in projects both inside and outside the classroom. This may be demonstrated by comparing the pre and post test scores, which reveal that the children have acquired a strong understanding of science and have shown a significant improvement in their scores. In addition, in terms of long-term impact, through an international pitching competition participated by researchers, the idea in developing this module won first place (the best idea) and won second place in the 3-minutes thesis competition at the university level.

Research Methodology

The researchers have employed a multi-method design in this study, collecting research data using both quantitative and qualitative methods. The ADDIE Model (Li & Cheong, 2023) is a methodical instructional design framework employed by researchers to facilitate the development of education products. Researchers commonly followed a five-phase phases, which includes phase 1: need analysis, phase 2: module design, phase 3: module development, phase 4: the implementation of activities through the module, and phase 5: module evaluation. Moreover, 9 educators with experience in teaching young children in the field of science were interviewed online as part of the data gathering process for phase 1. The duration of data collection for this phase was 9 weeks. Furthermore, a total of 6 experts specializing in early childhood education, educational psychology, and curriculum development have been chosen to review the module design instrument. This evaluation is being conducted to collect data for phase 2. The duration of data collection for this phase was 6 weeks. Furthermore, a total of 10 highly regarded experts specializing in early childhood education, educational psychology, educational pedagogy, and curriculum development have been recruited to evaluate the module development instrument. Their evaluation will serve as a means of collecting data for phase 3. The duration of data collection for this phase was 9 weeks. Furthermore, 50 preschool children were specifically chosen for data collection during phase 4. The participants were categorized into two distinct groups: the control group and the treatment group. The treatment group exclusively engaged in activities utilizing the MyPraSains Learning Module, whereas the control group participated in regular science learning facilitated by their teacher. The duration of data collection in this phase was 8 weeks. Last but not least, in phase 5, only teacher from the treatment group was interviewed to evaluate the effectiveness of the MyPraSains learning module in early science contexts. Data collection for this phase occurs one week following the conclusion of phase 4.

Furthermore, researchers have employed three distinct software programs for the data analysis procedure. Specifically, ATLAS.ti software has been utilized to examine data from phase 1, employing thematic content analysis. This software is a regularly employed strategy that utilizes interview and focus group data to get insight into individuals' experiences, ideas, and views regarding a specific subject (Jowsey et al., 2021). This is because, during this phase, only interview instrument was utilized for the purpose of data collection. In addition, for phases 2 and 3, researchers employed Microsoft Excel software. The researchers utilized the content validity index (CVI) to assess the consensus among experts during the design of the prototype for the initial science module and the development of the actual MyPraSains Module. In addition, to examine the data acquired in phase 4, researchers employed SPSS software. In order to examine the difference between the post test scores between the control and treatment groups, researchers employed the Independent-Samples T-Test method. Last but not least, in phase 5, researchers utilized Microsoft Word to analyze an interview transcription acquired from a teacher belonging to the treatment group. During this step, researchers do manual content analysis.

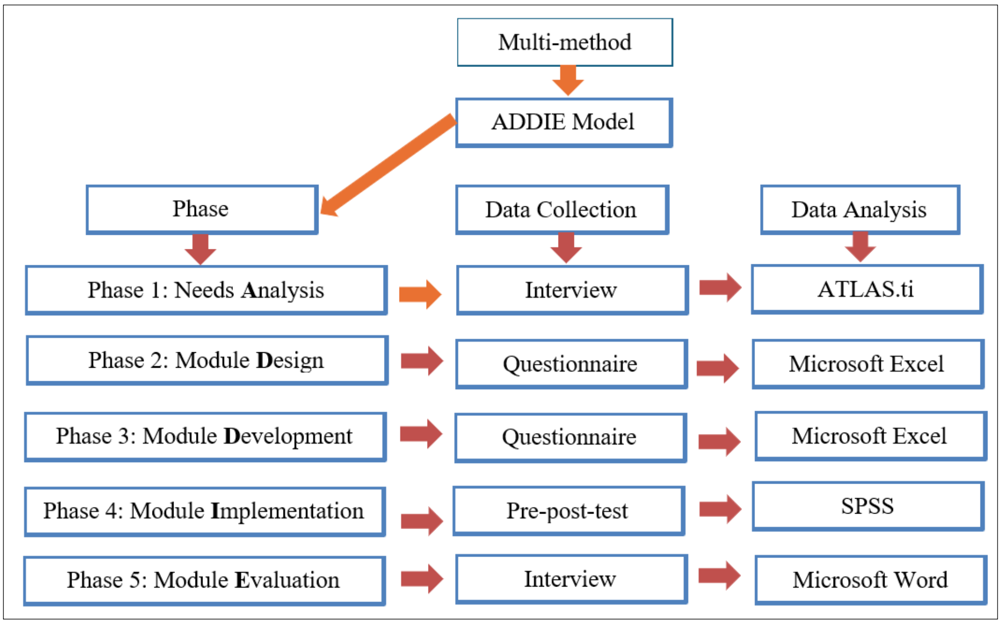

Figure 1: Research Methodology

Findings

RQ1: What are the needs of developing the MyPraSains learning module for preschoolers?

According to the findings from the interviews with the study participants, most of them hold the opinion that developing an early science module for preschoolers is crucial because it has the potential to enhance children's motivation to acquire knowledge. From the analysis conducted, three themes were effectively generated: T1: The Module's Uniqueness, T2: Digitalization in Learning and Facilitation, and T3: Guidelines for Easy Activity Implementation. The According to the interviews conducted with the participants, P2 expressed about T1 as below:

"They will be more interested, and I believe that possibly on the next day, they want to ask me to do the activity again based on the module. Because it is different from the others". – P2

In addition, regarding P3, she believed in her opinion about T2. It could be proved with the following transcript:

"With the help of teaching materials such as videos or digital objects, they can stimulate children's thinking in the classroom as well as at home". – P3

Furthermore, based on P8 experience, her perception brought to the creation of T3. The transcript provided below serves as evidence to support the claim:

"The main problem that I faced is in terms of preparing teaching materials. If we want to do an investigation, we use materials that are not in the classroom. We need to find it. It is so difficult". – P8

RQ2: How far is the consensus among experts on the design prototype of the MyPraSains learning module?

According to the responses from the experts in the area (Es), all of them have unanimously approved the prototype of the early science module that has been designed. The results indicate that the experts' overall coefficient value for Scale Content Validity Index (S-CVI) has successfully reached a value of k=1. Nevertheless, the experts have provided the following comments:

"The module exhibits excellent design; however, it is important to take into account the 40-minute duration allocated for each activity." – E3

"The activities in the module are highly engaging. I recommend revisiting the selection of technological materials that should be utilized." – E5

RQ3: How far is the consensus among experts on the development of the MyPraSains learning module?

According to the responses from the experts in the area (Es), all of them have unanimously approved the prototype of the MyPraSains learning module that has been developed. The results indicate that the experts' overall coefficient value for S-CVI has successfully reached a value of k=1. Nevertheless, the experts have provided the following comments:

"The module All activities conform to the guidelines outlined in the National Preschool Standard Document 2017. However, in my opinion, the allocated time of 40 minutes should be extended to 1 hour, as each activity within a project requires a significant amount of time." – E6

"Age-appropriate activities for children. Nevertheless, the teacher's assistance for each activity is crucial." – E9

RQ4: Is there any difference between the scores of treatment and control groups regarding children's motivation towards learning early science?

According to the post test scores of both groups, there is a notable disparity, with the treatment group achieving a higher score compared to the control group. If the p-value is lower than the predetermined alpha level (often .05 or .01), we will infer that the mean is statistically different from zero. As evidence, the p-value is less than 0.001 (see Table 1), which is smaller than the significance level of 0.05.

Table 1: Independent samples test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Motivation	Equal variances assumed	576.000	<.001	-14.000	48	<.001	<.001	-1.400	.100	-1.601	-1.199
	Equal variances not assumed			-14.000	24.000	<.001	<.001	-1.400	.100	-1.606	-1.194

Table 1 indicate that children who utilized the MyPraSains learning module in order to learn science topics exhibit increased motivation compared to those who relied on conventional approaches. This is because the developed learning module fosters children's engagement in activities without the fear of failure. Conversely, the teacher will provide encouragement and rewards once the children successfully finish the group task. Once they experience recognition, they will be motivated to engage in other educational endeavors in the future.

RQ5: What is the perception of teacher regarding to the effectiveness of the MyPraSains learning module.

According to the perspective of the teacher (T) in the treatment group that utilized the MyPraSains module, she reported that this module effectively enhances children's motivation to study science with greater self-assurance. She stated that in her previous classes, science learning lacked engagement due to her failure to incorporate hands-on activities for the children. This was mostly due to her limited availability and time to conduct thorough activities for the children. However, this module facilitated her ability to locate educational resources, whether they are in physical or digital form. To have a more comprehensive understanding of his perspectives, one can substantiate his beliefs through the statement provided in the transcript below:

"I am happy and satisfied to utilize this module. It not only offers explicit instructions for locating teaching resources for children, but it also assists me in creating teaching materials ahead of time. During my 8-week experience teaching preschoolers, I observed that they showed high levels of motivation to study. This was likely due to the implementation of PBL and the incorporation of technology, which stimulated their curiosity and motivated them to explore many early science concepts." – T1

Simultaneously, it demonstrates that the effectiveness of this module has an advantageous impact not only on the educator but also on the students themselves.

Discussion

The aforementioned findings have conclusively demonstrated the high efficacy of the PBL-TBL module in facilitating instruction in science within the realm of early childhood education. Research conducted by Mohd. Saad et al. (2024) demonstrates that doing project activities with children can effectively enhance their motivation to attend preschool. One study participant remarked that after each reflection session on the learning project, the children would eagerly anticipate the next learning and consistently enquire about the topics they wanted to explore in the upcoming days. In addition, in terms of learning using modules, a study conducted by Narayanasamy and Mohamad Jaafar (2024) revealed that by using modules that are built systematically and ethically, it is able to help children improve their knowledge in the topics they learn. As evidence, in this study, the module developed has passed 5 important phases and the final findings have revealed that the MyPrSains module is able to help children in increasing their motivation to learn science topics. Moreover, while considering the role of technology in science education, the study's findings indicate that integrating digitalization into the classroom can enhance the willingness of learners to concentrate on what they are learning. Integrating technology not only enhances children's engagement in learning, but it also serves as a method to enhance the quality of education in the 21st century. In a study conducted by Yilmaz (2023), it was elucidated that prioritizing a well-rounded and discerning approach to incorporating technology does not imply overshadowing traditional teaching methods. Rather, it pertains to fostering progressiveness in the realm of science education.

Subsequently, discussing the implication of this study on the standard of science education in Malaysia, this learning module will serve as a proactive measure for educators to enhance the standard of their instruction in STEM education from an early stage. The MyPraSains Learning Module provides children with the guidelines to carry out each activity under the supervision of a teacher. Furthermore, the distinguishing characteristic of this module is the provision of a directive module for teachers to effectively execute each project by following the appropriate procedures. According to the recommendations provided by Unis Hanoi (n. d.), one of the most effective methods for boosting STEM education in preschool is to implement the strategy of "Follow Children's Lead and Learn Alongside Them". This advanced module not only prioritizes children's engagement in activities, but also enhances the teacher's credibility as a facilitator through the utilization of established instructions. Therefore, by engaging in this reciprocal interaction, it has the capacity to enhance the rapport between educators and young learners, thereby fostering an enhanced science instructional setting in early childhood education.

Conclusion

Through the development of the MyPraSains Learning Module, but it is also able to bridge the gap between the inspiration of the Malaysian Ministry of Education in dignifying STEM education and the constraints faced by preschool teachers in improving the quality of their teaching in the core of Science and Technology. By transforming this module into a comprehensive guide for implementing science projects both inside and outside the classroom, it has the potential to enhance children's inclination to engage with science at an early age. The implementation of science education involves providing children with direct and relevant experiences. Research findings have shown that this learning approach can enhance children's interest in science. Furthermore, it will enhance their interests once their transition to higher education.

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We express our gratitude for the successful completion of this research. Thank you to Universiti Teknologi Malaysia for providing scholarships for researchers in developing and publishing the MyPraSains Learning Module for the purpose of promoting the holistic development of children in learning science education in preschool.

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ID 17: Pendekatan Heutagogi dan Penilaian Rakan Sebaya dalam Meningkatkan Pencapaian Pelajar

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Sorotan: Pelaksanaan pendekatan heutagogi dan penilaian rakan sebaya merupakan salah satu kaedah pengajaran dan pembelajaran mampu meningkatkan pengetahuan dan kemahiran pemikiran kritis para pelajar. Kesukaran memahami isu dunia sebenar untuk diselarikan dengan topik pembelajaran dalam kursus menjadi isu dikenalpasti dalam kajian ini. Untuk itu, kajian ini bertujuan untuk mengintegrasikan pendekatan heutagogi dan penilaian rakan sebaya dalam meningkatkan pengetahuan dan Kemahiran pelajar. 5 langkah pelaksanaan telah dilakukan, iaitu (1) persediaan awal, (2) perbincangan penilaian dan pembangunan rubrik, (3) pelaksanaan pembelajaran dan tugasan, (4) penilaian oleh rakan sebaya, dan (5) refleksi dan penambahbaikan. Pendekatan kajian ini fokus CLO3, CLO4 dan CLO5. Berdasarkan hasil analisis markah median berdasarkan CLO, CLO3 dan CLO5 menunjukkan peningkatan markah median, manakala CLO4 menunjukkan kemorosotan. Hasil kajian ini boleh ditambahbaik dengan pelaksanaan dan perancangan yang lebih rapi di masa akan datang.

Keywords: *Pendekatan Heutagogi, Penilaian Rakan Sebaya; pembelajaran aktif*

Pengenalan

Inovasi dalam pengajaran dan pembelajaran telah berkembang dengan pesat, dengan pelbagai kaedah dan teknik pembelajaran yang lebih mesra pelajar telah diperkenalkan. Inovasi dalam pembelajaran merujuk kepada pendekatan dan teknik baharu yang digunakan untuk meningkatkan pengalaman pendidikan dan keberkesanan pengajaran, seperti pembelajaran aktif, pembelajaran kolaboratif, selain pelbagai teknik-teknik kaedah perbincangan dalam kelas seperti *Think-Pair-Share, Sub-Stop Classroom, Flip Classroom*, dan lain-lain teknik yang bersesuaian(McCarthy & Anderson, 2000; Wolff et al., 2015).

Inovasi dalam P&P ini juga telah diterapkan dalam kursus Pengurusan Data Spatial (Spatial Data Management, SBEG4643), yang merupakan kursus elektif dalam Program Sarjana Muda Geoinformatik dengan Kepujian di Fakulti Alam Bina dan Ukur, UTM (FABU, 2021). Kursus ini menerapkan pengetahuan berkenaan pengurusan data spatial, termasuklah memahami isu, kekangan dan pelaksanaan semasa pengurusan data spatial di pelbagai peringkat, selain penambahbaikan yang boleh dilaksanakan. Kursus ini akan memerlukan kepada pengetahuan asas daripada tahun 1 hingga tahun 3 untuk diterapkan dan dilaksanakan dalam kursus ini. Kesukaran memahami pelbagai isu, selain ketidakselarian kefahaman berkenaan pengurusan data spatial dengan pengetahuan lain dalam kursus-kursus sebelumnya dilihat menjadi isu dalam mendalami pengetahuan dalam kursus ini.

Untuk mengatasi masalah ini, kajian ini mengintegrasikan pendekatan heutagogi dan penilaian rakan sebaya bagi meningkatkan kefahaman, pengetahuan dan implementasi kandungan kursus kepada para pelajar. Pendekatan heutagogi akan memahami kehendak pelajar dan bagaimana ianya boleh diselarikan dengan hasil pembelajaran kursus dan kandungan kursus. Kaedah heutatogi akan membangunkan pengetahuan dan pemikiran kritis (Bhoyrub et al., 2010). Pendekatan penilaian rakan sebaya pula dilaksanakan bagi memberikan pendedahan kepada pelajar berkenaan bagaimana melihat dan menilai hasil laporan tugasan rakan-rakan mereka supaya boleh menambahbaik laporan tugasan para pelajar kelak (Topping, 2017). Sampel kajian adalah para pelajar yang mengambil kursus Pengurusan Data Spatial (SBEG4643) bagi semester 1, sesi 2021/2022 hingga sesi 2023/2024.

Implementasi Pendekatan Heutagogi dan Penilaian Rakan Sebaya

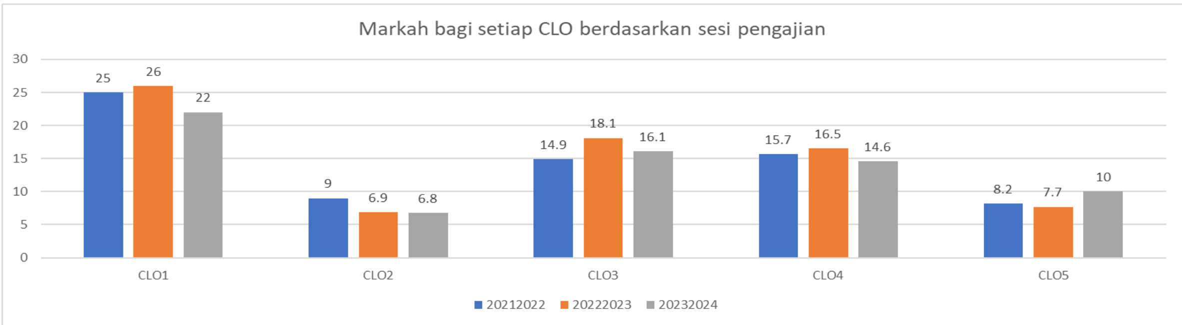
Bagi melaksanakan kaedah pembelajaran menggunakan pendekatan heutagogi dan penilaian rakan sebaya ini, ianya terbahagi kepada 5 langkah utama, iaitu; (1) persediaan awal, (2) perbincangan penilaian dan pembangunan rubrik, (3) pelaksanaan pembelajaran dan tugasan, (4) penilaian oleh rakan sebaya, dan (5) refleksi dan penambahbaikan (Rajah 1). Kaedah pendekatan heutagogi dan penilaian rakan sebaya ini menumpukan kepada kemahiran psikomotor dan afektif, iaitu bagi CLO3, CLO4, dan CLO5.

Langkah pertama adalah persediaan awal, iaitu berlakunya proses perancangan dan penyediaan bahan dan aktiviti yang akan dilaksanakan ketika kelas berjalan. Dalam langkah ini, pengajar menyediakan bahan-bahan bagi pembelajaran, langkah-langkah dan aktiviti yang bakal dijalankan, serta jangkaan hasil akhir yang bakal dihasilkan oleh pelajar. Langkah kedua pula adalah perbincangan penilaian dan pembangunan rubric. Dalam Langkah ini, pengajar dan pelajar akan berbincang apakah kehendak dan kemahuan pelajar, dan pengajar akan selarikan input daripada pelajar dengan kandungan kursus yang akan dijalankan. Selain itu, pelajar juga berbincang dan membangunkan rubric untuk tujuan menilai tugasan yang mereka akan hantarkan kelak.

Langkah ketiga adalah pelaksanaan pembelajaran dan tugasan, yang mana pelajar akan melaksanakan aktiviti pengajaran dan pembelajaran di dalam kelas, dan seterusnya menyiapkan tugasan yang diberikan, dan hasil tugasan perlu selari dengan rubric yang pelajar telah bangunkan. Langkah keempat adalah penilaian oleh rakan sebaya. Hasil laporan tugasan, akan diberikan kepada rakan-rakan pelajar yang lain, dan pelajar perlu menilai laporan tugasan yang telah dihantar berdasarkan rubric yang telah dibangunkan. Langkah terakhir adalah proses refleksi dan penambahbaikan. Dalam langkah ini, pelajar akan berbincang, dan menyatakan apakah penambahbaikan yang boleh dilakukan oleh laporan yang dinilai oleh mereka kepada rakan-rakan pelajar yang berkenaan.

Rajah 1: Langkah-langkah perlaksanaan kaedah pendekatan heutagogi dan penilaian rakan sebaya.

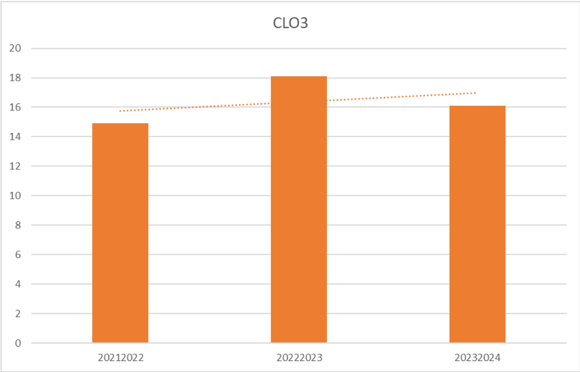
Bagi menilai tahap pencapaian secara formatif, perbandingan markah median bagi setiap CLO telah dilaksanakan. Perbandingan dilakukan bagi 3 sesi terkini, iaitu daripada sesi 2021/2022 sehingga 2023/2024. Rajah 2 menunjukkan perbandingan markah median bagi 5 CLO yang terdapat dalam kursus ini. CLO1 dan CLO2 dipetakan kepada Kemahiran kognitif, manakala CLO3 dan CLO5 berkaitan Kemahiran psikomotor dan CLO4 dipetakan kepada Kemahiran afektif.



Rajah 2: Skor median pencapaian pelajar mengikut CLO

Kajian ini menumpukan kepada perkembangan dalam kemahiran psikomotor dan afektif, iaitu CLO3, CLO4 dan CLO5 sahaja. Berdasarkan kepada hasil markah median ini, analisis regrasi linear menunjukkan kemerosotan nilai markah median CLO4 (Rajah 3). Akan tetapi terdapat peningkatan markah median bagi CLO3 dan CLO5. Ini menunjukkan kemerosotan pencapaian kemahiran psikomotor, akan tetapi peningkatan dari aspek afektif.

Sesi 2021/2022 adalah sesi pembelajaran secara atas talian sepenuhnya kerana Perintah Kawalan Pergerakan (PKP) fasa 2.0. Pembelajaran dilaksanakan secara online sepenuhnya, dan penilaian dilebihkan kepada kemahiran kognitif, sementara kemahiran psikomotor dibuat secara sederhana, akan tetapi kemahiran afektif kurang dapat ditekankan. Kekangan ini disebabkan pelbagai faktor termasuklah kekangan teknologi, dan masa dan kesesuaian untuk komunikasi antara pelajar. Penambahbaikan telah dilaksanakan pada sesi 2022/2023 hingga 2023/2024 dengan pelaksanaan pendekatan heutagogi serta penilaian rakan sebaya.



(a) Markah median bagi CLO3

(b) Markah median bagi CLO4

(c) Markah median bagi CLO5

Rajah 3: Skor Median dan analisis regreasi linear bagi CLO3, CLO4, dan CLO5

Kesimpulan

Kajian ini dilaksanakan bertujuan untuk melaksanakan implementasi kaedah pendekatan heutagogi serta penilaian rakan sebaya. Kaedah ini menekankan kepada kehendak asas pelajar, dan diselarikan dengan CLO yang telah digariskan, dan juga topik-topik dan tugasan yang diberikan kepada pelajar. Berdasarkan analisis markah median mengikut CLO, terdapat peningkatan pencapaian pelajar bagi CLO3 dan CLO5, manakala bagi CLO4 berlaku kemerosotan. Penambahbaikan yang boleh dicadangkan adalah meningkatkan kefahaman pelajar berkenaan kaedah pendekatan heutagogi dan penilaian rakan sebaya, selain itu integrasi dengan pembelajaran aktif di dalam kelas. Selain itu, untuk memastikan kaedah ini berjaya, pensyarah juga perlu terlebih dahulu menguasai kursus yang diajar, selain dinamik dengan topik-topik dan pendekatan pembelajaran.

Penghargaan

Penulis ingin mengucapkan penghargaan kepada kesemua pelajar kursus Pengurusan Data Spatial (SBEG4643), semester 1, sesi 2021/2022, 2022/2023, dan 2023/2024 di Universiti Teknologi Malaysia yang telah terlibat dalam proses pembelajaran di dalam kajian ini.

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ID 19: From Laser Pulse to 3D Models: A Project Based Learning

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Highlights: Terrestrial Laser Scanning, a cutting-edge method for rapid and precise 3D geospatial data collection, presents a formidable challenge for young minds dealing with millions of laser point clouds. To enhance student proficiency, an independent, project-based learning approach was implemented in subject SBEU4883. In the final 4-weeks of the subject, the student needs to propose an idea of application, the selected site and the processing involved, followed by independent project appraisal.

Keywords: *Terrestrial Laser Scanning; Point Cloud; Geoinformation, Project-Based Learning*

Introduction

Terrestrial Laser Scanning (TLS) is a trending skill in employment market for Geoinformation's graduate. As the pioneer in Geoinformation field, Universiti Teknologi Malaysia electively offering this subject to the final year student. The lesson covers from the basic physics of laser and electromagnetic wave properties, TLS measurement principal, and extended into hands-on skill cultivation for the TLS data collection and survey. Apart from that, the student also exposed to project planning, and data processing skills.

Project-Based Learning (PBL) has emerged as a significant instructional strategy in education, recognized for its potential to enhance student engagement and deepen understanding of subject matter through active participation in real-world projects. Unlike traditional learning methods that often rely on passive knowledge absorption, PBL fosters a learning environment where students actively construct knowledge by engaging in meaningful projects (Larmer et al., 2015). This approach aligns with the principles of constructivist learning theory, which posits that learners build understanding through experiences and reflection (Dewey, 1938; Piaget, 1970).

One of the primary advantages of PBL is its emphasis on student-centered learning, where learners are given autonomy over their learning process (Bell, 2010). This autonomy allows students to take responsibility for their educational journey, leading to increased motivation and engagement (Blumenfeld et al., 1991). Through PBL, students are encouraged to explore and inquire, which enhances critical thinking skills and fosters a deeper understanding of the content being studied (Thomas, 2000). The process of investigating, problem-solving, and presenting solutions enables students to apply their knowledge in practical contexts, bridging the gap between theory and practice (Krajcik & Blumenfeld, 2006).

Moreover, PBL promotes collaborative learning, as students often work in teams to complete their projects (Barron & Darling-Hammond, 2008). This collaboration not only helps students develop interpersonal skills but also exposes them to diverse perspectives and ideas, which can lead to more innovative solutions to the problems they are tackling (Hmelo-Silver, 2004). The social aspect of PBL is crucial for preparing students for the collaborative nature of modern workplaces (Bell, 2010).

However, despite its many benefits, PBL does present certain challenges in implementation. One significant challenge is the need for careful planning and structuring by educators to ensure that the projects remain aligned with curriculum standards and learning objectives (Mergendoller & Thomas, 2005). Additionally, assessing student performance in PBL can be complex, as it often requires evaluating both the process and the final product, as well as individual and group contributions (Thomas, 2000). Educators must develop robust assessment strategies that accurately reflect student learning while also providing meaningful feedback.

In short, Project-Based Learning represents a powerful instructional strategy that not only enhances student engagement and understanding but also equips students with essential 21st-century skills such as critical thinking, collaboration, and problem-solving. While there are challenges to its implementation, the potential benefits of PBL make it a valuable approach in modern education.

Foundation of PBL

This project-based learning aims to enhance students' ability to analyze, evaluate, and create solutions to real-world problems through a structured project. By the end of the project, at least 80% of students will demonstrate a 20% improvement in their critical thinking assessment scores, as measured by a standardized rubric. This project is achievable since student has been provided with guided exercises and resources before embarking on the project. The hands-on class on data collection using terrestrial laser scanning instrument (Topcon GLS-2000 Geodetic Laser Scanner) has been conducted in the 4th week with the step-by-step guidance by our professionally-trained technician – Mr Faizi Salleh and Mr Anuar Aspuri. Morever, these students are fourth-year student, which have ample experience in land surveying processes learned in previous semesters. Following, the hands-on tutorial on data processing also conducted in class using two main software – proprietary software for the Topcon GLS-2000 – magnetcollage and another software which is open source and more flexible in terms of processing ability – CloudCompare. Basically, before embarks on PBL, the student has been equipped with the theoretical and practical knowledge. On the last 5 weeks of lecture, the students are required to form a group of 6 and propose the project for their PBL. To enhance their communication skill, the proposal was delivered in form of NABC pitching which requires them to highlight the relevance of their project, the study area, the planning in Gantt chart, and the specification of data processing that will be done to achieve their objectives. Prior to pitch on their ideas, they need to do a critical discussion, site visit and comprehensive plan. Figure 1 shows the flowchart of overall process involved in ensuring the success of the project. According to previous experience, the data collection process always hindered by weather (rain) and clashing schedule of TLS equipment uses due to limited availability. After data cleaning and registration, the data processing can take place to achieve the intended objectives. All the process needs to be documented as a written report and the video recordings for future reference. Figure 2(a) and 2(b) shows the hands-on teaching session while Figure 3(a) and 3(b) shows the data collection for PBL.

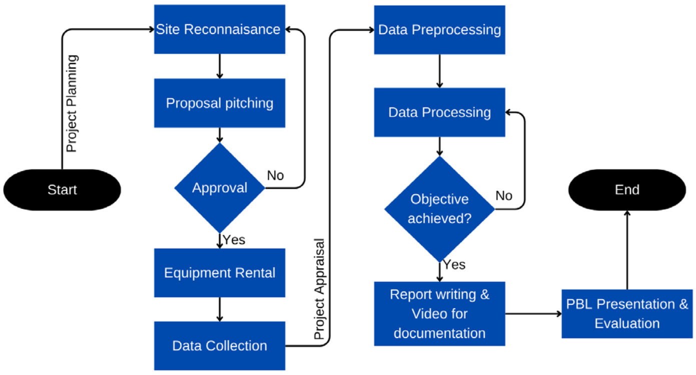


Figure 1: The overall flowchart of PBL processes.

2(a)

2(b)

Figure 1(a) and 1(b) : The hands-on session has been conducted to equipped the student with the skill of terrestrial laser scanning instrument handling tailored to the on-field requirement.

3(a)

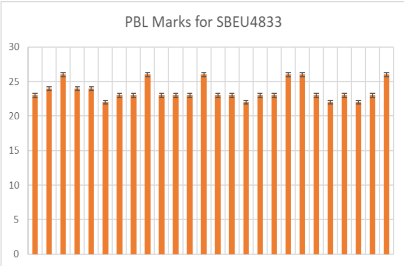
3(b)

Group A collecting the point cloud data for slope modelling.

Group B is focusing on recording the point cloud for landscape mapping.

Findings and Discussion

To evaluate the success of this PBL, two assessment methods were adopted. The lecturer's assessment is divided into three components: the success of the PBL project, the quality of the report writing, and performance during the presentation. To ensure a fair evaluation, students also contribute to the grading by assessing their group members using a peer assessment tool. This peer assessment evaluates each member's commitment in terms of punctuality, contribution, work quality, and attitude. The tangible results of their commitment are reflected in the final PBL mark, which totals 30 marks. The distribution of marks is shown in Figure 4. The feedback from the student is also positive since the data collection and processing that they learnt through this PBL is helping in their final year project, which is the independent research project. To date, there are two alumni from this subject manage to publish a high impact publication from their final year projects with DOI 10.48084/etasr.6888 and 10.5194/isprs-archives-XLVIII-4-W6-2022-439-2023 .



National Geomatic and Geoinformatics Student Innovation Competition

The top group from the 2024 batch was selected to represent UTM in the National Geomatic and Geoinformatics Student Innovation Competition (NGGSIC), where they presented their project on combining TLS and Structure from Motion (SfM) techniques to model an aircraft at an accurate 1:1 scale. The group successfully secured a bronze medal in this national competition.

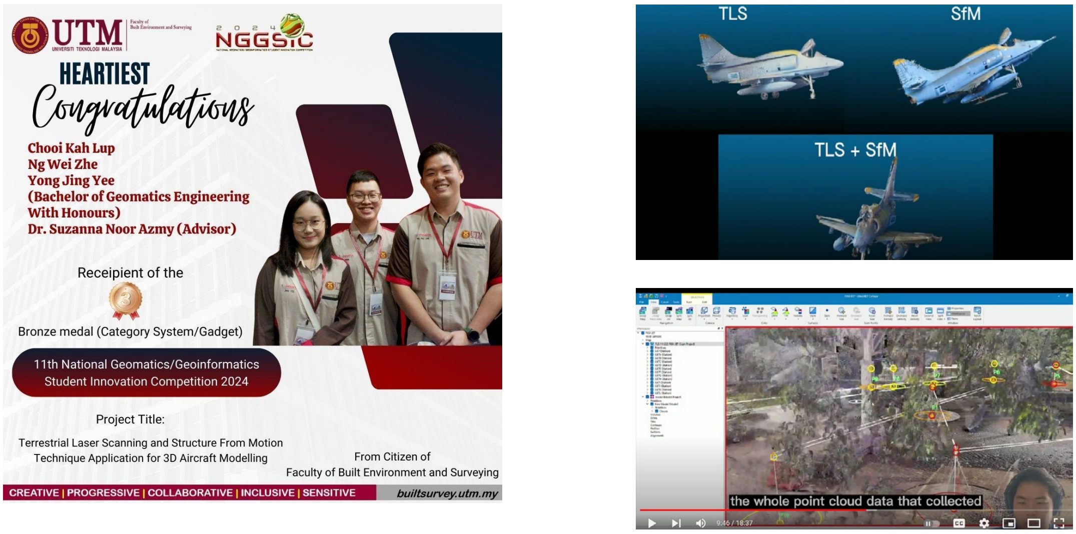


Figure 5: The student securing bronze at NGGSIC competition.

Acknowledgement

We sincerely appreciate the invaluable support from our Survey Technology Lab technicians, Mr. Anuar Aspuri and Mr. Mohd Faizi Salleh, for their dedication in sharing and teaching best practices in Terrestrial Laser Scanning to SBEU4883 students each year. We would also like to extend our thanks to the students in the class for their strong commitment to the assigned Project-Based Learning tasks.

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ID 20: Empowering Management Degrees: Leveraging Generative AI Tools for Future-Ready Careers

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Highlights: As industries increasingly leverage AI for decision-making, management graduates must be proficient in these technologies to remain competitive. To meet this demand, a performance-based assessment was leveraged to equip students with the necessary skills for their future careers. Students were required to study and explore AI tools relevant to their fields and demonstrate their knowledge with other students and faculty members. A module detailing the step-by-step use of these AI tools was developed as a knowledge artifact, encapsulating valuable information for others to share and utilize.

Keywords: *Artificial Intelligence (AI); Management Degrees; Future-Ready Career*

Introduction

A growing consensus is that incorporating AI technologies into management courses is essential. Projections indicate that the AI market will surpass $1.8 trillion by 2030 (Webster, M. 2024), highlighting the increasing significance of AI across all commercial domains starting in 2024. In the context of education, the adoption of AI into curricula, particularly in business and management courses, is gaining momentum. This is driven by the recognition that AI can significantly enhance productivity and decision-making processes. According to a report by Vena Solutions (2024), AI technologies boost the productivity of management consultants by over 25%, enabling them to complete tasks 25.1% faster, perform 12.2% more tasks overall, and achieve over 40% higher quality compared to conventional methods. Given these trends, the demand for AI integration in management education is expected to continue rising, as organizations increasingly seek professionals skilled in AI to stay competitive in a rapidly evolving business landscape.

Meanwhile, the Faculty of Management at Universiti Teknologi Malaysia (UTM) offers the Bachelor of Management program to equip students with the knowledge, skills, and competencies required to effectively manage and lead organizations. This includes developing a strong understanding of key business principles such as finance, marketing, operations, and human resources. Thus, a holistic curriculum has been designed and regularly updated based on current needs to remain relevant and be able to supply competent human capital. One of the courses focusing on digital literacy is Information Technology in Business, which prepares students with both theoretical and practical digital skills to facilitate organizations to conduct business in the modern organization. This course is enrolled by the 1st year student in Semester 1 with three credit hours and is assessed through quizzes, assignments, a final examination, and a project.

Assessment must be in line with current demands and dynamics to ensure that students are always ready for their future careers. Therefore, a performance-based assessment was designed to equip students with these recent digital skills, including artificial intelligence (AI), through a knowledge-sharing project called the Generative AI Tools Helpdesk Clinic.

Objectives

This project aimed to achieve the following objectives:

i. Equip students with cutting-edge AI technology to prepare them for future-ready careers.

ii. Foster collaboration among students to enhance peer learning and enrich the learning experience.

iii. Evaluate students' performance using performance-based assessment

Novelty:

Introducing students to AI tools exposes them to the latest technological advancements. This exposure to cutting-edge technology can inspire them to think creatively and explore innovative solutions. The Generative AI Tools Helpdesk Clinic acts as a catalyst for students to generate new ideas on how AI can be applied across various fields, leading to innovative creations that may not have been previously considered. Through hands-on experience with AI tools, students can discover innovative ways to apply AI in different fields, directing the development of new ideas and helping them to be ready for future careers once they graduate.

Creativity

The Generative AI Tools Helpdesk Clinic project inspires students to think creatively and explore the capabilities of AI tools in tasks like content creation, design, and problem-solving. In this helpdesk clinic, students must creatively set up their workstations to showcase the AI tools, attracting participants to visit and seek assistance in learning the technology. This hands-on approach not only enhances their understanding of AI but also fosters a collaborative learning environment.

Innovativeness

Performance-based assessments require students to showcase their knowledge, skills, and competencies through active, hands-on tasks instead of traditional tests. This kind of assessment focuses on both the process and the final product, providing a more authentic measure of students' abilities (Darling-Hammond, L., & Snyder, J., 2000). Performance-based assessments in the Generative AI Tools Helpdesk Clinic required students to explore the capabilities and functionality of the chosen AI tool and master it. They should be able to address any questions from participants, troubleshoot issues, and effectively demonstrate and guide participants through tasks using the technology. Their performance is assessed based on how efficiently they solve problems, their ability to communicate clearly, and their skill in understanding and meeting participants' needs. These interactions are crucial in the business world for them to remain competitive and excel.

Applicability

The performance-based assessments through the Generative AI Tools Helpdesk Clinic project can be applied to any digital literacy course. As we transition to a digital economy, it is essential to dynamically assess students to ensure they possess skills in problem-solving, creativity, and competitiveness in the workplace. Significantly, this course continues to address generic skills reflecting graduate attributes, particularly focusing on functional work skills, communication, and digital competency for management degree students.

Impact on Students' Learning

The interactive nature of the Generative AI Tools Helpdesk Clinic, where students actively demonstrate AI tools, can lead to greater engagement compared to traditional lecture-based learning. This helpdesk clinic project empowers students by equipping them with the skills to manage, innovate, and problem-solve independently. This sense of empowerment can boost their confidence and motivation in learning. Furthermore, it fosters collaboration among students through group activities. This collaborative environment enhances peer learning and encourages the sharing of ideas, further enriching the learning experience.

Methodology

The project was implemented with the following steps as shown in **Figure 1**.

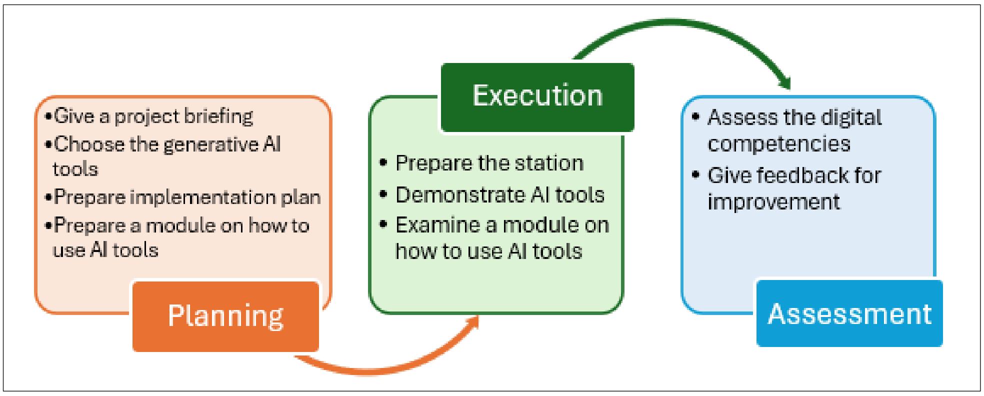


Figure 1: Project of Generative AI Tools Helpdesk Clinic Methodology

Phase I: Planning

In the first phase of the Generative AI Tools Helpdesk Clinic project, students were assigned to groups of 4-5 members. They received a comprehensive briefing on the project's goals and objectives. This stage also involved selecting the most suitable generative AI tools tailored to the specific needs of the university students and members of the faculty. After choosing the tools, each group developed a detailed implementation plan, outlining the necessary steps, timelines, and resources to ensure a successful helpdesk clinic project. Additionally, a poster was created to promote the clinic to others. The module on using the generative AI tools also needs to be prepared during this phase. The first phase of the Generative AI Tools Helpdesk Clinic project is illustrated in **Figure 2**.

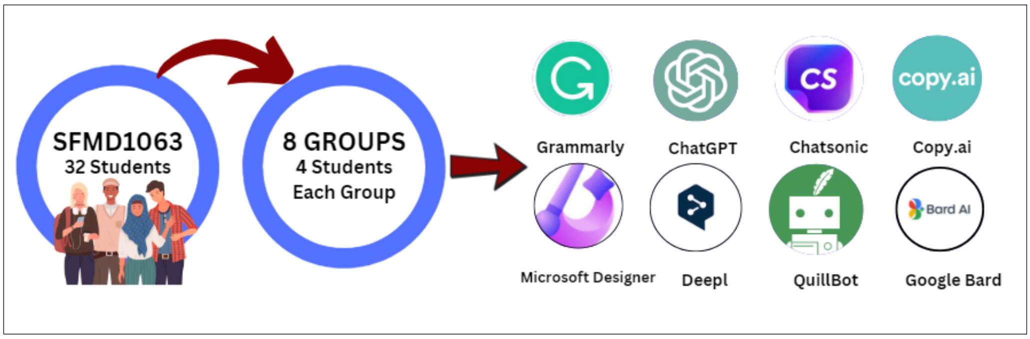


Figure 2: The Formation of Group

Phase II: Execution

The execution phase focused on hands-on engagement with the selected AI tools. Workstations were meticulously prepared for each group to facilitate seamless demonstrations, ensuring that each group could fully demonstrate the tools. The primary objective of this phase is to show the capabilities and functionalities of the generative AI tools, allowing participants to explore and experiment with them under guided instruction by the group. More importantly, students will gain proficiency in AI digital skills and confidently teach them to others. Students should be ready to address any questions from participants regarding the technology. Meanwhile, the module on using the generative AI tools, provided in the previous phase, has been reviewed during the demonstration.

Phase III: Assessment

In the final phase, students' digital competencies were assessed using performance-based assessment to gauge their understanding and proficiency with the generative AI tools. This assessment was followed by a feedback session, where strengths were acknowledged, and areas for improvement were identified. This feedback provided actionable insights and recommendations to help students further develop their skills and effectively integrate generative AI into their daily tasks. Accordingly, the rubric was designed to provide a comprehensive assessment of student's performance, focusing on their digital competency, communication skills, and ability to collaborate effectively during the Generative AI Tools Helpdesk Clinic project as shown in **Table 1**.

Table 1: Rubric on Student's Performance

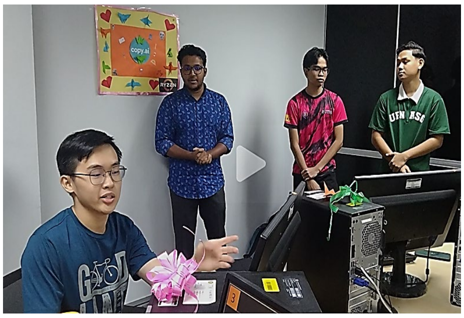
Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Digital Competency	Demonstrates exceptional proficiency in using AI tools; confidently explores advanced features.	Shows strong proficiency in using AI tools; explores several features.	Demonstrates basic proficiency in using AI tools; explores only fundamental features.	Lacks proficiency in using AI tools; struggles to explore features.
Communication	Communicates ideas clearly and persuasively; uses language and visuals effectively to engage the participant and enhance understanding.	Communicates ideas clearly with some persuasiveness; uses language and visuals effectively, though some parts may lack engagement.	Communication is generally clear but may lack persuasiveness or effective use of visuals and language.	Communication is unclear, unengaging, or disjointed; ineffective use of language and visuals.
Participant Engagement	Engages the participant throughout the helpdesk clinic; uses interactive elements (e.g., Q&A, discussions) effectively to maintain interest.	Engages the participant well, though some interactive elements may be less effective or underused.	Participant engagement is minimal; some attempts at interaction, but may lack effectiveness.	Fails to engage the participant; little to no interaction or effort to maintain interest.
Collaboration	The team works seamlessly together, showing strong coordination, equal participation, and mutual support.	The team collaborates well, with most members participating actively; some minor coordination issues.	Collaboration is uneven; some members participate more than others, and coordination is inconsistent.	Collaboration is poor; little evidence of teamwork, with some members contributing significantly less.
Feedback and Reflection	Provides insightful reflections on the helpdesk clinic process and incorporates feedback to improve the content and delivery.	Offers thoughtful reflections and attempts to incorporate feedback, though some areas may lack depth.	Reflection and feedback incorporation are basic, with minimal effort to improve based on feedback.	Little to no reflection or feedback incorporation; lacks awareness of areas needing improvement.

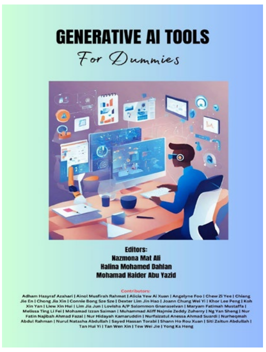
Findings and Conclusion

In summary, assessing students' performance through the Generative AI Tools Helpdesk Clinic project can significantly enhance teaching and learning. It introduces novel ideas, fosters creativity, encourages innovation, and ensures the project's applicability to other IT courses. Additionally, it positively impacts students' engagement and empowerment. The feedback from students was very encouraging, and here are some of their reflections.

"Prior, to this project I had no idea of AI tools. I had yet to explore their full potential. Engaging in the preparation and showcasing of the AI tool provided me with experience that greatly enhanced my digital skills. I discovered how to leverage AI tools not only for functions but also for more complex tasks. This encounter has encouraged my confidence in utilizing AI technologies viewing them as resources, for addressing challenges."

"Looking back on the helpdesk clinic 1 assisted with I feel a sense of accomplishment, in the knowledge gained about AI technology and the art of conducting projects. Getting ready for the project challenged me to step beyond my boundaries especially when it involved demonstrating AI tools that were new, to me. This practical exposure has boosted my self-assurance in utilizing tools."





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ID 22: Microalgae: Future Sustainability, A STEM Program for Standard Six Primary School Students

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Highlights: A Science, Technology, Engineering and Mathematics (STEM) program on microalgae uses for sustainable future involving standard six primary school children from Sekolah Kebangsaan Sri Pulai Perdana were held recently. School children were exposed to hands-on learning about microalgae role in biotechnology and environmental science. School children were trained on how to grow microalgae in controlled conditions (photobioreactor construction), while monitoring their growth. They explored the applications of microalgae for biofuel production, carbon capture, and animal feeding. This activity enhances understanding of environmental science, fostering skills in data collection, and analysis. Through real-world applications, students gain insight into sustainable solutions and the potential of microalgae in addressing the challenges of future sustainability.

Keywords: *Microalgae; STEM; Future Sustainability; Primary school; Sustainable future*

Introduction

In 2013, the government of Malaysia through the Ministry of Education (MOE) introduced the Malaysia Education Blueprint, a comprehensive development plan spanning from 2013 to 2025. This blueprint targeted development plans that include strengthening science, technology, engineering and mathematics (STEM) in schools (Idris et al, 2023). This blueprint was constructed to meet the future workforce needs in the light of Industrial Revolution 4.0 (MOE, 2013). The declining of interest among primary and secondary school students in STEM is a major problem that need to be addressed.

The science curriculum for standard six primary schools in Malaysia involved microorganism as part of their syllabus. However, the inability to observe microorganisms with naked eye makes this topic difficult for students to grasp, potentially diminishing their overall interest in STEM. Lately, microalgae have gain interest due to its potential as an alternative energy and food resources. Microalgae are versatile microorganisms with promising use as a feedstock in the production of value-added products (Gualtieri and Barsanti, 2018). Thus, this program was designed to excite students' interest in STEM among primary school students using microalgae as a model microorganism.

Research Methodology

In this STEM program, five methods of teaching and hands-on activities were implemented to improve the knowledge of participating students. Students were also given worksheet before the program to be filled in on each station they visited. The activities include:

- **Talk on Microalgae (Station 1)** – Students gained knowledge about microalgae
- **Culturing Microalgae (Station 2)** – Students used agar media to grow microalgae
- **Tipscope (Station 3)** – Students observed microalgae with a smartphone
- **Microscope (Station 4)** – Students observed the shape of microalgae using a microscope.
- **Make your own Photobioreactor (Station 5)** – Students learned to construct their own photobioreactor.

These activities aimed to provide a comprehensive and engaging leaning experience, fostering a deeper understanding of microalgae and their applications.

Worksheet prepared for the students were related to station 3, 4 and 5.

Tipscope (Station 3): Students were required to draw and answer questions related to microalgae and its application in water treatment.

Station 4 (Microscope): Students were required to draw what they observed under the microscope.

Station 5 (Make Your Own Photobioreactor): Students were required to draw and label the photobioreactor.

Additionally, they were tasked with monitoring the photobioreactor for two weeks to observe the growth of microalgae. These activities aimed to reinforce the students' learning by encouraging observation, drawing, and critical thinking, as well as providing hands-on experience in monitoring microalgae growth.

A pre and post survey were conducted to gauge the effectiveness of the program and its content. A pre survey was divided into two sections, which are the details of the participants (Section 1) and knowledge on microalgae (Section 2). As for the post survey, it was divided into three sections, which are the details of participants (Section 2), knowledge on microalgae (Section 2) and feedback on the program (Section 3). Links to survey forms were distributed via social media platform. Figure 1 explains the methodology used in this study.

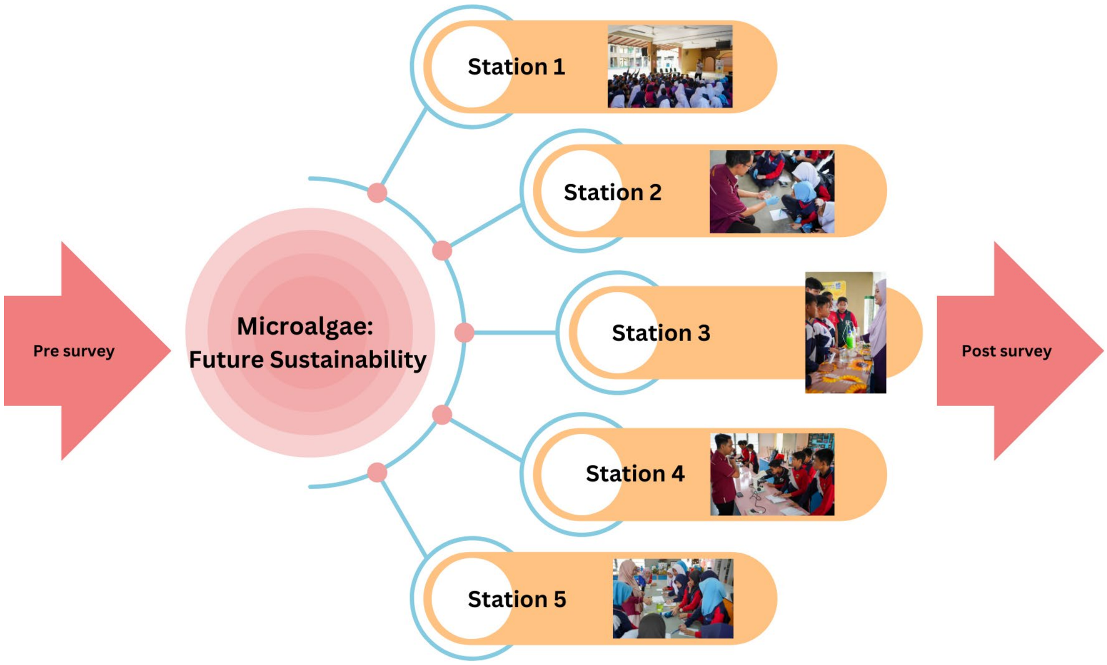

Figure 1: Five teaching methods and hands-on activities during the study.

Findings

1. Student's perception on learning materials (knowledge on microalgae)

Results from the pre survey has revealed that most students only have limited knowledge on microalgae and its potential. Based on Figure 2 a): Before the program, about 78.1% students barely know about microalgae and its potential, but after the program, 56.8% of students responded that they know more about microalgae and its potential (Figure 2 b)). This significant increase in knowledge highlights the effectiveness of the program in enhancing students' understanding of microalgae and their applications.

2. Student's perception on program activities.

Figure 2 c) shows the results on the student's interest in each station provided in the program. Most students showed interest in Station 4, which is using microscope. Students acknowledged that this is their first experience handling microscope as there are no microscope available in the school laboratory. During the program students were prepared with two different strains of microalgae and they were asked to draw it inside the worksheet. This hands-on experience with microscopes and the opportunity to observe and draw different strains of microalgae contributed to a heightened interest and engagement in the activity.

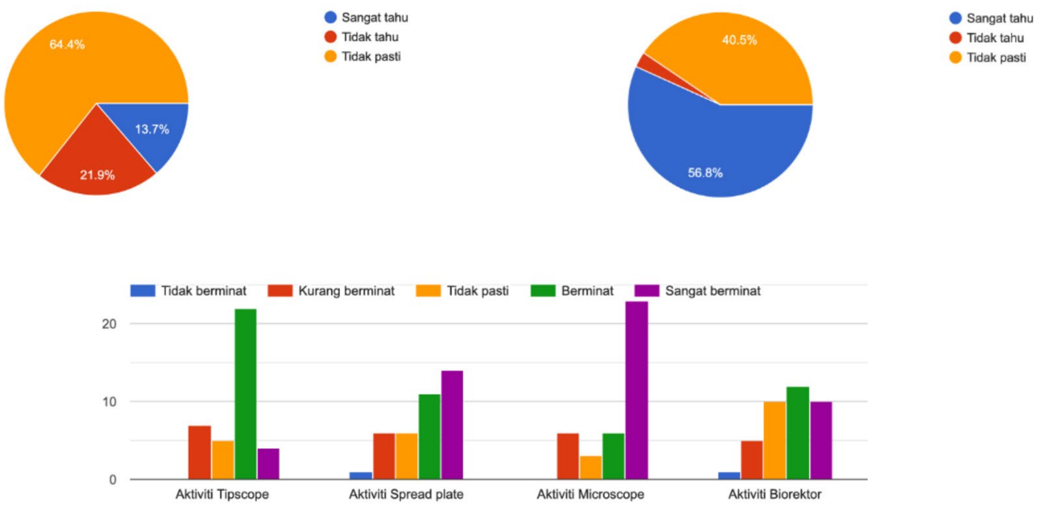

Figure 2: Survey results: a) (before program) and b) (after program) Perception on learning materials and c) Perception on program activities.

Conclusion

In conclusion, the program has successfully improved students' knowledge about microalgae and increased their interest in STEM-related activities. The hands-on approach and interactive learning stations were effective in engaging the students and enhancing their understanding of the subject matter.

Acknowledgement

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ID 24: Pengajaran dan Pembelajaran berasaskan Kajian Kes di Fakulti Pengurusan, Universiti Teknologi Malaysia bagi subjek Kajian Kes Bersepadu

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Sorotan: Kajian Kes Bersepadu (*Integrated Case Study*) adalah salah satu subjek bagi program Sarjana Muda Perakaunan dengan Kepujian di Jabatan Perakaunan dan Kewangan, Fakulti Pengurusan, Universiti Teknologi Malaysia (UTM). Pelbagai kaedah yang boleh digunakan dalam menganalisis kajian kes antaranya *SWOT, PEST, PESTLE, Mind Map, Fishbone Diagram, Decision Matrix Analysis,* dan *BCG Matrix*. Kajian kes daripada *Harvard Business School* telah digunakan bagi tujuan pengajaran dan pembelajaran bagi subjek Kajian Kes Bersepadu antaranya Lenovo, Netflix, Apple Inc., Toshiba, Anandam Manufacturing Company dan Northwest Company. Pendekatan pembelajaran menggunakan kajian kes memberi kesan yang sangat positif kepada pencapaian prestasi akademik pelajar. Ini dibuktikan secara empirikal dengan hasil keputusan akademik yang menunjukkan peningkatan nilai min (gred) 70.9% (B+) kepada 81.5% (A) bagi pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 1 Semester 2 Sesi 2023/2024. Manakala, peningkatan nilai min (gred) 73.6% (B+) kepada 80% (A) bagi pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 2 Semester 2 Sesi 2023/2024.

Kata Kunci: *Pengajaran dan Pembelajaran; Kajian Kes; Kajian Kes Bersepadu; Prestasi Akademik; Fakulti Pengurusan.*

Pengenalan

Kajian kes merupakan subjek yang mengintegrasikan pengetahuan dari pelbagai disiplin ilmu termasuk aspek perakaunan, kewangan dan pengurusan. Pelbagai kaedah yang boleh digunakan dalam menganalisis kajian kes antaranya *SWOT, PEST, PESTLE, Mind Map, Fishbone Diagram, Decision Matrix Analysis,* dan *BCG Matrix*. Kajian kes daripada *Harvard Business School* telah digunakan bagi tujuan pengajaran dan pembelajaran bagi subjek SBSC 4093 Kajian Kes Bersepadu antaranya Lenovo, Netflix, Apple Inc., Toshiba, Anandam Manufacturing Company dan Northwest Company.

Berdasarkan tinjauan menggunakan *google form* yang dibuat, lebih 50% pelajar menggunakan data daripada telefon untuk mengikuti pengajaran dan pembelajaran aktif secara dalam talian. Pensyarah menggunakan pelbagai platform seperti Whatsapp, UTM E Learning, WEBEX dan kajian kes untuk menjalankan kelas secara dalam talian dan fizikal. Tambahan, medium pengajaran menggunakan Whatsapp, pensyarah masih turut mengaplikasikan pembelajaran aktif seperti UTM E Learning, WEBEX waktu pengajaran dan pembelajaran secara dalam talian serta fizikal semasa mengendalikan kuliah mahupun sesi tutorial perbincangan.

Kaedah Pelaksanaan NALI

Di dalam usaha untuk menginovasi kaedah pengajaran dan pembelajaran bagi kursus Kajian Kes Bersepadu, pelbagai medium inovasi pengajaran yang dilaksanakan pada subjek ini, antaranya ialah: i. Whatsapp, ii. UTM E Learning iii. WEBEX, dan iv. Kajian Kes. Maklum balas daripada dapatan kajian ini diharapkan akan dapat membantu memberikan atau mengilhamkan idea atau kaedah baru kepada penyelidik dan pengajar untuk bagaimana menginovasi kaedah teknik pengajaran di dalam bilik kuliah bagi memastikan kaedah pengajaran dan pembelajaran yang lebih menarik, menawan dan dekat di hati pada pelajar.

Objektif memperkenalkan inovasi kaedah pengajaran dan pembelajaran termasuklah:

- Untuk meningkatkan kefahaman para pelajar tentang asas ilmu kajian kes bersepadu termasukkan penggunaan kajian kes perniagaan dari Harvard Business School (HBS).
- Untuk menyediakan satu pengalaman amalan dunia perniagaan kepada situasi sebenar pembelajaran berdasarkan senario di kalangan para pelajar perakaunan melalui satu tugasan, sebagai contoh membuat analisis kes daripada kes sebenar dalam perniagaan yang diambil dari Harvard Business School (HBS).
- Untuk meningkatkan kefahaman ilmu analisis kes perniagaan dengan mendalami lebih lanjut ilmu perakaunan khususnya kajian kes bersepadu seperti penggunaan beberapa teknik atau kaedah menganalisis kes iaitu *SWOT, PEST, PESTLE, Mind Map, Fishbone Diagram, Decision Matrix Analysis,* dan *BCG Matrix*.

Kaedah Kajian

Terdapat 63 orang pelajar yang mendaftar seksyen 1 (41 orang) dan seksyen 2 (22 orang) bagi kursus SBSC 4093 Kajian Kes Bersepadu pada semester 2 sesi 2023/2024. Soal selidik yang digunakan untuk membuat tinjauan untuk pengajaran dan pembelajaran secara dalam talian dan fizikal dibina menggunakan *google form*. Soal selidik yang digunakan adalah diadaptasi daripada kajian Ali et al. (2020), Ali Khan (2021), Ali Khan (2022) dan Ali Khan (2023)

bagi mendapatkan pandangan balas daripada responden kajian. Tujuan tinjauan dibuat adalah untuk mengetahui tahap kesediaan pelajar terhadap perlaksanaan pembelajaran aktif dalam talian dan fizikal. Seterusnya, apabila selesai pengajaran secara dalam talian dan fizikal, sekali lagi tinjauan diedarkan kepada pelajar dalam bentuk *google form* untuk mendapatkan respon pelajar terhadap pelaksanaan pengajaran dan pembelajaran aktif secara dalam talian serta fizikal yang telah diikuti pada setiap minggu. Pensyarah seterusnya membuat penambahbaikan terhadap respon yang dinyatakan oleh pelajar.

Dapatan Kajian dan Perbincangan

Berdasarkan tinjauan yang dibuat terhadap prestasi akademik, didapati min bagi subjek Kajian Kes Bersepadu bagi seksyen 1 pada semester 2 sesi 2023/2024 ialah 81.5% (A). Manakala, didapati bahawa majoriti pelajar di dalam seksyen ini memperoleh gred A dengan kekerapan seramai 31 orang (75.6%). Jadual 1 menunjukkan dapatan yang diperolehi daripada tinjauan keputusan akademik pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 1 Sem 2 2023/2024. Keputusan nilai min menunjukkan peningkatan gred B+ ke A, iaitu 70.9% ke 81.5% bagi keputusan akademik pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 1 Sem 2 2023/2024 berbanding keputusan akademik pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 1 Sem 2 2022/2023. Manakala, Jadual 2 menunjukkan dapatan yang diperolehi daripada tinjauan keputusan akademik pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 2 Sem 2 2023/2024. Keputusan nilai min menunjukkan peningkatan gred B+ ke A, iaitu 73.6% ke 80% bagi keputusan akademik pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 2 Sem 2 2023/2024 berbanding keputusan akademik pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 2 Sem 2 2022/2023.

Jadual 1: Keputusan Akademik Pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 1 Semester 2 2023/2024

Gred	A+	A	A-	B+
No (%)	1 (2.4%)	31 (75.6%)	3 (7.3%)	6 (14.6%)
Min	81.5%			

Jadual 2: Keputusan Akademik Pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 2 Semester 2 2023/2024

Gred	A	A-
No (%)	17 (77.3%)	5 (22.7%)
Min	80%	

Berdasarkan tinjauan yang dibuat terhadap prestasi akademik, didapati min bagi subjek SBSC 4093 Kajian Kes Bersepadu Seksyen 1 Sem 2 2022/2023 ialah 70.9% (B+). Manakala, didapati bahawa majoriti pelajar di dalam seksyen ini memperoleh gred A- dengan kekerapan seramai 17 orang (45.9%). Jadual 3 menunjukkan dapatan yang diperolehi daripada tinjauan keputusan akademik pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 1 Sem 2 2022/2023. Hasil kajian mendapati bahawa terdapat peningkatan nilai min sebanyak 10.6% daripada nilai 70.9% kepada 81.5%. Peningkatan keputusan gred daripada B+ kepada A. Manakala, Jadual 4 menunjukkan dapatan yang diperolehi daripada tinjauan keputusan akademik pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 2 Sem 2 2022/2023. Hasil kajian mendapati bahawa terdapat peningkatan nilai min sebanyak 6.4% daripada nilai 73.6% kepada 80%. Peningkatan keputusan gred daripada B+ kepada A.

Jadual 3: Keputusan Akademik Pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 1 Semester 2 2022/2023

Gred	A	A-	B+	B	B-	E
No (%)	2 (5.4%)	17 (45.9%)	12 (32.4%)	4 (10.8%)	1 (2.7%)	1 (2.7%)
Min	70.9%					

Jadual 4: Keputusan Akademik Pelajar SBSC 4093 Kajian Kes Bersepadu Seksyen 2 Semester 2 2022/2023

Gred	A	A-	B+	B
No (%)	4 (9.8%)	18 (43.9%)	17 (41.5%)	2 (4.9%)
Min	73.6%			

Berdasarkan tinjauan yang dibuat sebelum memulakan pengajaran dan pembelajaran secara dalam talian serta fizikal didapati, terdapat 100% yang memberikan respons. Jadual 5 menunjukkan dapatan yang diperolehi daripada tinjauan sebelum pengajaran dan pembelajaran secara dalam talian serta fizikal dilaksanakan.

Jadual 5: Tinjauan sebelum pengajaran dan pembelajaran secara dalam talian serta fizikal dilaksanakan

No.	Soalan	Dapatan	
1.	Adakah anda mempunyai capaian internet di tempat yang anda tinggal sekarang?	Ya (100%)	Tidak (0%)
2.	Apakah capaian internet yang anda gunakan untuk pembelajaran secara dalam talian?	Data Telefon (hotspot) 76.9%	Wifi (Unifi atau provider lain melebihi 100 mbps) 23.1%
3.	Adakah anda boleh mengakses UTM UTM E Learning dari tempat yang anda tinggal?	Ya (100%)	Tidak
4.	Adakah anda boleh mengakses *YouTube* dari tempat yang anda tinggal sekarang?	Ya (100%)	Tidak
5.	Adakah anda mempunyai masalah untuk membeli data bagi pembelajaran secara dalam talian?	Tidak (78.8%)	Kadang-kadang (21.2%)

Berdasarkan tinjauan yang dibuat selepas pengajaran dan pembelajaran secara dalam talian serta fizikal dijalankan, terdapat 100% yang memberikan respons. Jadual 4 menunjukkan dapatan yang diperolehi daripada tinjauan setelah pengajaran dan pembelajaran secara dalam talian serta fizikal dilaksanakan.

Jadual 6: Tinjauan selepas pengajaran dan pembelajaran secara dalam talian serta fizikal dilaksanakan

No.	Soalan	Dapatan			
1.	Platform pembelajaran secara dalam talian yang digemari	Webex (100%)	GoogleMeet	WhatsApp	
2.	Adakah alatan yang anda gunakan untuk pembelajaran secara dalam talian?	Komputer (Desktop) (75%)	Komputer peribadi (23.1%)	Smartphone (1.9%)	
3.	Adakah anda berpuas hati pelaksanaan pembelajaran secara dalam talian?	Ya (100%)	Tidak (0%)		
4.	Adakah pembelajaran secara dalam talian selama hampir dua jam ini terlalu lama bagi anda?	Ya (46.2%)	Tidak (48.1%)	Bergantung kepada subjek (5.7%)	Kadang-kadang (0%)
5.	Pembelajaran secara dalam talian selama hampir dua jam ini membuang masa.	Ya (5.8%)	Tidak (94.2%)		
6.	Cara perlaksanaan yang mana anda rasa lebih mudah faham selepas sesi pembelajaran dalam talian dilaksanakan?	Tidak segerak (Asynchronous) seperti recored video tutorial, tugasan di UTM E Learning, Whatsapp (51.9%)	Segerak (Synchronous) seperti live session menggunakan BigBlueButton, Zoom @ Webex (48.1%)		
7.	Apakah kekangan dan masalah yang dihadapi terhadap pembelajaran dalam talian yang dilaksanakan?	Pengurusan masa bagi pembelajaran dalam talian Masalah bekalan elektrik, teknikal dan capaian internet Kurang interaksi dan komunikasi bagi kelas dalam talian			

Kesimpulan

Berdasarkan pencapaian keputusan akademik, didapati bahawa hasil kajian menunjukkan bahawa terdapat peningkatan prestasi akademik nilai min bagi seksyen 1 sebanyak 10.6% daripada nilai 70.9% kepada 81.5%. Manakala, seksyen 2 pula terdapat peningkatan nilai min sebanyak 6.4% daripada nilai 73.6% kepada 80%. Peningkatan keputusan gred prestasi akademik daripada B+ kepada A. Berdasarkan tinjauan menggunakan *google form* yang dibuat, sebanyak 94.2% responden menjelaskan masa pembelajaran aktif secara dalam talian selama hampir dua jam ini tidak membuang masa bagi para pelajar. Pensyarah banyak menggunakan medium alternatif iaitu Whatsapp, UTM E Learning, WEBEX dan kajian kes untuk menjalankan kelas secara dalam talian. Maklum balas para pelajar iaitu lebih 90% responden menunjukkan pengajaran daripada WEBEX dan ePPP pengajaran menunjukkan para pelajar suka, berpuas hati dan seronok dengan aktiviti yang dijalankan secara dalam talian menggunakan Whatsapp, UTM E Learning, WEBEX dan kajian kes perniagaan. Pandangan balas pelajar dalam pengajaran dan pembelajaran khususnya penggunaan kajian kes perniagaan, antaranya ialah 1. penggunaan kajian kes sangat membantu untuk menghubungkan pengetahuan secara teori dengan aplikasi secara praktikal 2. Perbincangan dalam sesi tutorial kajian kes bersepadu sangat jelas dan amat membantu dalam memahami kes yang dibincangkan 3. Kesemua kajian kes perniagaan dalam kelas kajian kes bersepadu sangat amat menarik dan mempunyai pelbagai perspektif bidang pengajian 4. Kelas kajian kes bersepadu memang terbaik dari segi tenaga pengajarnya, amat menyeronokkan, sangat menarik, tidak membosankan dan kami saling belajar di antara satu sama lain serta meningkatkan kemahiran untuk berkomunikasi dalam sesi pembentangan. Akhirnya, hasil kajian menunjukkan bahawa penggunaan pelbagai kaedah dalam menganalisis kes perniagaan memberikan kesan yang sangat positif kepada peningkatan prestasi akademik pelajar. Seterusnya, secara keseluruhan para pelajar lebih suka, gemar, memilih dan mengutamakan pendekatan secara bersemuka, iaitu pertemuan secara fizikal dalam pengajaran dan pembelajaran bagi subjek Kajian Kes Bersepadu.

Penghargaan

Penulis mengucapkan terima kasih dan penghargaan kepada semua pelajar kursus SBSC 4903 Kajian Kes Bersepadu Seksyen 1 dan Seksyen 2 Semester 2 Sesi 2023/2024, ahli akademik Jabatan Perakaunan dan Kewangan, Fakulti Pengurusan (FM), Universiti Teknologi Malaysia (UTM) dan UTM CDex yang menganjurkan projek ini dan ahli jawatankuasa NALI 2024.

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ID 25: Revolutionize Cutting-Edge Data Access Elevating Operational Efficiency at No.18 Squadron, Butterworth Air Base, Penang, Malaysia.

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Highlights: Revolutionizing data access at No. 18 Squadron, Butterworth Air Base, Penang, Malaysia, the Express Data Access System (EDAS) elevates operational efficiency. Originally using QR Codes linked to a Google Drive database for F/A-18D aircraft maintenance manuals, the squadron has embraced Near Field Communication (NFC) technology. This cutting-edge evolution delivers instant, reliable access to critical technical data, replacing bulky physical manuals and empowering maintenance crews with speed, accuracy, and precision. EDAS is not just a technological upgrade, it represents a paradigm shift in how modern military aviation approaches data-driven maintenance, ensuring unparalleled readiness and mission success for the No. 18 Squadron.

Keywords: *Express Data Access System; Aircraft First Line Maintenance; Data Accessibility; Digital Transformation*

Introduction

No. 18 Squadron is indispensable in safeguarding Malaysia's airspace, operating as a frontline unit with the F/A-18D Hornet fighter aircraft. These aircraft, renowned for their agility, advanced avionics, and versatile combat capabilities, are essential to the squadron's mission readiness. Maintaining such sophisticated assets is critical for operational effectiveness and the safety and efficiency of the personnel involved. Traditionally, maintenance relied heavily on extensive printed manuals, which, while comprehensive, were inefficient and time-consuming. The manual retrieval of specific information from thousands of pages often resulted in delays, and the static nature of these printed documents hindered the timely incorporation of critical updates, creating potential risks to aircraft availability and operational efficiency (RMAF, 2007; Morris et al., 2024).

To overcome these limitations, No. 18 Squadron has implemented the Express Data Access System (EDAS), a cutting-edge digital solution to revolutionize the maintenance process by digitizing maintenance manuals into a centralized, searchable database. This innovation represents a paradigm shift from traditional maintenance workflows, enabling maintenance personnel to access up-to-date, precise technical data instantly (Al-Momani et al., 2020). By leveraging real-time data integration, the EDAS reduces retrieval times and minimizes the cognitive load of navigating voluminous paper manuals. Such advancements align with the findings of Nguyen et al. (2024), who emphasize the importance of streamlined data access in enhancing maintenance efficiency and reducing operational risks. Additionally, Patel and Wong (2023) highlight that real-time digital systems are crucial in mitigating errors caused by outdated information, thus directly contributing to improved safety protocols and operational readiness.

The integration of EDAS has significantly enhanced the operational agility of No. 18 Squadron, allowing for real-time updates to maintenance procedures, parts, and safety guidelines accessible to all personnel across the squadron. This capability reduces aircraft maintenance downtime and ensures rapid deployment and responsiveness to emerging threats. The EDAS demonstrates how digital transformation in military aviation maintenance can provide a competitive advantage by enabling faster decision-making and reducing turnaround times (Dou, 2020). As Liu et al. (2023) and Williams (2023) discuss, the adoption of advanced digital tools like the EDAS reflects a broader shift towards data-driven maintenance strategies, emphasizing speed, precision, and adaptability, which are fundamental to maintaining a state of high operational readiness in dynamic defense environments.

Project Innovation

The Express Data Access System (EDAS) was developed to address critical limitations inherent in using traditional printed manuals for aircraft maintenance. A thorough assessment was conducted to identify the existing data access processes within No. 18 Squadron's F/A-18D aircraft maintenance operations, revealing that physical manuals, though historically relied upon, are increasingly impractical due to their bulk, susceptibility to damage, and constrained availability. This analysis highlighted how the absence of a centralized digital data system hampers maintenance efficiency and decision-making and increases aircraft downtime. To overcome these challenges, EDAS is proposed as an innovative solution, integrating all maintenance-related data into a streamlined, easily accessible digital platform, transforming maintenance practices and significantly enhancing operational efficiency.

Figure 1: Current Maintenance Using Paper Manual Book

Furthermore, in an era where digital transformation is revolutionizing industries, relying on outdated paper-based methods is no longer viable. The maintenance of sophisticated aircraft like the F/A-18D requires access to vast amounts of technical data that must be up-to-date, easily searchable, and instantly accessible. EDAS was developed to meet these needs, providing a digital solution that eliminates the physical constraints of book manuals and incorporates advanced features such as real-time updates, multimedia integration, and remote access capabilities (Badea et al., 2018).

By digitizing maintenance information, EDAS propels No. 18 Squadron into the future, enabling faster decision-making, reducing the risk of human error, and ensuring that maintenance personnel are always equipped with the latest data. This system represents a leap forward in operational efficiency, aligning with the technological advancements of the digital age and setting a new standard for aircraft maintenance practices across the board (Dinis & Teixeira, 2018).

EDAS Implementation Outcomes

The hypothetical data presented offers a comprehensive overview of the Express Data Access System (EDAS)'s transformative impact on various aspects of military aviation maintenance at No. 18 Squadron. The analysis identifies the current data access processes by examining data across key areas, such as maintenance efficiency, training effectiveness, and operational readiness. It evaluates how the centralized digital platform of EDAS has addressed the limitations of traditional methods. This approach provides a deeper understanding of the improvements achieved through integrating EDAS, particularly in decision-making speed, reduced aircraft downtime, and enhanced maintenance practices.

The data was meticulously collected over six months, from January 2024 to June 2024, to ensure a thorough and accurate evaluation of the EDAS's effectiveness. During this period, the lack of centralized data in previous methods was analyzed by closely monitoring several metrics, including maintenance efficiency, training effectiveness, and operational readiness. Data was gathered from daily maintenance logs, training assessments, operational reports, and user feedback, enabling a comprehensive proposal to optimize data access. The findings demonstrate the real-world impact of EDAS on No. 18 Squadron's operations, highlighting its role in streamlining processes, enhancing decision-making, and reducing aircraft maintenance downtime.

Maintenance Efficiency Before and After EDAS Implementation

This data illustrates the dramatic improvements in maintenance operations since the implementation of EDAS. The shift from physical manuals to a digital platform has significantly reduced the time required for technicians to access necessary information, leading to faster task completion and reduced aircraft downtime.

Metric	Before EDAS	After EDAS	% Improvement
Average Time to Access Manuals	25 minutes	5 minutes	81%
Average Maintenance Task Duration	5 hours	1 hours	80%
Aircraft Downtime per Month	50 hours	10 hours	83%
User Satisfaction Score (out of 10)	5.0	9.0	80%

Impact on Training Effectiveness

The integration of EDAS has substantially boosted training effectiveness. The data reveals a quicker time to competency, higher retention rates of critical procedures, and improved pass rates on technical assessments.

Training Metric	Traditional Methods	Using EDAS	% Improvement
Average Time to Competency	5 weeks	1 weeks	80%
Retention Rate of Key Procedures (6 months)	50%	92%	82%
Pass Rate on Technical Assessments	50%	92%	82%
Average Exam Score	50%	92%	81%

Operational Readiness Metrics

Operational readiness is a critical measure of a squadron's ability to respond to threats, and the data shows that EDAS has made a significant impact in this area. The reduction in aircraft turnaround time, coupled with an increase in the percentage of aircraft ready for deployment, underscores the system's role in enhancing the squadron's agility and preparedness.

Metric	Before EDAS	After EDAS	% Improvement
Average Turnaround Time for Aircraft (days)	10 days	2 days	80%
Percentage of Aircraft Ready for Deployment	50%	90%	81%
Maintenance Personnel Availability	60%	95%	85%
Number of Aircraft Fully Operational	5 out of 10	9 out of 10	80%

The military aviation industry has changed significantly over the years; however, the trend has not lasted long. Express Data assessability in learning and maintenance will completely revolutionize how trainers teach and technicians learn, as shown in Figure 2.

Figure 2: EDAS for aircraft maintenance

Transformative EDAS Impact

The Express Data System (EDAS) at No. 18 Squadron has revolutionized maintenance by replacing physical manuals with a digital platform that offers real-time updates, remote access, and multimedia resources. This system directly addresses modern military aviation needs by enhancing maintenance efficiency, reducing errors, and improving decision-making.

Reduced Downtime: EDAS cuts the time needed to find maintenance information, reducing user workload by 80%. This digital access eliminates the need for bulky manuals, enabling quick retrieval of data and faster maintenance. This reduction in downtime is critical for keeping aircraft ready for immediate deployment, ensuring No. 18 Squadron's operational readiness.

Streamlined Workflow: EDAS offers a digital interface with step-by-step guides and cross-referenced data, simplifying complex procedures and reducing errors. This efficient workflow is essential in military contexts where speed and precision are crucial, fostering consistency and reliability in maintenance tasks.

Resource Optimization: EDAS provides insights into maintenance history, parts usage, and service needs, saving 75% of human resources. The system's remote access capability allows for better planning and resource use, minimizing waste and ensuring that the right parts and personnel are available without unnecessary movement.

Training and Knowledge Retention: EDAS enhances training through interactive tutorials and simulations, accelerating learning for new technicians. Its comprehensive digital records ensure critical knowledge is maintained and accessible, supporting continuous improvement and consistency in maintenance practices.

This project is a practical, cost-effective training solution that sets a new standard for aircraft maintenance. The Express Data System (EDAS) improves operational efficiency by digitizing and streamlining maintenance tasks, providing up-to-date, easily accessible information that reduces maintenance time and errors. This ensures that aircraft remain mission-ready, making EDAS a critical innovation for the No. 18 Squadron and others. It represents a significant shift in military maintenance practices (Ceruti, 2003).

Acknowledgment

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ID 26: IMMERSIVE ViRAL STUDIO: TRANSFORMING ARCHITECTURAL EDUCATION FOR GEN Z

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Highlights: The Immersive Virtual Reality Architetural Learning (ViRAL) Studio revolutionises architectural education by integrating Virtual Reality (VR) technology into the curriculum. It enhances students' spatial understanding and design capabilities, offering immersive experiences that bridge the gap between theory and practice. Implemented in final-year architecture courses at Universiti Teknologi Malaysia, ViRAL equips students with essential Industry 4.0 skills, preparing them for modern professional challenges. This innovative approach fosters creativity, engagement, and higher-quality design outcomes, making it a standout initiative in architectural education.

Keywords: *virtual reality learning; architectural education; teaching pedagogy; architecture design studio*

Introduction

Incorporating Virtual Reality (VR) technology into architectural design studio pedagogy has significantly transformed the educational landscape, enhancing students' learning experiences and engagement with architectural concepts. This transformation is characterized by immersive learning environments that foster a deeper understanding of architectural theory, design processes, and spatial relationships. VR enables users to navigate through a simulated representation of a building, fostering collaboration and communication among design teams and clients (Keung et al., 2021). This immersive capability is essential for effective design reviews, as it allows for real-time feedback and adjustments based on user interactions within the virtual environment (Sateei, 2023).

Various studies have explored the pedagogical framework for integrating VR into architectural education. VR has the potential to accelerate learning and understanding, and its successful integration requires careful consideration of pedagogical strategies and the specific learning goals of architectural courses (Ibrahim et al., 2021). The Immersive ViRAL Studio is closely aligned with two key Sustainable Development Goals (SDGs): SDG 4: Quality Education (Targets 4.4 & 4.7) and SDG 9: Industry, Innovation, and Infrastructure (Target 9.5). By integrating advanced VR technology into architectural education, this project promotes inclusive, equitable, quality education and fosters innovation in teaching practices.

ViRAL transforms traditional architectural education, particularly for Gen Z students, by offering a fully immersive learning environment. Unlike conventional methods that rely on 2D images and limited spatial comprehension, ViRAL enhances students' ability to visualise and design complex spaces. This innovation addresses the challenges of architectural education by enabling students to construct relevant architectural knowledge (CLO1) and develop architectural design schemes with justified arguments (CLO2). The project is implemented in the final-year Bachelor of Science in Architecture courses SBEA3158 – Design 5 and SBEA3169 – Design 6 at UTM, taught face-to-face to meet the Board of Architects' standards.

Project Aim and Objectives

The primary purpose of the Immersive ViRAL Studio project is to revolutionise architectural education by integrating immersive VR experiences into the learning process. This approach bridges the gap between traditional methods and architectural design's dynamic, spatially complex nature, enhancing the pedagogical strategy. Three objectives have been outlined to achieve the aim of this project which are: -

1) To utilise a user-friendly VR platform tailored for architectural education, combining Oculus VR hardware with specialised applications like Wander to create an intuitive and immersive learning environment.
2) To integrate students' understanding and visualisation of 3D architecture design by fostering their understanding of spatial relationships and form-making.
3) To empower architectural students towards the Industrial Revolution 4.0 and the demands of the global economy with 21st-century teaching and learning.

Novelty, Creativity and Innovativeness of ViRAL

The Immersive ViRAL Studio project stands out for its innovative integration of VR technology into architectural teaching and learning delivery, a novelty not commonly seen in architectural education, especially in Malaysia. Unlike most architecture schools that use VR primarily for simulations, ViRAL employs VR across multiple stages of the design process, offering a more comprehensive and immersive learning experience. The project's inclusion in the course information (CI) under special requirements in teaching delivery highlights its significance and uniqueness. In my section of the team-taught course, VR is specifically applied, further showcasing this technology's tailored and innovative application.

ViRAL uses fully immersive and semi-immersive tools to enable virtual visits and walk-throughs, providing immediate feedback. This novel approach allows students to experience architectural spaces in an immersive environment, significantly enhancing their ability to understand and engage with complex designs, which traditional flat images cannot provide. ViRAL fosters an interactive and engaging learning environment by enabling students to collaborate in a shared virtual space, discuss ideas, and provide peer feedback. This collaborative platform encourages active involvement, making the learning process more participatory and dynamic.

VR technology in ViRAL provides immediate feedback on design adjustment, enhancing the efficiency and effectiveness of the learning process. Additionally, immersive learning experiences allow students to receive peer feedback and learn from each other's mistakes, fostering a deeper understanding and improvement. Furthermore, the repeated design process supported by VR enables continuous design refinement. Students can explore different ideas without the constraints of physical models, encouraging innovative thinking and risk-taking. ViRAL prepares students for Industry 4.0 by integrating digital and immersive technologies into the curriculum. This forward-thinking approach equips students with the skills needed for the global economy and enhances their educational experience, making learning more engaging and effective.

Applicability of ViRAL

Studio-based learning in architecture can be attributed to various educational reforms and pedagogical innovations that have emerged since the inception of the École des Beaux-Arts in the early 19th century. This institution is often recognised as a pioneer in formal architectural education, establishing the studio as a central component of the curriculum, where students engage in hands-on design projects under the guidance of experienced faculty (Harry & Kumar, 2022). The Immersive ViRAL Studio integrates Architectural Studio-Based Learning with VR to create an innovative educational environment called Virtual Reality Architectural Learning (ViRAL). At Universiti Teknologi Malaysia (UTM), the architectural design process emphasises an issue-driven design exploration approach in a comprehensive process consisting of six stages – Issue Identification, Precedence Study, Concept Development, Schematic Design, Technical Development, and Final Design Presentation (Figure 1).

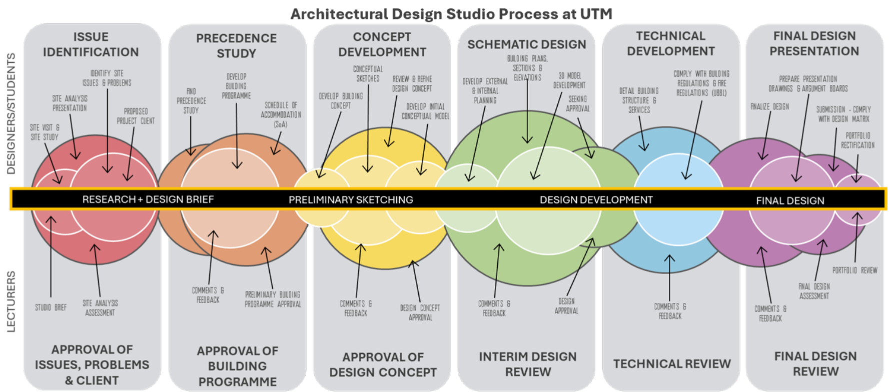

Figure 1: Architectural Design Studio Process at Universiti Teknologi Malaysia (UTM)

Each stage aims to systematically develop students' abilities to address complex architectural challenges. Therefore, ViRAL is integrated into the SBEA3158 (Design 5) – Sem I and SBEA3169 (Design 6) – Sem II courses to ensure sustainable and meaningful learning experiences through structured and engaging activities across two semesters. In both semesters, the ViRAL approach is implemented at three stages of the design process: the Precedence Study stage, the Schematic Design stage, and the Final Presentation stage (Figure 2). Students use fully immersive VR tools like Oculus Quest 2 and Wander App to virtually visit their selected precedent study worldwide, enhancing their engagement and understanding of architectural spaces and design concepts. During the Schematic Design Phase, VR facilitates detailed exploration and alteration of architectural ideas, allowing students to visualise complex designs in 3D and receive immediate feedback. In the final presentation stage, students present their projects using fully and semi-immersive VR tools, including Virtalis Set, which provides a comprehensive and interactive demonstration of their work. Moreover, the ViRAL Immersive Studio uses VR technology to boost students' understanding of spatial design, encourage critical thinking, and keep them engaged.

This approach bridges the gap between what students learn in theory and how they apply it in practice. The new method, called Virtual Reality Architectural Learning (ViRAL), is a significant step forward, providing interactive and immersive learning experiences. By using VR in the delivery of studio courses, ViRAL prepares students for modern, tech-driven careers, ensuring they are ready for future challenges. With cutting-edge VR technology, the ViRAL Immersive Studio transforms traditional architectural education into a more engaging, effective, and future-oriented experience. The consistent use of VR across two semesters ensures sustained engagement and learning. Students build upon their skills progressively, leading to a deeper and more meaningful understanding of architectural design. By embedding ViRAL into the curriculum, students are better prepared for the demands of Industry 4.0 and equipped with modern technological skills that enhance their professional readiness. This innovative approach enhances educational outcomes and fosters a deeper connection between students and their studies.

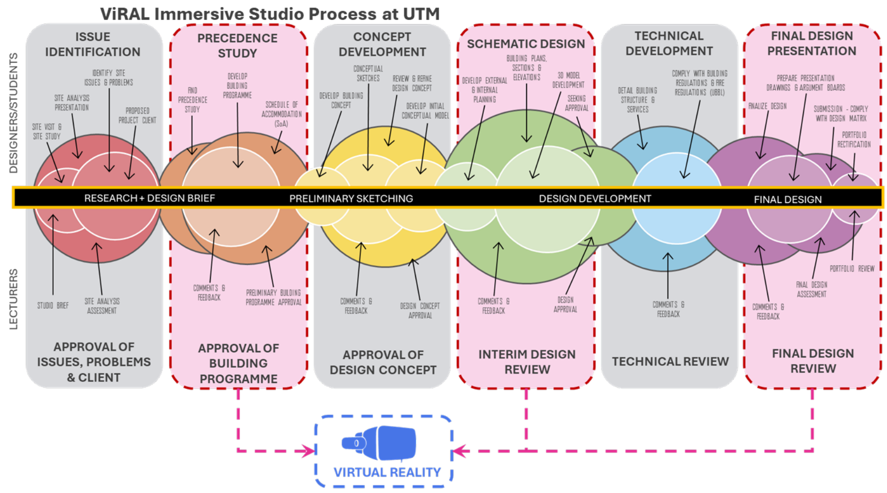

Figure 2: ViRAL Immersive Studio Process within the UTM Architectural Design Studio Framework

Impact of ViRAL on Student Learning

On the achievement of Course Learning Outcomes (CLOs) as stipulated in Table 1, for Design 5, the average attainment for CLO1 was 79%, with all students scoring above 65% and 50%. This demonstrates ViRAL's effectiveness in enhancing understanding of architectural principles. The average attainment for CLO2 was 76%, indicating the positive impact of ViRAL in fostering comprehensive design solutions. Additionally, in Design 6, ViRAL continued to show positive results. For CLO1, the average attainment was 87%, with all students scoring above 65% and 50% - ViRAL significantly improved students' presentation and conceptualisation skills. Furthermore, for CLO2, the average attainment was 71%, with 80% scoring above 65% and all scoring above 50%, highlighting the refinement of design processes through ViRAL.

Table 1: Summary of CLO Achievement

CLOs	SBEA3158 Design 5 (Sec 06) Session 2022/2023 – Sem I	SBEA3169 Design 6 (Sec 03) Session 2022/2023 – Sem II
CLO1	The average attainment level for this CLO was 79%, with 100% of students scoring above 65% and 100% of students scoring above 50%. *ViRAL has effectively enhanced students' understanding and application of architectural principles in their design projects.*	The average attainment level for this CLO was 87%, with 100% of students scoring above 65% and 100% of students scoring above 50%. *ViRAL has significantly enhanced the students' presentation and conceptualisation skills, enabling them to convey their design ideas more clearly and effectively.*
CLO2	The average attainment level for this CLO was 76%, with 100% of students scoring above 65% and 100% of students scoring above 50%. *The positive impact of ViRAL in helping students create well-justified and comprehensive design solutions.*	The average attainment level for this CLO was 71%, with 80% of students scoring above 65% and 100% of students scoring above 50%. *ViRAL has been instrumental in helping students refine their design processes and produce comprehensive design schemes.*

Advancing Student Skills through ViRAL

The ViRAL project has significantly enhanced student skills in architectural education, as reflected in the learning outcomes of the chosen course. ViRAL provides a highly immersive learning experience by incorporating VR technology, allowing students to walk through and interact with architectural designs virtually. This immersive quality captivates students' attention, making learning more engaging and effective. One of the key improvements is in spatial design and visualisation. VR enables students to visualise architectural designs in 3D, enhancing their ability to grasp complex spatial relationships. This improvement is evident in the higher quality of students' design work. Additionally, VR facilitates design exploration and modification by allowing students to quickly create and explore multiple design options in a virtual environment. This process leads to more innovative and refined design solutions as students can test and modify their designs. Furthermore, VR supports real-world simulations through contextual learning. By simulating real-world conditions and contexts, VR helps students design with a deeper understanding of how their projects will interact with the environment, climate, and user experience.

This contextual learning enhances the practical applicability of their designs. Moreover, students gained new technical skills through their proficiency in using advanced VR tools such as Oculus Quest 2 and the Virtalis set. These technical skills are essential for modern architectural practices and prepare students for industry demands. Overall, the ViRAL project has effectively advanced student skills, contributing to improved learning outcomes. The ability to visualise and interact with designs in a virtual environment has enhanced students' understanding, creativity, and technical proficiency, leading to more comprehensive and contextually aware architectural solutions. This innovative approach better prepares students for professional challenges in architecture.

Transforming Student Attitudes through ViRAL

The ViRAL initiative has remarkably impacted students' attitudes towards architectural education. By immersing them in hands-on VR experiences, students have become more enthusiastic, confident, and motivated in their studies and design projects. One standout outcome is the boost in confidence students have gained for participating in competitions. For example, one student shared how ViRAL increased his confidence, leading to several competition wins and showcasing his newfound skills. The constant refinement process facilitated by VR technology has significantly enhanced students' design skills. The other student noted how this process made his designs better and more competitive, resulting in multiple awards. This recognition and these awards validate the skills students have developed through ViRAL. Prestigious accolades like the Best Undergraduate Research Award and top placements in various design competitions highlight their achievements and the external validation of their talents.

Students have expressed deep gratitude for the knowledge and experience gained through ViRAL. They praised the collaborative environment fostered by VR sessions, appreciating the support from lecturers and peers that led to better learning and design outcomes. The initiative has also motivated students to strive for excellence. The success and recognition gained through ViRAL have pushed them to reach new heights, which is evident in their proactive participation in events like the PAMSC Design Festival and the AYDA Awards. In conclusion, the ViRAL initiative has profoundly transformed students' attitudes, driving them to excel in their architectural studies and boosting their confidence and creativity. This innovative approach has equipped them with the skills and motivation to succeed in their academic and professional journeys.

Commercialisation Potential

The ViRAL Immersive Studio demonstrates several scalable aspects, allowing its innovative approach to be expanded across various contexts and industries. Students trained in the ViRAL Immersive Studio can organise workshops and seminars to train educators and professionals in using VR technology effectively. This expansion of knowledge can significantly impact the use of VR across educational and professional fields, enhancing the overall application of immersive technologies. Furthermore, students can offer VR services to real estate agencies by creating virtual property tours. This dynamic marketing tool allows real estate agents and property developers to provide potential buyers with immersive property experiences. The scalability of this service can lead to widespread adoption in the real estate market, making property tours more accessible and engaging. Additionally, implementing VR technology in the architectural design studio can foster commercial collaborations.

Architects and students can work together in a virtual environment by creating and marketing VR-based collaborative design tools. This fosters teamwork and innovation, with the scalability of this approach extending to other fields requiring collaborative design processes. Moreover, VR enables immersive walkthroughs of architectural designs, offering valuable visualisation services to architecture firms, real estate developers, and construction companies. This allows stakeholders to interact with and better understand designs in a virtual space, improving decision-making and project outcomes. The scalability of this service benefits multiple industries in design and construction. Therefore, the scalable aspects of the ViRAL Immersive Studio demonstrate its potential to expand beyond architectural education. By leveraging student expertise, virtual tours, commercial collaborations, and architectural visualisation services, ViRAL can significantly impact various fields, enhancing the use of VR technology in innovative and practical ways.

Awards Received

Gold Award in New Academia Learning Innovation (NALI) 2023 Exhibition & Competition, UTM

Project Title: Archvision VR: Empowering Next-Gen Architects Through Immersive Design Pedagogy

Bonze Awards in International Teaching Enhancement & Learning Innovation Carnival (iTeLiC) 2024, UMK

Project Title: Archvision VR: Empowering Next-Gen Architects Through Immersive Design Pedagogy

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ID 27: Heritage Meets Innovation: Empowering Research and Teaching in the Façade Facelift Project of Melaka Shoplots

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Highlights: The "Heritage Meets Innovation" project utilises an interdisciplinary approach to revitalise Melaka's historical shop lots of façade by integrating academic research with the pragmatic application. It involved 32 student groups concentrating on vernacular design, timber construction, and tenant collaboration. This approach encouraged critical thinking, problem-solving, and practical learning. The initiative fostered community engagement and cultural preservation while incorporating art integration, Design Thinking seminars, and project-based learning aligned with the NALI strategy. The project improved educational possibilities, raised community awareness, and offered commercialization potential by merging new technologies with heritage protection; however, conserving historical integrity required balancing tradition and innovation.

Keywords: *Facade Facelift; Heritage Preservation; Project-Based Learning; Vernacular Design*

Introduction

An innovative project titled "Heritage Meets Innovation: Empowering Research and Teaching in the Façade Facelift Project of Melaka Shoplots" was designed for UTM Year 2 architecture students in 2023–2024. Thirty-two groups of 3–4 students each redesigned the façade of one heritage area shoplot for the revitalisation project.

According to the NALI approach, the project revitalises old shoplots in Bandar Hilir, Melaka, preserving their historical relevance while adding modern aesthetics. Mainstream and direct-entry students work together on this cooperative project that emphasises imaginative problem-solving. The project gives students experience in sustainable and culturally relevant vernacular architecture, specifically timber structures.

Background

The project's scope encompassed a thorough site analysis to ensure the proposed designs were visually appealing and culturally sensitive. Students were required to visit the location on October 12th and 13th, 2023, to physically evaluate the current shop lots, take measurements, and create designs. This practical experience ensured that the designs were informed by the historical and architectural context of the neighbourhood, providing firsthand knowledge and inspiration from Melaka's legacy.

The site visit allowed students to interact directly with the current tenants, ensuring that their designs were pertinent and considerate of the distinctive attributes of the location. The students created design proposals that paid homage to Melaka's vernacular architecture, emphasizing timber construction to reflect traditional and environmentally friendly building methods. The involvement of tenants in the design process guaranteed that the new designs matched the specific demands of the business and adhered to branding criteria, thus improving the relevance and functionality of the renovated shop lots. The project's evaluation highlighted the significance of this procedure, promoting critical analysis, cooperation, and proficient interaction among students.

Creativity & Concept: The level of creativity and innovation demonstrated in the conceptualization and overall design of the façade. This criterion emphasized the importance of originality and the ability to think beyond conventional design approaches (Emam et al., 2019; Harun, 2011).

Identity Integration: The sensitivity to vernacular design and effective use of materials, particularly timber, that reflected Melaka's architectural identity. This criterion assessed how well the design integrated local cultural elements and sustainable materials (Hassan & Nawawi, 2014; Kumar et al., 2022).

Design Relevance: The relevance of the design to the tenant's business and its appeal to their patrons or users. This ensured that the design not only enhanced the visual appeal of the shoplot but also supported the tenant's branding and business objectives.

Presentation: The quality of the group's overall presentation, including the clarity and effectiveness of their communication through drawings, sketches, animations, models, and verbal explanations. This criterion highlighted the importance of being able to clearly and effectively convey design ideas to a broader audience (Wan Ismail, 2013; Emam et al., 2019).

Objectives

The objectives of this project are multifaceted, reflecting a balance between heritage preservation, sustainable design, and educational innovation.

1. To preserve the historical and cultural significance of the Melaka shoplots while enhancing their visual appeal and modern context relevance.
2. To reflect local culture and heritage, the facade facelift serves as a tribute to Melaka's past while ensuring sustainability and relevance to current tenants' businesses and branding.
3. The use of timber as the primary construction material underscores the project's commitment to sustainability aligns with contemporary environmental practices.
4. To foster collaborative learning, encouraging teamwork and diverse idea-sharing, thereby enhancing students' learning experience and preparing them for real-world architectural practices.

NALI Approaches

The Novelty

The "Heritage Meets Innovation: Empowering Research and Teaching in the Façade Facelift Project of Melaka Shoplots" project incorporates several novel aspects that align with the NALI approach. It combines architectural education with practical heritage conservation, merging academic research with real-world application. The project equips students with the ability to navigate the complexities of historical and cultural contexts by blending tradition with modernity. It ensures preserving Melaka's shoplots' historical integrity while integrating contemporary design. The project focuses on real-world projects to enhance students' critical skills, which is essential for future architects. Furthermore, it contributes to cultural preservation, significantly enriching the heritage of Bandar Hilir and serving as a model for innovative architectural education.

The Creativity and Innovation

Project-Based Learning (PBL): Implement PBL where students engage in real-world projects related to the heritage and culture of Melaka. This could involve researching the history of shoplots and proposing design improvements that honour heritage while integrating modern aesthetics and functionality.

Design Thinking Workshops: Facilitate workshops that teach students the design thinking process, including empathising with community needs, defining problems, ideating solutions, prototyping, and testing. Students can create proposals for the façade facelift that reflect both innovation and cultural significance.

Art Integration: Incorporate art into the curriculum by encouraging students to create visual representations of their ideas for the shoplots. This could include murals or installations that reflect Melaka's heritage, allowing students to express their understanding creatively while enhancing the shoplots' visual appeal.

Flexible Learning Environments: Redesign classroom spaces to be flexible and conducive to collaborative work, with movable furniture, areas for group discussions, and spaces for displaying student projects related to the façade facelift.

Makerspaces: Establish a makerspace where students can experiment with materials and techniques related to façade design. This hands-on approach can encourage innovation and practical application of their learning.

Interactive Façade Prototypes: Create interactive prototypes of the proposed façades that can be displayed in public areas. This would not only engage the community but also serve as a learning tool for students to gather feedback and refine their designs.

The Applicability

The project incorporates innovative teaching methods aligned with NALI's emphasis on enhancing student engagement and active learning. Project-Based Learning (PBL) involves students in authentic and practical tasks connected to Melaka's cultural legacy, cultivating vital cognitive abilities such as analytical thinking and effective problem-solving that are crucial in contemporary education. In addition, Design Thinking workshops facilitate innovative problem-solving and cooperation, empowering students to create solutions that respect the cultural importance of the shoplots while incorporating contemporary design aspects.

One of the main principles of NALI is to actively involve the local community. The project aims to create connections between students and community members by providing students with the opportunity to engage with local communities, collecting narratives and perspectives regarding Melaka's shoplots, enhancing their educational experience and fostering stronger community connections. Engaging in Collaborative Design Sessions with local architects guarantees that the designs accurately embody neighbourhood values and heritage, fostering a sense of ownership and pride among people.

NALI emphasises the importance of establishing environments that encourage innovation and collaboration. This objective is achieved by implementing adaptable learning spaces and makerspaces. Flexible learning environments enhance collaboration and deep engagement with the subject matter by adapting classroom rooms to promote group discussions and project work. Furthermore, makerspaces support NALI's objective of fostering an innovative and creative culture in education by giving students practical chances to experiment with materials and methods associated with façade design.

The Impact

This project conforms to NALI principles to greatly enhance students' learning by prioritising experiential learning, critical thinking, and collaboration—essential for equipping them to tackle real-world architectural difficulties. The project facilitates the application of theoretical knowledge in the design and construction of heritage shoplot facades, thereby enhancing students' comprehension of architectural principles and cultural context. The program cultivates critical thinking, problem-solving skills, resilience, and flexibility by engaging students in intricate creative challenges. Additionally, its collaborative structure encourages teamwork and effective communication, which mirrors real-world professional settings. In addition, the project involves the practice of reflection-in-action, which enables students to evaluate and improve their designs continuously based on immediate feedback.

Methodology

The "Heritage Meets Innovation" project follows a structured methodology that emphasises creative problem-solving, sustainability, and hands-on learning, in line with the NALI principles. This approach ensures that students gain practical experience and develop critical skills that are applicable to real-world architectural challenges.

Comprehensive Project Planning: The project starts with detailed planning, including setting objectives, selecting the site, and allocating resources. Students conduct site analysis to understand the historical and architectural context, guiding their design decisions.

Creative Design Process: During the design phase, students prioritise the incorporation of local culture and sustainability principles into their façade designs. They employ design thinking to understand the community's perspective, identify issues, generate ideas, develop prototypes, and evaluate their concepts through testing.

Material Selection and Sustainability Considerations: Students must choose sustainable, affordable materials, with a focus on timber to match the region's vernacular architecture. This phase research material qualities, prices, and environmental implications to create functional and eco-friendly designs.

Construction and Prototype Testing: The construction phase involves the creation of physical models and prototypes of the façade designs. Students test these prototypes to evaluate their functionality, resilience, and alignment with the design brief. Feedback from these tests is used to refine the final designs.

Documentation and Reflective Analysis: Students document their methods using design sketches, material investigations, and reflective evaluations of their decisions throughout the project. This documentation helps students explain their design decisions, which is important for assessment and learning.

Evaluation and Presentation: The project concludes with a formal evaluation based on creativity, sustainability, design relevance, and presentation quality. Students present their designs to peers and instructors, defending their decisions and receiving feedback that further enhances their learning.

Findings and Discussions

The project successfully integrates cultural conservation, current technology, and educational improvement. Heritage shop lots were restored using 3D modelling, laser scanning, and sustainable materials to ensure historical accuracy and current safety. Involving academic institutions, offering students historic conservation experience, and improved educational prospects.

Additionally, the project promoted community involvement, raising local understanding and responsibility for heritage site protection. The façade renovation increased tourism, supported local companies, and attracted investment by retaining historical characteristics alongside modern facilities. The project required careful collaboration to preserve the site's historical significance while balancing historical accuracy with modern upgrades.

Interdisciplinary heritage conservation is stressed in the "Heritage Meets Innovation" effort, which brings together historians, architects, engineers, and educators to conserve Melaka's history while maintaining modern usefulness. It provides significant learning opportunities and advances new conservation practices, demonstrating how revitalising historic sites benefits the community and economy. The project also shows how blending tradition and modernity requires careful management to preserve the site's history. Learnings can be applied to other heritage sites to promote sustainable development and cultural preservation.

Commercialization Potential

The commercialization potential of this project is vast, offering opportunities to generate revenue while preserving and promoting Melaka's unique heritage. By strategically leveraging the intersection of heritage and innovation, the project can attract investment, tourism, and international attention, making it a blueprint for similar initiatives worldwide.

Acknowledgement

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ID 28: DEVELOPING SAKK-TI APP AS ONE STOP CENTRE DIGITAL PLATFORM FOR CO-CURRICULUM COURSE IN IPGMK TEMENGGONG IBRAHIM

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Highlights: The Co-curriculum Course requires student teachers at the Teacher Education Institute (IPG) to master the knowledge and information related to the Co-Curriculum Course that they are participating in. Student teachers also need to be able to master physical skills in order to be able to pass them on to students when they are placed as teachers in the future. Therefore, student teachers need to be skilled in obtaining references and information quickly to be delivered during Teaching and Learning sessions. As a result of the survey, 81% of student teachers stated that they found it difficult to find reference sources related to Co-curriculum Course in IPGM, 12% of student teachers stated that they could get references from the Co-curriculum Course, but it was not in line with the IPGM's curriculum, 7% stated that reference sources could be obtained from books but outdated. Thus, the SAKK-TI innovation project (Sistem Aplikasi Kokurikulum-Temenggong Ibrahim) through an android application has been created as a Co-curriculum Course reference resource platform that is parallel to the IPGM curriculum. Through the SAKK-TI application, student teachers can access information quickly, easily and anywhere.

Keywords: *Co-Curriculum; Application; Student Teacher*

Introduction

The Malaysia Teacher Education Institute (IPGM) offers the Co-Curriculum Course to IPGM student teachers for the Bachelor of Education Degree Program (PISMP) and the foundation program of PISMP (PPISMP) . Through this course, student teachers are exposed to Uniformed Unit (Unit Beruniform), Sports (Sukan dan Permainan), Athletics (Olahraga), School's Society Management (Pengurusan Persatuan di Sekolah) and Teachers Development Program (BIG). Co-curriculum Course involves 4 major component which are bincludes history of establishment, management information, organizational structure, skills and physical basic skills (kemahiran asas), coaching (kejurulatihan), technical officers (kepegawaian teknikal) and organizing (kepengelolaan). All of these 4K major components need to be mastered by IPGM's student teachers to become competent and skilled co-curriculum teachers.

Thus, in order to become a competent and highly skilled co-curriculum teachers, student teachers need to be skilled in obtaining accurate co-curriculum course reference sources quickly, easily and everywhere. Lecturers have to competent in pedagogical methods and the technology usage (Hong, 2021) to prepare the students teachers to be more updated with the 21st Century Education (Kamal Baharom, 2023). In accordance with the working environment of co-curriculum activities that are carried out outside the busy classroom and limited time allocation, student teachers need to be ready to apply co-curriculum skills immediately when the situation requires such as marching training, first aid training and others.

Through a survey conducted on student teachers and co-curricular lecturers, they stated that they experienced difficulties in obtaining information and reference materials related to the co-curriculum course. If there are the source, the reference material is seen to be outdated and not relevant to the current co-curriculum syllabus. Apart from that, student teachers and lecturers also need a resource that is easy, accurate and fast to access in accordance with the teacher working environment that is always moving (mobile). This is because students and lecturers have to attend lectures. If students are undergoing practicum training, they need to be prepared to teach in class and need to get information related to the co-curriculum easily, accurately and quickly.

Therefore, this SAKK-TI application was built as a solution to overcome the problems of student teachers and lecturers to obtain information related to the co-curriculum course. Nowadays, in digital era lecturers and student teacher need to me more flexible and transforms to be more futuristic(Umaira & Isa, 2022). So, to make sure the student teachers updated with the digital aid in the teaching and learning process, lecturers need to use the current technology to help the student teachers be more creative and innovative ((Noor Hasiah Sulaiman & Saidatul Nadiah Shamsuddin, 2020). The SAKK-TI application can help student teachers and lecturers to get information through just one platform and indirectly this will help them to get references easily, accurately and quickly.

Objectives

To help provide a digital platform as a reference for the co-curriculum course, this SAKK-TI application was introduced to student teachers and lecturers. The objective of developing this SAKK-TI application is:

1. Become a one stop digital center reference source regarding co-curriculum course.
2. Provide a platform so that each co-curriculum components can share ideas and findings in carrying out co-curriculum activities.
3. Provide platform to users to get information easily, accurately and quickly and accessible everywhere.

Product Development

Product Development is focused on the application of educational technology in the curriculum. Through this product, SAKK-TI application has been built through the AppsGeyser site and its content focuses on the co-curriculum course which is a compulsory course for IPGM teacher students for the Bachelor of Education Degree Program (PISMP) and the foundation program (PPISMP). The SAKK-TI application has been developed through the APPsgeyser site and the Google site. Through the SAKK-TI application, it requires smartphone users to install the SAKK-TI app.

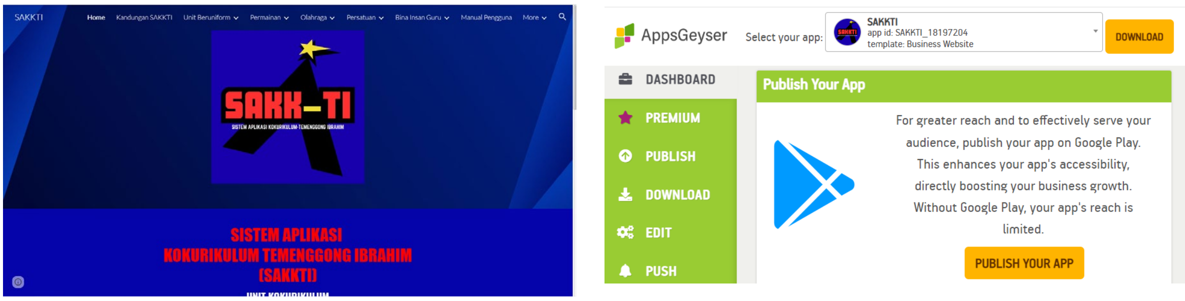


Figure 1: Product development of SAKK-TI application.

Filling in the information content of the co-curriculum course in this application pays attention to uniformed units (unit beruniform), sport games (sukan dan permainan), olahraga (athletics), school's society management (pengurusan persatuan di sekolah) and teacher development program (Bina Insan Guru).

Figure 2: SAKK-TI application's contents and the menus

Innovation Product Results

The results of the innovation product show that users are satisfied with the SAKK-TI application used. Users state that SAKK-TI app helps them to get information more easily, accurately and quickly. This is because they do not need to find reference material from multiple places. Besides that, experts also recognized SAKK-TI app as a one stop digital centre and it's very helpful.

PENGESAHAN PAKAR

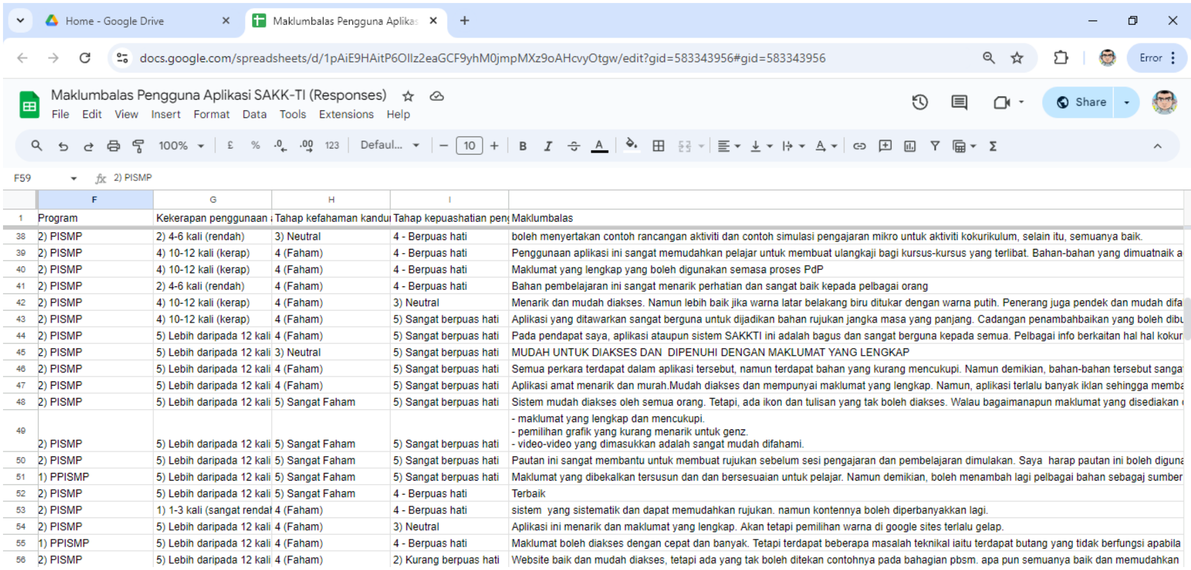
TAJUK INOVASI : MEMBANGUNKAN APLIKASI SAKK-TI SEBAGAI *ONE STOP CENTRE* SECARA DIGITAL BAGI KURSUS KOKURIKULUM DI IPGMK TEMENGGONG IBRAHIM

Dibangunkan oleh :
Muhammad Ridzuan Bin Jamhari, Muhammad Syukri Bin Yahya, Norliyana Binti Ahmed, Hishamuddin Bin Hassan, Mohtar Bin Yacob, Abd Jabar Bin A Rahman, Jamalulaili Bin Selamat
Institut Pendidikan Guru Kampus Temenggong Ibrahim

Bil	Kriteria / Elemen Penilaian	Komen Pakar
1	Pembangunan Produk Inovasi: -Aspek pembinaan diberi perhatian -Mesra Pengguna Keunikan Produk -Bahan inovasi baru -Bahan penambahbaikan	Pembangunan produk inovasi yang menarik, mudah digunakan dimana sahaja. Easy to access everywhere and at anytime.
2	Impak Produk Inovasi: -Produk inovasi bercirikan penyelesaian masalah. -Kaedah/Teknik penggunaan produk inovasi menepati keperluan dan kemudahan pengguna. -Pembinaan produk inovasi memberi manfaat terhadap proses membuat rujukan oleh pengguna produk inovasi	Membantu memberi manfaat kepada semua warga sama ada pendidik, bakal pendidik mahupun pelajar sekolah bagi mendapatkan maklumat tambahan selari dengan pembelajaran Kapasiti Pembelajaran Bermakna.
3	Penglibatan Komuniti: -Pembinaan produk inovasi merujuk kepada keperluan pengguna. -Pembinaan produk inovasi mendapat bimbingan dan nasihat daripada komuniti	Pembinaan produk ini, turut melalui fasa meminta pandangan dan pendapat daripada guru dan bakal guru supaya dapat memenuhi kehendak dan keperluan mereka bagi menghasilkan produk inovasi yang memberi manfaat secara langsung.
4	Daya Saing Produk Inovasi : -Produk Inovasi boleh digunakan oleh pelajar dan pensyarah. -Sifat mesra pengguna dan kreatif dalam pembinaan produk inovasi menjadi nilai tambah (Added Value) kepada produk.	maklumat mudah diperoleh sama ada oleh guru, bakal guru dan pelajar, produk inovasi mesra pengguna ini dapat memberikan maklumat tambahan kepada semua pemegang taruh yang terlibat.

DR. MOHAMMAD SYAKERUL HANIZ BIN MOHAMMAD SABRI
Pensyarah (Kokurikulum)
IPG Kampus Perempuan Melayu Melaka

Figure 3: Expert's respond on SAKK-TI Application.



	F	G	H	I	
1	Program	Kekerapan penggunaan a	Tahap kefahaman kandu	Tahap kepuashatian peng	Maklumbalas
38	2) PISMP	2) 4-6 kali (rendah)	3) Neutral	4 - Berpuas hati	boleh menyertakan contoh rancangan aktiviti dan contoh simulasi pengajaran mikro untuk aktiviti kokurikulum, selain itu, semuanya baik.
39	2) PISMP	4) 10-12 kali (kerap)	4 (Faham)	4 - Berpuas hati	Penggunaan aplikasi ini sangat memudahkan pelajar untuk membuat ulangkaji bagi kursus-kursus yang terlibat. Bahan-bahan yang dimuatnaik a
40	2) PISMP	4) 10-12 kali (kerap)	4 (Faham)	4 - Berpuas hati	Maklumat yang lengkap yang boleh digunakan semasa proses PdP
41	2) PISMP	2) 4-6 kali (rendah)	4 (Faham)	4 - Berpuas hati	Bahan pembelajaran ini sangat menarik perhatian dan sangat baik kepada pelbagai orang
42	2) PISMP	4) 10-12 kali (kerap)	4 (Faham)	3) Neutral	Menarik dan mudah diakses. Namun lebih baik jika warna latar belakang biru ditukar dengan warna putih. Penerang juga pendek dan mudah difa
43	2) PISMP	4) 10-12 kali (kerap)	4 (Faham)	5) Sangat berpuas hati	Aplikasi yang ditawarkan sangat berguna untuk dijadikan bahan rujukan jangka masa yang panjang. Cadangan penambahbaikan yang boleh dibu
44	2) PISMP	5) Lebih daripada 12 kali	4 (Faham)	5) Sangat berpuas hati	Pada pendapat saya, aplikasi ataupun sistem SAKKTI ini adalah bagus dan sangat berguna kepada semua. Pelbagai info berkaitan hal hal kokur
45	2) PISMP	5) Lebih daripada 12 kali	3) Neutral	5) Sangat berpuas hati	MUDAH UNTUK DIAKSES DAN DIPENUHI DENGAN MAKLUMAT YANG LENGKAP
46	2) PISMP	5) Lebih daripada 12 kali	4 (Faham)	5) Sangat berpuas hati	Semua perkara terdapat dalam aplikasi tersebut, namun terdapat bahan yang kurang mencukupi. Namun demikian, bahan-bahan tersebut sanga
47	2) PISMP	5) Lebih daripada 12 kali	4 (Faham)	5) Sangat berpuas hati	Aplikasi amat menarik dan murah.Mudah diakses dan mempunyai maklumat yang lengkap. Namun, aplikasi terlalu banyak iklan sehingga memba
48	2) PISMP	5) Lebih daripada 12 kali	5) Sangat Faham	5) Sangat berpuas hati	Sistem mudah diakses oleh semua orang. Tetapi, ada ikon dan tulisan yang tak boleh diakses. Walau bagaimanapun maklumat yang disediakan
49	2) PISMP	5) Lebih daripada 12 kali	5) Sangat Faham	5) Sangat berpuas hati	- maklumat yang lengkap dan mencukupi. - pemilihan grafik yang kurang menarik untuk genz. - video-video yang dimasukkan adalah sangat mudah difahami.
50	2) PISMP	5) Lebih daripada 12 kali	5) Sangat Faham	5) Sangat berpuas hati	Pautan ini sangat membantu untuk membuat rujukan sebelum sesi pengajaran dan pembelajaran dimulakan. Saya harap pautan ini boleh diguna
51	1) PPISMP	5) Lebih daripada 12 kali	5) Sangat Faham	5) Sangat berpuas hati	Maklumat yang dibekalkan tersusun dan dan bersesuaian untuk pelajar. Namun demikian, boleh menambah lagi pelbagai bahan sebagaj sumber
52	2) PISMP	5) Lebih daripada 12 kali	5) Sangat Faham	4 - Berpuas hati	Terbaik
53	2) PISMP	1) 1-3 kali (sangat rendal	4 (Faham)	4 - Berpuas hati	sistem yang sistematik dan dapat memudahkan rujukan. namun kontennya boleh diperbanyakkan lagi.
54	2) PISMP	5) Lebih daripada 12 kali	4 (Faham)	3) Neutral	Aplikasi ini menarik dan maklumat yang lengkap. Akan tetapi pemilihan warna di google sites terlalu gelap.
55	1) PPISMP	5) Lebih daripada 12 kali	4 (Faham)	4 - Berpuas hati	Maklumat boleh diakses dengan cepat dan banyak. Tetapi terdapat beberapa masalah teknikal iaitu terdapat butang yang tidak berfungsi apabila
56	2) PISMP	5) Lebih daripada 12 kali	4 (Faham)	2) Kurang berpuas hati	Website baik dan mudah diakses, tetapi ada yang tak boleh ditekan contohnya pada bahagian pbsm. apa pun semuanya baik dan memudahkan

Figure 5: Responses by the students in the survey

Methodology

In this study, survey method using Google forms were used to gather the data from the respondents. The purposive sampling method was used to enlist participation through WhatsApp and the link to the questionnaire (Google forms) were shared to all students in that cohort (N= 88). The survey was intended to identify the response from the students about the SAKK-TI application.

We mainly analyze the responses based on three components. The components are frequencies of using the SAKK-TI application (kekerapan), understanding the teaching and learning session by the hel of SAKK-TI application (kefahaman) and the level of satisfaction of using the SAKK-TI application (kepuashatian).

All items were analysed based on a 5-point Likert scale to measure respondent's application of the mobile apps for learning based on these anchors: (1) Never, (2) Rarely, (3) Sometimes, (4) Most of the Time, (5) Always. We send out three soft reminders for a duration of a week to all students to respond to the questionnaire as the participation is voluntarily. Next, the data from Google forms were exported as a csv file into a Microsoft Excel format before being analysed bu using SPSS version 22.

Findings

Based on the findings, 88 respondents participated in the study. 11 males and 77 females respond to this survey. 21.6% are 18-19 years old, 47.7% 20-21 years old and 30.7% are 22-23 years old. There from programmes of PPISMP (21.6%) and PISMP (78.4%).

Table 1: Gender, age, progrramme demography.

Jantina					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lelaki	11	12.5	12.5	12.5
	Perempuan	77	87.5	87.5	100.0
	Total	88	100.0	100.0	
Umur					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-19 Tahun	19	21.6	21.6	21.6
	20-21 Tahun	42	47.7	47.7	69.3
	22-23 Tahun	27	30.7	30.7	100.0
	Total	88	100.0	100.0	
Program					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	PPISMP	19	21.6	21.6	21.6
	PISMP	69	78.4	78.4	100.0
	Total	88	100.0	100.0	

The three components show as Table 2. The means of frequencies (kekerapan) is 4.19, understanding (kefahaman) is 4.24 and satisfaction (kepuashatian) is 4.00.

Table 2: Statistics on frequency, understanding and satisfaction

Statistics				
		Kekerapan	Kefahaman	Kepuashatian
N	Valid	88	88	88
	Missing	0	0	0
Mean		4.19	4.24	4.00
Median		5.00	4.00	4.00
Mode		5	4	4
Sum		369	373	352

Kekerapan					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-3 kali (Sangat Rendah)	4	4.5	4.5	4.5
	4-6 kali (Rendah)	9	10.2	10.2	14.8
	10-12 kali (Kerap)	28	31.8	31.8	46.6
	Lebih 12 kali (Sangat Kerap)	47	53.4	53.4	100.0
	Total	88	100.0	100.0	

Kefahaman					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	4	4.5	4.5	4.5
	Faham	59	67.0	67.0	71.6
	Sangat Faham	25	28.4	28.4	100.0
	Total	88	100.0	100.0	

Kepuashatian					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tidak Puas Hati	11	12.5	12.5	12.5
	Neutral	6	6.8	6.8	19.3
	Puas hati	43	48.9	48.9	68.2
	Sangat Puas Hati	28	31.8	31.8	100.0
	Total	88	100.0	100.0	

Discussion

The data show that the user of SAKK-TI application is using the application as learning and teaching aids. The use the SAKK-TI application frequently. By using the SAKK-TI application, it helps the students understand the co-curriculum course better and they also satisfied with the application. Through the results of the feedback received from the experts, the experts stated that the SAKK-TI app innovation product is a very beneficial application, and its use can help improve students' knowledge about the co-curriculum course.

Feedback from lecturers stated that this application helps them to carry out teaching in lectures. This is because SAKK-TI app helps to be a reference for students and makes it easier for them to understand and get information easily, accurately and quickly. This is because the SAKK-TI application is easy to access and can be accessed at any event outside the classroom where extracurricular activities are the most appropriate place to carry out uniformed unit activities.

Students gave feedback that the SAKK-TI application made it easier for them to get information about the co-curriculum course. Students only need to browse the SAKK-TI application and can explore various information about the co-curriculum course offered by IPGM. As the results, SAKK-TI application also an effort of IPGM to improve student teacher competency in line with the 21st century education programme (Manisah Mohd Shah & Mahamsiatus Kamaruddin, 2022).

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ID 30: Digital English Language Learning Site Malaysia (DELLS.My)

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Highlights: Digital English Language Learning Site Malaysia (DELLS.My) is a pioneering digital English language learning platform tailored specifically for Malaysian students. It offers authentic, interactive and quality educational resources, assistance, and information for students, teachers, and other stakeholders. DELLS.My excels in providing a highly personalized and interactive learning experience by mapping the existing quality resources with the Malaysian curriculum combined. Besides, it accentuates implementation strategies and adaptation ideas for teachers. This innovation not only offers effortless resource-finding for teachers but also enhances learning experience and students' motivation.

Keywords: *Digital Learning Platform; ELL Websites; Online Learning; Website Evaluation; ADDIE Model*

Introduction

English Language Learning (ELL henceforth) websites are powerful tools that teachers can leverage to support teaching and learning (Fuentes & Martinez, 2018; Aguayo & Ramírez, 2020). They enhance students' learning via the existence of interactive visual aids and the accessibility to lessons in which they can follow at their own pace (Sihombing, 2020; RahmtAllah & Mohamedahmed, 2021). Besides, these fun and engaging resources help students in reviewing and building vocabulary as well as literacy skills, eventually supporting the language learning process. Apart from that, they are ideal tools to foster learners' autonomy (Sholihah & Wijaya, 2020; Bashori et al., 2022).

The existence of English Language Learning (ELL) websites as tools to support learning contribute towards assisting educators especially in preparing teaching materials. Despite the abundance of websites available, teachers especially in primary schools in Malaysia face difficulties in finding appropriate and easily accessible websites (Fuentes & Martínez, 2018). In reality, Gani and Habil (2023) in their study, revealed a few key shortcomings, including a lack of culturally relevant content, insufficient writing tasks, and certain accessibility issues in remote areas.

Despite many studies conducted within the continuum of online learning and website evaluation, there are still distinct number of facets which appear ambiguous in this research literature. Despite being a viable learning tool, the features of ELL websites and their potential for use in Malaysian contexts remain vague. Significantly, although there has been numerous research conducted within the spectrum of websites evaluation that, there is a notable lack of thorough mapping of these resources (Gani & Habil, 2023). To date, no studies on the internet have specifically focused on mapping a corpus of ELL websites (selected via systematic screening procedure) with the Malaysian curriculum. All in all, there are less studies conducted about the potential of ELL websites from primary school teachers' perspectives. Thus, this research seeks to explore the potential of ELL websites from the primary school teachers' perspectives, identify, analyse and map these precious resources with the Malaysian curriculum.

This study sheds light on the potential of websites as viable learning tools to support the development of learners' language. Educators will be informed on a list of appropriate websites to be utilised for primary students. The site will definitely urge the education provider and the curriculum developer on the needs to design personalised and contextualised ELL websites for Malaysian primary students. Besides, it will serve as a guide to create learning sites.

Content

Project or innovation objectives

1) To create a digital English Language learning hub which will be useful for all the stakeholders (teachers, learners, education provider and material developer).
2) To integrate quality resources from the selected ell websites (as supplementary resources) with the Malaysian curriculum.
3) To highlight appropriate implementation schemes (adaptation ideas and implementation strategies) for teachers, education provider and material developer.

NALI approach

Novelty

This concept can be discussed in terms of DELLS.My's novelty to the Malaysian curriculum as well as to the context of language learning sites. DELLS.My is new to the Malaysian education system which refers to its novelty within the boundaries of the country. Currently, the Digital Educational Learning Initiative in Malaysia provides limited resources. The idea of mapping the existing resources from ELL websites coupled with the suggestion of implementation strategies is a new way of intelligently dealing with the issue of limited supplementary resources.

The platform incorporates Malaysian cultural references, examples, and scenarios to make learning more relatable and engaging for students. The platform aligns its content with the Malaysian school curriculum, ensuring that students are learning material relevant to their academic requirements. This alignment supports their performance in school assessments.

Creativity
In comparison to existing digital learning platforms, the idea of sourcing quality resources, evaluating, arranging and mapping according to the syllabus excels in providing a highly personalized and interactive learning experience.

Innovativeness
Three crucial features which sets DELLS.My apart from traditional learning methods and other digital platforms are:

- Implementation strategies.
- Adaptation ideas for teachers.
- The organization of resources based on the topics outlined in the curriculum.

Applicability
Demonstrates broad applicability by addressing the specific educational needs of Malaysian teachers, students, supporting diverse learning styles, and enhancing accessibility and engagement for all stakeholders. It serves as a valuable tool for students, teachers, and parents, fostering an effective and inclusive learning environment.

Impact to Students' Learning
DELLS.My's unique features are tailored to the specific needs of Malaysian teachers and students. By integrating localized content, advanced technologies, and innovative pedagogical methods, it provides a highly engaging and effective English learning experience suited to the Malaysian context.

Research Methodology

This study explores the adaptation of ADDIE instructional model in designing and developing a digital ELL site for Malaysian teachers and students by mapping the existing quality resources from selected ELL websites. The whole process is summarized in Table 1.

Table 1: Research Methodology

Stages	Task	Output
Analysis: The process of defining.	Need analysis Problem identification	Needs Problem statement Learner profile Description of issues/concerns
Design: The process of specifying how.	Write objectives Learning content design. Identify resources Plan implementation strategies	Measurable objectives Instructional strategy Prototype specification Integration plan
Development: The process of authoring and developing.	Organising the identified resources Mapping the resources with the curriculum	Storyboard Adaptation ideas Implementation strategies Lessons plan Other relevant materials are developed and uploaded on the site.
Implementation: The process of trying out the project in the real-world context.	Teacher training Briefing	Students comments Data
Evaluation: The process of assessing the efficiency and effectiveness.	Questionnaire Interview	Recommendation Project report Revised site

This study utilises mixed-method approach, implementing both quantitative and qualitative methods. Specifically, it employs the exploratory research design with the aim of exploring the perception of primary school teachers regarding the potential and appropriateness of free ELL websites within Malaysian context (need analysis). The population of the study is 375 primary school English Language teachers in Malaysia. It is a purposive sampling as the participants were selected based on the characteristics of a population and the objectives of this study.

The first data collection method is survey (needs analysis) which involved the distribution of questionnaire to all 375 respondents. This instrument was adopted from the study conducted by RahmtAllah and Mohamedahmed, (2021). All the 11 items were checked by the experts (validity test) and the reliability of the questionnaire was found to be .87 (Rahmt Allah & Mohamedahmed, 2021). The responses gathered from the questionnaires were analysed using descriptive analysis to explore the potential of ELL websites from the teachers' perspectives. The percentage of agreement and disagreement for each item were calculated and tabulated to clearly infer how teachers perceive the potential of ELL websites. The percentage of agreement is clearly depicted in Figure 1 below.

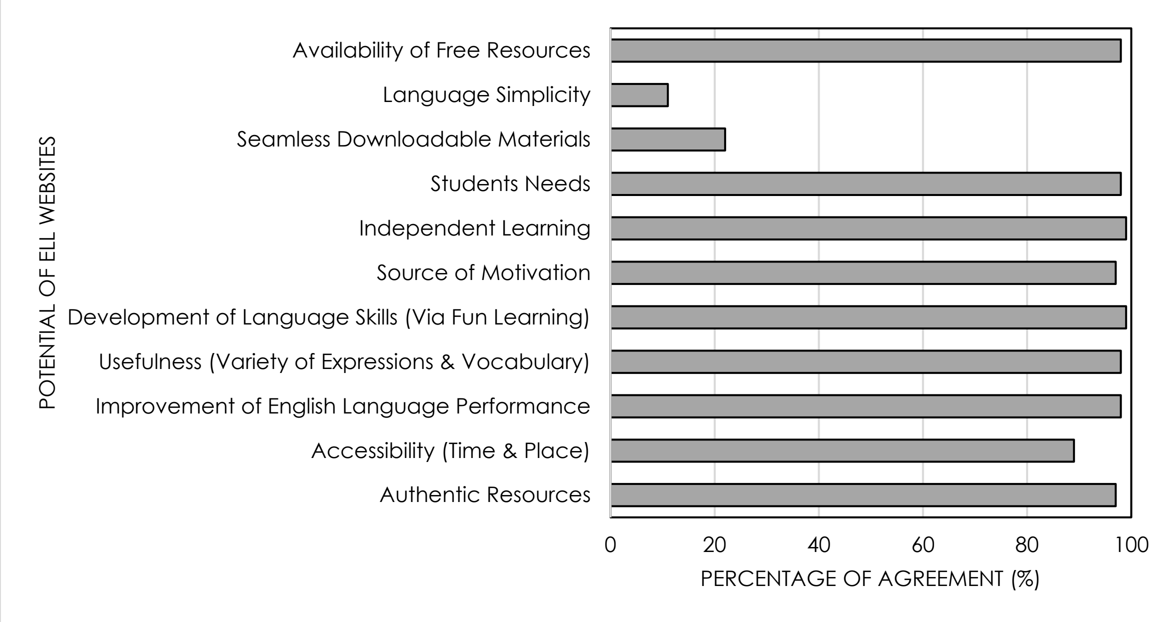

Figure 1: the percentage of agreement according to the potential of ELL websites

The second data collection method is interview. A few teachers with consent, analysed the site, used it and provided their responses. As proposed by Korth et al. (2017), interview is essential to complement other types of data such as survey responses as it allows the researchers to explore the issues which are not evident. Besides, interviews can be highly beneficial as it assists in collecting additional data to complement incomplete answers. Therefore, 5 teachers (with consent) were interviewed to evaluate the site. Thematic analysis was carried out to identify the themes based on the common points in the responses provided by the teachers throughout the interview. This study employs the external audit as the strategy to validate the findings (Creswell, 2012). The interview questions, themes and codes of the interview data were audited by two experienced English Language teachers.

Finding and Discussion

Based on the interview data, DELLS.My receives positive responses from all of the respondents. Among the crucial features highlighted are the systematic organization and implementation ideas provided on the sites.

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ID 31: Connecting Classrooms Across Borders: A Transnational Service-Learning Partnership for Digital Literacy in Malaysia and Indonesia

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Highlights: This transnational service-learning program innovates by bridging the digital divide through a collaborative approach between students from Universiti Teknologi Malaysia (UTM) and Universitas Negeri Malang (UM). By integrating experiential learning, community engagement, and digital media literacy, the program empowers rural adolescents in Desa Pagelaran, Indonesia and Kampung Jawa in Malaysia to become digital citizens. This practical exposure not only bolstered students' confidence but also equipped them with essential skills highly relevant in both academic and professional settings. The program's unique blend of cross-cultural exchange and community-focused initiatives positions it as a pioneering model for addressing educational disparities and fostering global citizenship.

Keywords: *Transnational Service-Learning; Digital Media Literacy; Cross-Cultural Exchange*

Introduction

Transnational service-learning is emerging as a powerful tool for addressing global challenges and cultivating future-ready graduates. In an increasingly interconnected world, traditional classroom-based learning often falls short in preparing students for the complexities of global citizenship. By bridging academic theory with real-world practice, transnational service-learning initiatives like "Uprise Digital Media" (Lindawati, 2023; Usman, 2023) held during Semester 2-2022/23 in Malang, Indonesia, and "Genius Multimedia: Canva Camp" (Shariff, 2024) held during Semester 2-2023/24 in Hulu Langat, Selangor offer a transformative approach to education. These programs, collaboratively designed by students from Universiti Teknologi Malaysia and Universitas Negeri Malang, aim to empower rural adolescents with digital media literacy skills while fostering cross-cultural understanding. By integrating experiential learning, community engagement, and academic rigor, this study explores how these program initiatives contribute to the development of globally competent and socially responsible citizens. This innovative approach also empowers young people to become active participants in the digital age.

Objectives

These programs were designed as part of a requirement for the undergraduate students enrolled in the co-curriculum service-learning course "Digital Media and Community" in Semester 2-2022/23 and Semester 2-2023/24. The objectives of these programs were to increase digital media literacy proficiency among 80% of participating rural adolescents by the end of the program; to develop a replicable transnational service-learning model that can be adapted to other contexts; to establish a long-term partnership between the universities and the target communities for sustainable development; to create a collaborative and student-centered learning environment; and to integrate technology and digital tools into teaching and learning.

Implementation of New Academia Learning Innovation (NALI)

This study explores the innovative potential of transnational service-learning in addressing the digital divide and empowering rural communities. By examining two case studies, "Uprise Digital Media" in Indonesia and "Genius Multimedia: Canva Camp" in Malaysia, we investigated how collaborative partnerships between Universiti Teknologi Malaysia (UTM) and Universitas Negeri Malang (UM) could contribute towards the development of globally competent citizens. This paper delves into the novelty, creativity, innovativeness, applicability, and impact of these programs, highlighting their potential as models for future initiatives.

Novelty and Creativity

These programs introduced a novel approach to addressing the digital divide by focusing on rural adolescents in Desa Pagelaran and Kampung Jawa through a transnational service-learning partnership between students and lecturers from Universiti Teknologi Malaysia (UTM) and Universitas Negeri Malang (UM). This collaboration was distinguished by its emphasis on cultural understanding and community engagement. The "Uprise Digital Media" program, implemented in Desa Pagelaran, Indonesia, exemplifies this approach by tailoring workshop content to the community's specific needs, such as promoting local products through poster creation. Similarly, the "Genius Multimedia: Canva Camp" in Kampung Jawa, Malaysia, demonstrated creativity in adapting the program to a different cultural context, focusing on the local craft of "tudung saji." These programs showcase innovative curriculum design and delivery, with a strong emphasis on experiential learning and student-centered pedagogy. Students from UTM and UM co-created the programs' content, workshop activities, and conducted project assessments through competitions. This approach empowered students to take ownership of the learning process while developing essential skills in project management and evaluation. This collaboration, combined with the unique curricula of "Uprise Digital Media" and "Genius Multimedia: Canva Camp," presents a fresh perspective on digital media literacy education.

In 2023, the "Uprise Digital Media" service-learning program, implemented in Desa Pagelaran, Indonesia, aimed to bridge the digital divide among rural communities. By collaborating with Universitas Negeri Malang, students from Universiti Teknologi Malaysia designed and facilitated a workshop focused on photography and poster creation using Canva. Participants from the village were actively engaged in hands-on activities, culminating in a social media campaign to promote local products. The program emphasized cultural sensitivity, accessibility, and skill development, fostering a sense of empowerment among participants. The workshop was organized and led by a team of students from both universities, demonstrating a student-centered approach to service learning. By combining academic knowledge with practical application, the program successfully created a platform for community engagement and digital literacy development.

A year later, roles were reversed with UM students travelling to Kampung Jawa, Hulu Langat to collaborate with UTM students on "Genius Multimedia: Canva Camp". The program aimed to enhance digital literacy among community members, focusing on photography and Canva skills. Through interactive workshops and a design competition, participants were equipped with practical digital tools and knowledge. The program emphasized hands-on learning and community engagement, fostering creativity and digital competence among participants. The Canva Camp successfully empowered Kampung Jawa residents with digital skills, enabling them to create visually appealing content and potentially contribute to local economic development. This initiative demonstrated the effectiveness of transnational collaboration in addressing community needs and promoting digital literacy.

Innovativeness and Applicability

By targeting underserved rural communities in both Indonesia and Malaysia, the project directly addresses a critical digital divide. The transnational collaboration fosters cross-cultural understanding and knowledge exchange, making it an innovative approach to educational development and community empowerment. The programs' focus on practical skills, such as photography and digital tools such as Canva, combined with a strong emphasis on community engagement, enhances their applicability to various contexts. The successful implementation of both programs demonstrates their potential for replication and adaptation in other regions facing similar challenges.

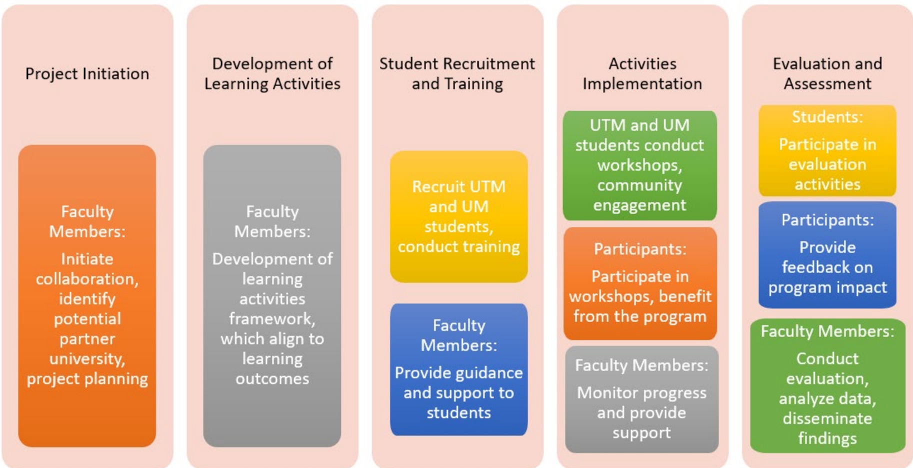

Figure 1: Process diagram of the phases involved in designing the transnational service-learning program

Figure 1 shows the phases involved in the transnational service-learning process, from project initiation, development of learning activities, student recruitment and training, program implementation, and finally to evaluation and assessment. It also shows the roles of faculty members, UTM and UM students, and community members for each phase.

Impact on Student Learning

These programs demonstrate a strong commitment to student learning and development. By involving students as active participants in the design and implementation of the service-learning programs, the project fosters critical thinking, problem-solving, and leadership skills. The emphasis on cultural exchange and community engagement promotes global citizenship and social responsibility. Moreover, the integration of digital media tools and Artificial Intelligence (AI) into the curriculum equips students with essential 21st-century skills. The success of both "Uprise Digital Media" in 2023 and "Genius Multimedia: Canva Camp" in 2024 in achieving their objectives highlights the potential of transnational service-learning to create meaningful and lasting impact on both students and communities.

Research Methodology

This study employed a case study research design to examine the effectiveness of transnational service-learning programs in enhancing digital literacy among rural adolescents in Malaysia and Indonesia. Data were collected through participant observations, in-depth interviews with UTM students and community members who participated in the programs, and document analysis. The document consisted of workshop materials. Qualitative data was analyzed using thematic analysis to identify key themes and patterns. Quantitative data, including pre and post assessments, were used to measure changes in digital literacy skills. Ethical considerations, such as informed consent and confidentiality, were strictly adhered to throughout the study.

Findings and Discussion

Transnational service-learning initiatives have a significant impact on students' learning and efficacy, as demonstrated by the reflective reports of UTM students who engaged in such programs. The reflections underscored the transformative nature of these experiences, highlighting the educational value that extends beyond traditional classroom boundaries. The students recognized the importance of teamwork in the successful execution of the program, emphasizing the role of collaborative efforts and mutual support among team members in overcoming challenges and achieving objectives (Figuccio, 2020). Effective communication within the team was identified as a crucial factor that enabled meaningful contributions from all participants, fostering idea-sharing, problem-solving, and efficient task coordination.

Moreover, the interactions and communication dynamics during the program provided students with valuable new experiences that broadened their perspectives and enhanced their practical skills. These experiences emphasized the significance of collaboration, teaching students how to effectively work within diverse teams and adapt to different working styles. The development of interpersonal skills was highlighted as essential for navigating challenges and ensuring the smooth operation of the program, as students learned to trust and rely on one another. Managing the program also deepened students' understanding of project management and community engagement, providing them with firsthand experience in planning, organizing, and executing community-based initiatives.

The practical exposure gained from participating in transnational service-learning not only boosted students' confidence but also equipped them with essential skills relevant in academic and professional settings (Ali, 2023). The students acknowledged that the program was not solely about imparting knowledge to the community but also about their personal growth and development as future leaders and change-makers (Leistner et al., 2022). This holistic view of the program's impact underscores the efficacy of the teaching and learning innovation embedded in transnational service-learning, showcasing its profound influence on student development and community engagement (Schanz & Giles, 2021).

Furthermore, the reflections from the UTM students align with existing literature on service-learning, which emphasizes the positive effects of such initiatives on students' self-esteem, self-efficacy, teamwork, and leadership skills (Dincă et al., 2023). Service-learning activities have been shown to enhance students' cognitive and civic learning outcomes, fostering a deeper sense of engagement and responsibility towards community issues (Liu, 2023). The collaborative nature of service-learning experiences not only enhances academic outcomes but also contributes to students' personal and professional growth (Sensenig, 2022).

Ultimately, the impact of transnational service-learning on students' learning and efficacy is multifaceted, encompassing personal development, practical skill-building, and a deeper understanding of community engagement and project management. The reflections of UTM students participating in such programs underscore the transformative nature of these experiences, highlighting the importance of teamwork, effective communication, and practical exposure in shaping students into well-rounded individuals prepared for future leadership roles. Table 1 shows the comparison of the two programs, highlighting their unique characteristics and also shared features in terms of key activities, outcomes, and lessons learned.

Table 1: Comparison of the two programs, "Uprise Digital Media" and Genius Multimedia: Canva Camp

Feature	Uprise Digital Media (Indonesia)	Genius Multimedia: Canva Camp (Malaysia)
Focus Area	Photography, for the purpose of marketing products or services, Canva design	Photography, general application, Canva design
Participants	19 participants, aged 13-50 years	28 participants, aged 12-17 years
Key Activities	Briefing on photography techniques and Canva design, hands-on session for photography, competition for poster design.	
Outcomes	Improved digital skills and community engagement	
Challenges	Participants represented a wide age range, necessitating adaptable knowledge delivery methods.	Initially, the competition was based on group activities. However, due to an imbalance in participant age and creativity levels between children and teenagers, the competition format was changed to individual participation. This decision was influenced by the fact that only 31% of participants were 12 years old.

Lessons Learned	Requires thorough group discussion and planning, need to respect other group members, have individual responsibility towards the group.

Other Information

Building on the success of both of these programs, we have submitted it to another competition related to teaching and learning, besides securing coverage in UTM's news hub and also UM's Tugu Jatim newsletter. The transnational service-learning model will also be submitted for copyright with UTM's Innovation and Commercialisation Centre (ICC). Recently, a paper related to this study was presented at the 1st International Conference on Co-Curricular Learning Experience (ICCLE 2024) on June 21, 2024.

Acknowledgement

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ID 32: Using Bard G to Improve Secondary School Students' Essay Writing Skills

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Highlights: This is a Gold Award innovation project that uses Bard G, an AI platform in teaching essay writing to secondary school students. Students need to key in the suitable words or known as prompts in order to get the responses from Bard G. The T-test conducted shows that students had improved significantly through the use of Bard G in their essay writing. On top of that, students also showed favourable responses towards the use of Bard G in assisting them in their essay writing. This is because Bard G does not only help students to learn about ideas generation, new vocabulary, but it also provides flexibility for them to learn at their own pace. Hopefully, Bard G will also be widely practised in other aspects of language teaching.

Keywords: *Artificial Intelligence, Generative AI, Essay Writing, Second Language Acquisition*

Introduction

Writing is one of the most difficult language skills to acquire because writing consists of many elements such as word choice, language use and spelling (Siddek & Ismail, 2021; Minn et al. 2019 and Rahman et al., 2020). The main problems faced by students in their essay writing include the inability to form grammatically accurate sentences and generalization of ideas due to poor command of vocabulary and interference from their mother tongue (Siddek & Ismail, 2021). Due to lack of time, lack of facilities and poor command of the English language, majority of our English teachers usually employ teacher-centred method in teaching essay writing (Gustiani, 2020 and Chun & Yunus, 2023). Thus, there should be a call for a more creative approach in teaching essay writing such as through the use of Artificial Intelligence (Alharbi 2023; Buriak et al; Quintans-Junior et al. and Kim, 2023).

Although AI has long existed since 1950, it has only made tremendous impact in education field since the emergence of ChatGPT. Similar to ChatGPT, Bard G is able to generalise information from a large corpus of data built in it. Research shows that Bard G can help with creative tasks, explaining complex topics and generally extracting information from a variety of sources on the internet. Although studies had been carried out about ChatGPT, there are a few studies on the use of other AI tools especially among secondary school students (Aydın & Karaarslan, 2022; Jen & Salam, 2024; Rahman et al., 2023; and Libório et al., 2023).

Project Objectives

The objectives for this innovation project are:

i. to use Bard G to improve secondary school students' essay writing performance
ii. to investigate students' perceptions regarding the use of Bard G

Methodology

In this study, Bard G was used as a digital tool in teaching essay writing to students. Bard G is a free AI platform in order to assist students in their essay writing. To use Bard G, students need to key in suitable words or known as 'prompts' into the space provided. The prompts must consist of 'action verbs' that the users want Bard G to do followed by personalized responses such as 'in 120 to 150 words' and 'in a primary school'. Sample of prompts used in Bard G for different functions.

Table 1: Functions and Sample of Prompts Used by Bard G

Functions	Sample of Prompts
Translating a word into English	Translate the word 'gembira' into English.
Generalising ideas	Write an essay about 'a road accident' in '120 to 150 words'.
Giving synonym of words	Give the synonym of the word 'happy'.
Writing a report	Write a report for 'school Teachers' Day celebration' in 'a primary school'.
Generating images	Produce an image about 'a school'.

Below are the steps involved in using Gemini.

i. Students key in the correct prompts.
ii. Students click the 'arrow' in Bard G to generate answer based on the students' responses.

iii. Bard G generates answer.

iv. Students paraphrase the response given.

Below is a layout of a Bard G that is used in this study.

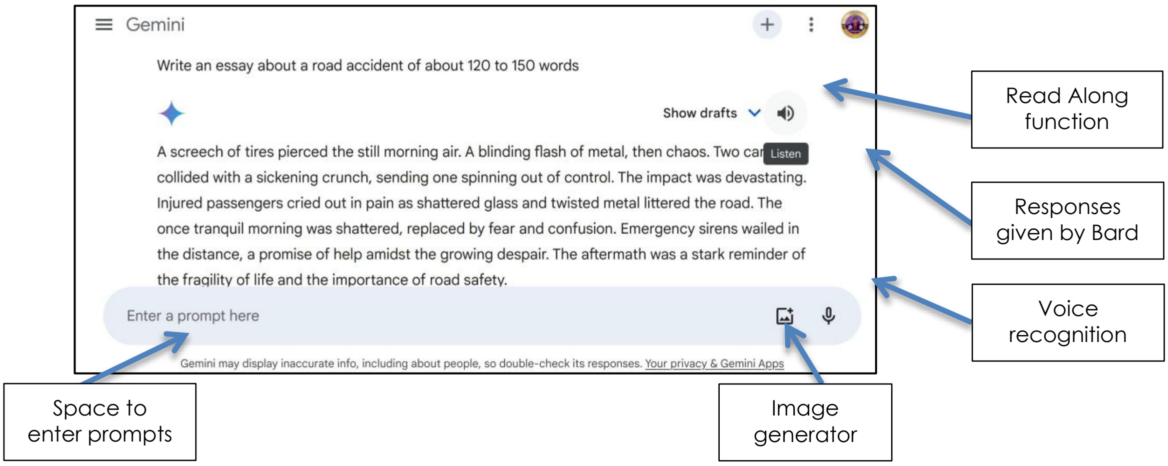

Figure 1: Layout of Bard G

Apart from generalisation of ideas, Bard G also enables students to learn different vocabulary, pronounciation of the words through 'Read Along' function in Gemini as shown in the above diagram.

Impacts

Findings from T-Test

40 students of a secondary school in Johor Bahru were chosen as the respondents to examine the effectiveness of Bard G in improving students' essay writing skills. A paired sample t-test was conducted to compare the pre-test and post test scores of the experimental group. The experimental group was the students who went through the essay writing class using Bard G. The results revealed a significant difference between the pre-test and post-test results as the p-value was less than 0.05. These findings suggest that we have to reject the null hypotheses as students had improved significantly through the use of Bard G in their essay writing. This is because Bard G helps students in terms of generalisation of ideas and translation of new words. Bard G also eases students' comprehension of the reading text through the 'Read Along' function in the text.

Findings from Students' Journal Entries

All the 40 students were asked to write down their perceptions regarding the use of Bard G after the essay writing lessons. Below are the students' responses analysed using thematic approach.

Student 1

One of the benefits of using Bard G is that it provides us with information from different sources, even the most tedious information. Subsequently, we can expand our vocabulary with Bard G.

Student 2

Bard G provides us with a lot of information from different sources. We can also get to know information from Bard G very quickly.

Student 3

We can learn new words through Bard G.

Student 4

Bard G is easy to use even for a 10-year-old kid.

Student 5

Bard G is better than real Google. We can use Bard G to get a lot of information and simple to use.

Findings from Questionnaires

The questionnaires administered to the respondents in the study showed that majority of them (60%) had never used Bard G before. This was the first time for most of them to use Bard G. However, all of them expressed that they liked using Bard G. This is because of the features of Bard G which are easy to use for students.

Apart from that, 95% of the students stated that they had improved their essay writing using Bard G and all of them stated that they had learnt new vocabulary and ideas from Bard G. This was termed as 'perceived usefulness' in the TAM Theory. Venkatesh et al (2003) asserted that, perceived usefulness is defined as the extent to which using a system enhances an individual's productivity. Bard G does not only help students in generation of ideas, but also helps them to translate words from their mother tongue into suitable words in their essay writing. Finally, Bard G also eases their understanding through 'Read Along' function in Bard G.

Findings from Observation
It was observed that all the students enjoyed using Bard G. They even ventured further on their own by using Bard G for their other writing tasks. However, it was observed that not all the students were given equal opportunities in using Bard G and time was limited for students to explore using Bard G. To overcome this problem, students were asked to continue surfing for online materials using Bard G at home since most of them had either mobile phones or laptops at home.

Findings from Semi-Structured Interview
The focus group interviews conducted with the students showed that all of them liked to use Bard G. This was because Bard G was something new for them. Bard G also has many other benefits as highlighted by the students.

Firstly, Bard G helped students to generate ideas for their essays. Students were only required to enter the keywords into the 'prompt' for the essay task and Bard G would generate a lot of content in paragraphs for them. Apart from that, Bard G had also improved students' vocabulary as students could key in words in their mother tongue into the system. Bard G would then translate the given word into a few suggested English words with explanation. Through this, students had not only learnt about the new words, but they had also learnt the meaning of the new words provided by Bard G. Finally, Bard G had also improved students' reading comprehension and pronunciation through the 'Read Along' feature provided in the text. Once activated, the 'Read Along' feature in Bard G would read out all the words shown in the Bard G. Students would be able to learn about the correct pronunciation of every word and at the same time understood the text better since they were not only using their sight sensory, but they were using their listening sensory at the same time.

Finally, all the students stated that they did not face any problem while using Bard G. This is because Bard G was an easy-to-use application. Students were only required to key in the keywords into the 'prompt' function and the responses would be given by Bard G automatically in a few seconds. Thus, students did not face any problem while using Bard G. This 'perceived ease of use' feature of Bard G enables it to be used easily and conveniently (Venkatesh et al., 2003).

Applicability

Bard G is indeed an effective tool in improving students' essay writing performance. The results of from the T-Test, questionnaires, interviews and observation showed that majority of the students had positive perceptions regarding the use of Bard G. it helps students to improve their essay in terms of content, communicative achievement, organisation and language aspects. In terms of content, Bard G helps students by generating ideas for their essays.

Furthermore, students can also learn new words through the translation feature in Bard G. Whenever students face problems in translating words from their mother tongue, students can key in the words into the prompt using the keywords 'translate (word) into English'. Bard G will then suggest a list of words with their definition. Moreover, Bard G eases students' understanding through 'Read Along' feature. When activated, the 'Read Along' feature will read out all the words shown on Bard G response screen. Students can learn the pronunciation of the words through it.

In conclusion, Bard G is a great aid for students to improve on their writing performance. This is supported by studies done by Guo et al. (2022) and Nazari et al. (2021) who asserted that Artificial Intelligence tools have great benefits in improving students' essay writing performance. This is because apart from generating ideas, Artificial Intelligence tools are also able to perform other functions such as translation, providing feedback, evaluating students' essays and give personalised comments to the users.

Future research should be carried out regarding the use of Bard G in other language learning aspects and with different age groups as Bard G is still a new technological tool in language teaching and learning.

Novelty

Although artificial intelligence has long existed since 1950, it has only started to make its tremendous impact in the education field since the emergence of ChatGPT. Studies remain scarce on other AI tools (Aydın & Karaarslan, 2022; Jen & Salam, 2024; Rahman et al., 2023; and Libório et al.,2023). Thus, this study seeks to investigate the use of Bard G, a free AI platform in assisting Malaysian secondary school students in their essay writing since majority of our students are having problems in their essay writing.

Commercialisation Potential

Since this project uses the free Google AI application available on webpages, it has the potential to be commercialized in teaching of essay writing not only in secondary schools but also at other learning institutions such as higher learning institutions and primary schools.

Award Achieved

Gold Award Virtual Innovation Competition 2024

Publication

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Exhibition

This project has been presented in High Impact Conference for Educators, Ohio, USA on 11 June 2024.

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ID 33: Pengajaran dan Pembelajaran (PdP) dari Hati ke Hati Melalui Pendekatan P-TED

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Sorotan: Pengajaran dan pembelajaran (PdP) dari hati ke hati mampu membentuk akal dan jasmani pelajar berteraskan nilai dan akhlak. P-TED merupakan gabungan daripada Pembelajaran Teradun (Blended Learning) yang membawa maksud integrasi pengajaran secara bersemuka dan pengajaran secara dalam talian yang telah diterima secara meluas di seluruh pengajian tinggi. Konsep pembelajaran teradun menggabungkan pembelajaran tradisional secara bersemuka dengan pembelajaran dalam talian, menjadikan pelajar lebih aktif dan dapat mencari kaedah belajar yang sesuai. Meskipun tenaga pengajar berperanan sebagai fasilitator untuk memastikan pembelajaran kondusif dan terkawal, namun mereka juga perlu memastikan kaedah pengajaran dan pembelajaran (PdP) dari hati ke hati turut diaplikasikan. Tujuannya adalah bagi memastikan penyampaian PdP dapat membentuk kecemerlangan akal dan jasmani para pelajar sekali gus mendidik rohani berteraskan nilai dan akhlak. Hasil PdP dari hati ke hati melalui pendekatan P-TED dilihat memberi kesan positif melalui maklum balas pelajar dan buktinya dapat dilihat melalui pencapaian Penghasilan Pembelajaran (Programme Learning Outcomes) terhadap empat seksyen yang diukur berdasarkan sistem Outcome Based Learning (OBE).

Keywords: *Pengajaran dan Pembelajaran; Pdp; Hati Ke Hati; P-TED.*

Latar Belakang

Dalam Islam, Pengajaran dan pembelajaran (PdP) tidak hanya foKus kepada kecemerlangan akal dan jasmani semata-mata, bahkan juga kecemerlangan terhadap Pendidikan Rohani dan akhlak turut diambil kira. Kajian ini ingin melihat keberkesanan kaedah PdP dari hati ke hati yang telah dibangunkan oleh Amir Nason (2021) sebelum ini. Pendekatan yang dilaksankan mengambil kira analisis teks sirah empat Imam Mazhab muktabar iaitu merangkumi lima elemen utama. Pertama, kasih sayang; kedua, memahami kehendak murid; ketiga, pengamalan sunnah; keempat kesucian jiwa, dan kelima keberkatan ilmu. Kesemua elemen tersebut diterapkan dengan gabungan Pembelajaran Teradun (*Blended Learning*) iaiatu Konsep pembelajaran teradun menggabungkan pembelajaran tradisional secara bersemuka dengan pembelajaran dalam talian agar dapat melahirkan pelajar yang cemerlang dari segi akhlak dan juga berkemahiran dalam ilmu digital. Menurut Graham (2013), pembelajaran teradun (*Blended learning)* merupakan integrasi pengajaran secara bersemuka dan pengajaran dalam yang talian telah diterima pakai secara meluas di seluruh pengajian tinggi. Tambahan pula, pembelajaran teradun berasal daripada latihan korporat yang dilakukan dalam dunia perniagaan (Sharma & Barret 2007). Konsep pembelajaran teradun merupakan gabungan model pembelajaran tradisional iaitu secara bersemuka dengan pembelajaran secara dalam talian. Melalui kaedah pembelajaran secara teradun ini, pelajar akan lebih aktif semasa proses pembelajaran dan boleh mencari cara belajar yang sesuai untuk mereka. Tenaga pengajar bertindak sebagai fasilitator bagi memastikan keadaaan pembelajaran lebih kondusif serta terkawal. Justeru, P-TED diperkenalkan agar para pelajar bukan sahaja mampu meningkatkan dan memperkukuh kemahiran etika semata-mata, bahkan mereka juga mampu memantapkan elemen digital dalam kemahiran diri mereka. Sloam Consortium (2007) membezakan kursus secara dalam talian dengan menggunakan peratusan. Menurutnya, sejumlah 30-70% peratusan kandungan secara dalam talian merujuk kepada pelbelajaran teradun iaitu gabungan pembelajaran secara atas talian dan secara bersemuka. Perkara ini bermaksud, sebahagian besar pembelajaran adalah secara atas talian, menghantar tugasan dan sukatan pelajaran serta pembelajaran secara bersemuka atau dalam kelas turut diaplikasikan (Nursyazwani Zainul Abidin, 2015).

Objektif

Berikut adalah objektif Pengajaran dan Pembelajaran (PdP) dari Hati ke Hati Melalui Pendekatan P-TED:

1. Untuk menerapkan PdP dari hati ke hati agar membentuk kecemerlangan akal dan jasmani melalui pembelajaran teradun dan kolaboratif (P-TED).
2. Untuk mendidik rohani berteraskan nilai dan akhlak serta meningkatkan kemahiran digital pelajar melalui pembelajaran teradun dan kolaboratif (P-TED).

Novelty

PdP dari hati ke hati melalui pendekatan P-TED dapat memberi contoh yang baik kepada pelajar. Melalui kaedah ini, pelajar dapat mempelajari ilmu etika dan akhlak yang baik melalui tingkah laku pensyarah. Secara tidak langsung, pembelajaran secara teradun dan kolaboratif dapat memperkukuh kemahiran digital para pelajar melalui aspek kemahiran digital (PO6) dan pencapaian dalam etika, nilai dan profesional (ethics, values and professionalise) PO11.

Kebolehgunaan

Pengajaran dan Pembelajaran (PdP) dari Hati ke Hati Melalui Pendekatan P-TED merupakan konsep pembelajaran yang dilaksanakan oleh pelajar sepenuhnya dan mendapat bantuan dan bimbingan daripada pensyarah. Dalam melaksanakan tugasan, pensyarah menyampaikan ilmu dengan menggunakan konsep PdP dari hati ke hati kepada para pelajar. Konsep ilmu yang disampaikan mempunyai beberapa bentuk pelaksanaan dan melalui tiga fasa utama iaitu sebeleum, semasa dan selepas. Konsep yang dilaksanakan ini mampu memperkasakan Amalan Pendidikan Berimpak Tinggi (HIEP) iaitu dengan melakukan pembelajaran secara teradun.

Kesan Terhadap Pembelajaran Pelajar

Cabaran bagi kursus ini adalah mendidik para pelajar dengan menggunakan kaedah PdP dari hati ke hati melalui pembelajaran secara teradun. Pelajar bukan sahaja cemerlang dari segi akademik, malah turut berjaya dalam mendidik jasmanai dan rohani dalam kehidupan seharian.

Kreativiti

Pengajaran dan Pembelajaran (PdP) dari Hati ke Hati Melalui Pendekatan P-TED merupakan gabungan pengajaran secara autentik yang terdiri daripada sembilan elemen. Pertama, konteks autentik; kedua, tugas dan aktiviti autentik; ketiga, akses kepada prestasi pakar; keempat, pelbagai perspektif; kelima, kerjasama; keenam, refleksi; ketujuh, artikulasi; kelapan, bimbingan dan perancah, dan kesembilan adalah penilaian autentik (Herrington & Oliver, 2000). Justeru, gabungan pembelajaran teradun dan kolaboratif melalui auntentik dan senario mampu melahirkan pelajar yang mahir dalam kemahiran etika dan digital. Tambahan pula, kedua-dua pendekatan ini selari dalam usaha melahirkan pelajar yang tidak hanya cemerlang dari segi intelektual, tetapi juga dari segi nilai moral, etika, dan spiritual. Gabungan pendekatan ini dapat mewujudkan pembelajaran yang lebih berkesan dengan melibatkan aspek intelek, emosi, dan akhlak, serta mengasah kemahiran digital yang diperlukan dalam era moden ini.

Kaedah Penyelidikan

Sampel kajian ini melibatkan pelajar daripada empat seksyen berbeza yang mengikuti kursus Penghayatan Etika dan Peradaban (ULRS1182), di bawah Fakulti Sains (Sains Kimia), Kejuruteraan awam dan Fakulti Alam Bina bagi Sesi 2023/2024 Semester 1, dengan jumlah pelajar seramai 158 orang. Rajah 1 menggambarkan PdP dari hati ke hati terhadap gabungan proses penggunaan pembelajaran teradun dan pembelajaran kolaboratif. Tujuannya adalah bagi melahirkan pelajar yang memiliki akhlak yang baik dan serta berkemahiran dari aspek etika dan digital.

Elemen Pengajaran dan Pembelajaran (PdP) dari Hati ke Hati Melalui Pendekatan P-TED adalah melalui 3 fasa utama seperti berikut:

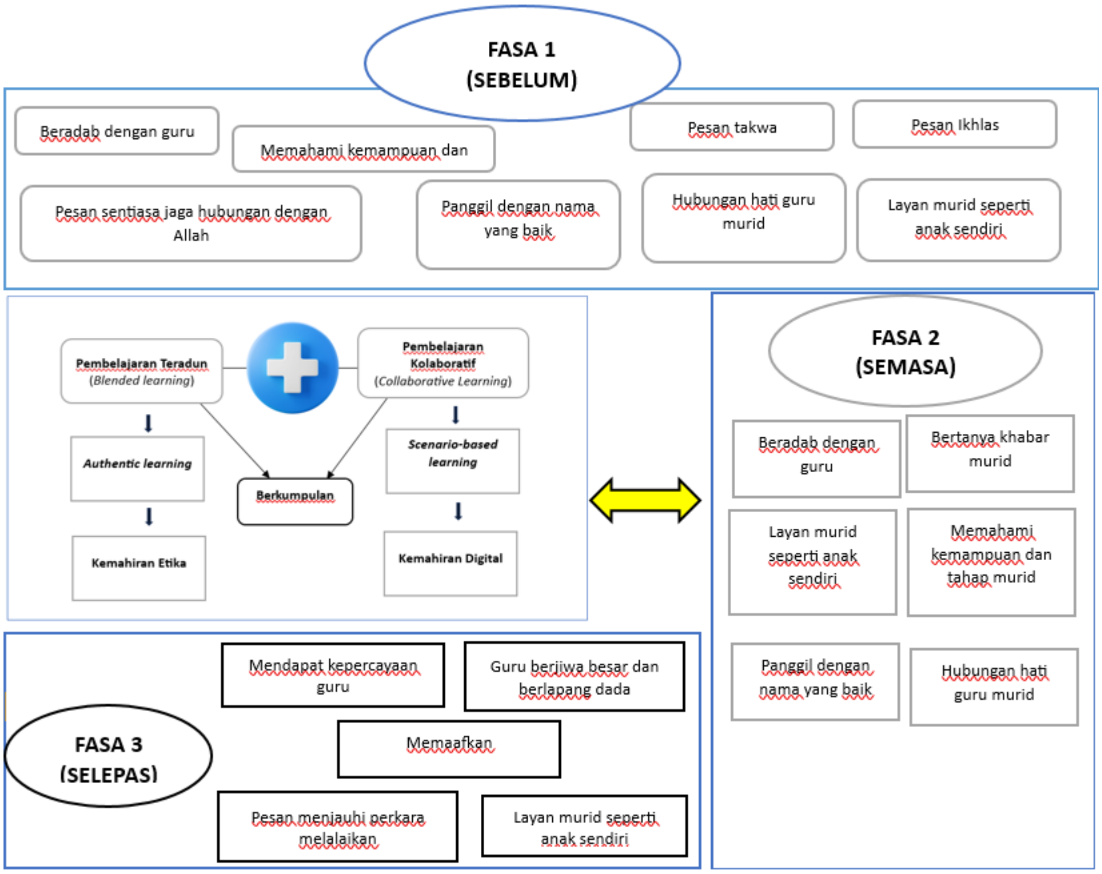
Fasa 1: Aplikasi Pendekatan Pdp Sebelum Pengajaran dan Pembelajaran
Menurut Amir Mohd Nason et. al., (2021), PdP dari hati ke hati berdasarkan sejarah terpilih empat imam mazhab merupakan satu pendekatan yang boleh dilaksanakan dalam sesuatu proses PdP. Meskipun pendekatan yang digunakan adalah secara tidak langsung, namun hasilnya dapat dirasai ketika pendekatan ini digunakan oleh pensyarah untuk diaplikasikan Pendekatan PdP dari hati ke hati menekankan kesucian jiwa seseorang pensyarah. Keadaan ini bermula dari kesedaran bahawa tugas pendidikan adalah amanah Allah SWT. Setiap pensyarah perlu membuang sifat mazmumah dan memiliki kekuatan dalaman serta kerohanian untuk melaksanakan tanggungjawab yang mencabar ini. Menurut al-Ghazali (2011), guru yang tidak mengamalkan ilmunya diumpamakan seperti kayu bengkok yang tidak menghasilkan bayang lurus. Hubungan antara guru dan murid perlu bermula dengan pesanan takwa, seperti ditunjukkan oleh Imam Malik kepada Imam al-Syafi'ie. Al-Zarnuji (1981) menekankan keikhlasan hati, manakala al-Kinani (2012) menyatakan tujuan pendidikan adalah untuk Allah SWT. Guru perlu mengawasi tingkah laku murid dan menasihati mereka supaya menjauhi perkara haram. Guru juga harus memenangi hati murid sebelum mengajar, seperti Imam Malik yang sering menjemput muridnya ke rumah. Pendekatan qalbu juga menekankan adab, dengan guru memanggil murid menggunakan nama baik. Selain itu, guru perlu mengenali latar belakang murid, seperti Imam Abu Hanifah yang membantu muridnya menghadapi kesusahan kewangan. Hubungan erat antara guru dan murid akan memudahkan pembelajaran dan meningkatkan keberkesanannya.

Fasa 2: Aplikasi Pendekatan PdP Semasa Pengajaran dan Pembelajaran
Pendekatan PdP dari hati ke hati menekankan kasih sayang dalam mengikat hati murid agar fokus dalam pembelajaran. Guru, seperti Imam Malik yang bertanya khabar murid, dapat membangkitkan semangat dan kesediaan mereka untuk belajar. Guru juga perlu menyesuaikan penyampaian mengikut kemampuan murid, seperti yang ditegaskan oleh al-Kinani (2012). Memanggil murid dengan nama yang baik meningkatkan rasa hormat dan mesra, menjadikan guru sebagai figura ibu bapa di sekolah. Contoh adab dari Imam Ahmad terhadap gurunya turut menekankan pentingnya penghormatan dalam hubungan guru dan murid.

Fasa 3: Aplikasi Pendekatan PdP Selepas Pengajaran dan Pembelajaran
Pendekatan PdP dari hati ke hati perlu diterapkan secara berterusan, bahkan selepas sesi PdP tamat, untuk memastikan kelangsungan ilmu. Hubungan guru dan murid harus berkekalan agar ilmu yang disampaikan terus bermanfaat. Guru perlu berjiwa besar, menerima kekurangan murid, dan mencari kaedah terbaik untuk membantu mereka mencapai tahap yang diinginkan. Di penghujung PdP, guru sebaiknya memberi pesanan yang mengingatkan murid untuk menjaga hubungan dengan Allah SWT, mendirikan solat, berakhlak baik, dan sentiasa berpegang teguh pada agama. Pada awal semester, pelajar telah diberi taklimat oleh pensyarah tentang proses pembelajaran yang melibatkan konteks pembelajaran secara teradun dan kolaboratif iaitu melibatkan pembelajaran secara bersemuka dan secara atas talian. Para pelajar dibahagikan kepada 5 kumpulan bagi melaksanakan aktiviti pembelajaran secara *authentic* dan *scenario-based.* Pembelajaran authentic dilaksanakan

bagi memastikan pelajar memahami situasi yang nyata dan sebenar disamping dapat menyelesaikan pelbagai masalah yang berkait dengan kemahiran etika. Disamping itu, pembelajaran *scenario-based* pula digunakan bagi mempamerkan kemahiran dan pengetahuan yang dikuasai oleh pelajar. Situasi sebenar diterangkan kepada pelajar kerana situasi tersebut mungkin akan ditemui dalam kehidupan sebenar. Pelajar akan lebih bermotivasi untuk menyelesaikan masalah secara intrinsik apabila scenario yang diberikan adalah lebih menarik (Hmelo-Silver, 2004). Justeru, pembelajaran secara scenario-based ini mampu meningkatkan tahap kemahiran digital para pelajar melalui rakaman dan suntingan video lakonan yang berkait dengan penghayatan etika.Terdapat beberapa aktiviti yang dilaksanakan secara berkumpulan oleh para pelajar bagi memastikan pelajar dapat berinteraksi dan bekerja secara dalam kumpulan. Berikut merupakan aktiviti yang dilaksanakan:

1) Berbincang dan menghuraikan definisi etika daripada pelbagai perspektif.
2) Membuat penulisan artikel berkenaan tamadun yang terpilih.
3) Membuat lakonan mengenai kehidupan masyarakat dalam pelbagai tamadun.
4) Membuat peta minda berdasarkan subtopik yang diberikan dengan menggunakan canva.
5) Membuat penulisan artikel akhbar mengikut kreativiti ahli kumpulan masing-masing berdasarkan tajuk yang dipilih.
6) Membuat video rumusan keseluruhan kursus berdasarkan kreativiti ahli kumpulan.



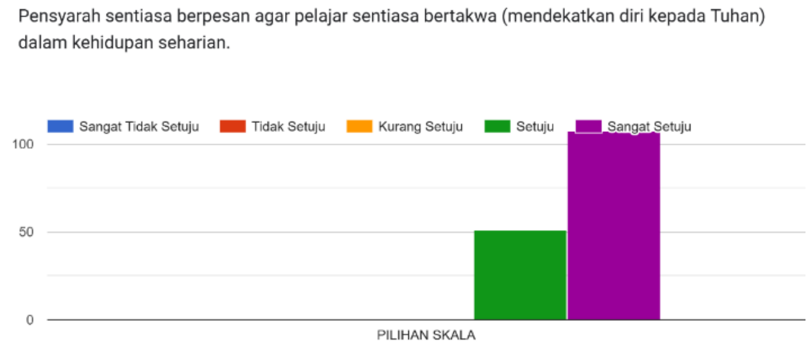
Rajah 1 dibawah menggambarkan kerangka kesulurhan bagi kaedah PdP dari hati ke hati melalui P-TED dilaksanakan.

Keputusan dan Perbincangan

Pengajaran dan Pembelajaran (PdP) dari Hati ke Hati Melalui Pendekatan P-TED menunjukkan peratusan yang memberangsangkan. Para pelajar menunjukkan maklum balas yang positif semasa sesi PdP berlangsung. Berikut disertakan hasil maklum balas daripada pelajar melalui edaran (*google form*) mengenai kaedah PdP yang dilaksanakan oleh pensyarah mengikut 3 fasa utama iaitu sebelum, semasa dan selepas.

Berdasarkan maklumbalas yang diperolehi pada Rajah Fasa 1, majoriti pelajar berpandangan sangat setuju bahawa pensyarah menunjukkan adab yang baik sewaktu minggu pertama kelas bermula. Hal ini kerana, pelajar merasai keikhlasan dan semangat untuk mendidik yang ada dalam diri pensyarah dilahirkan melalui adab dengan pelajar. Selain itu, pelajar bersetuju pensyarah sentiasa berpesan agar pelajar sentiasa bertakwa dengan mendekatkan diri kepada tuhan dalam kehidupan seharian. Hal ini menggambarkan bahawa pesanan Ikhlas dari hati ke hati pensyarah telah diterima oleh majoriti pelajar walaupun di kuliah minggu pertama.

Fasa 1: Sebelum sesi PdP

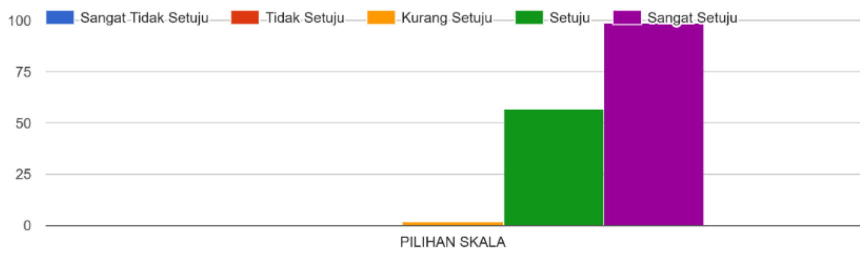


Seterusnya, pada Fasa 2 iaitu semasa sesi PdP berlangsung, majoriti pelajar sangat bersetuju bahawa pensyarah mengajar menggunakan pendekatan dari hati ke hati antara pensyarah dengan pelajar. Malah, majoriti pelajar turut sangat bersetuju pensyarah sering bertanya khabar atau keadaan pelajar. Pelajar dapat merasai keikhlasan dan kasih sayang dalam PdP yang diterapkan oleh pensyarah. Pendekatan ini adalah sangat diperlukan bagi melahirkan pelajar yang baik, beradab dan berbudi pekerti di dalam kehidupan mereka berdasarkan contoh perilaku dan keikhlasan serta kasih sayang yang dipamerkan oleh pensyarah.

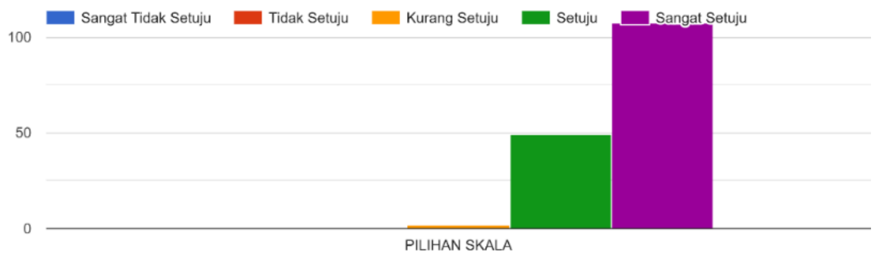
Fasa 2: Semasa sesi PdP

Selain itu, Rajah Fasa 3 adalah maklumbalas yang diterima oleh pelajar selepas kuliah berakhir. Di dalam fasa ini, terdapat dalam pelajar berhadapan dengan cabaran dan kekangan masa serta komitmen dalam tempoh PdP di universiti. Namun begitu, majoriti pelajar sangat bersetuju pensyarah sentiasa bersedia dalam menyelesaikan masalah pelajar sepanjang waktu meskipun waktu PdP telah tamat. Malah, majoriti pelajar turut sangat bersetuju bahawa pensyarah bersikap memaafkan sekiranya terdapat kesalahan dari pihak pelajar sepanjang waktu walaupun waktu PdP telah tamat. Hal ini boleh berlaku di dalam sesi PdP apabila pelajar tidak memberi perhatian di dalam kelas, mahupun melaksanakan tugasan sambil lewa, namun begitu, pensyarah masih boleh memaafkan kekurangan pelajar mereka, malah memberi sokongan untuk memberikan hasil yang terbaik sepanjang waktu PdP hingga tamat PdP.

FASA 3: Selepas sesi PdP
Pensyarah sentiasa bersedia dalam menyelesaikan masalah pelajar sepanjang waktu sekalipun waktu PdP telah pun tamat



Pensyarah bersikap memaafkan sekiranya terdapat kesilapan daripada pihak pelajar sepanjang waktu sekalipun waktu PdP telah pun tamat



Jadual 1 di bawah menunjukkan *programme learning outcomes* (PLO) bagi PL06 dan PLO11 untuk sekyen 2, 6, 4, dan 13.

Jadual 1 Purata Markah Pelajar Mengikut Seksyen

Penghasilan Pembelajaran ***Programme Learning Outcomes***	**SEKSYEN (Purata Markah %)**				**Purata KPI (%)**	**Catatan**
	2	**4**	**6**	**13**		
PLO6	84.5	88.6	82.5	87.3	85.7	100% pelajar melebihi 65%
PLO11	83.2	89.1	82.2	86.9	85.4	100% pelajar melebihi 65%

PLO6 menunjukkan pencapaian elemen kemahiran digital (DS) yang menunjukkan peratusan purata KPI sebanyak 85.7%, manakala PLO11 pula menunjukkan pencapaian dalam etika, nilai dan profesional (*ethics, values and professionalise*) iaitu 85.4% purata KPI. Kedua-dua PLO menunjukkan 100% pelajar yang melebihi 65%.

Kebolehgunaan dan Implikasi Pendidikan Berimpak Tinggi

Pendekatan P-TED juga bertujuan untuk memperkasakan Amalan Pendidikan Berimpak Tinggi (HIEP). Pelaksanaan pembelajaran secara teradun dan kolaboratif melalui pendekatan ini membantu dalam memperkukuhkan kemahiran digital pelajar serta kemahiran dalam etika dan profesionalisme. Pelajar terlibat dalam pelbagai aktiviti seperti penulisan artikel, lakonan, dan pembuatan video yang bukan sahaja mengasah kemahiran akademik mereka tetapi juga kemahiran insaniah dan digital.

Cabaran dan Penyelesaian dalam Melaksanakan PdP dari Hati ke Hati

Walaupun pendekatan ini membawa banyak manfaat, ia juga hadir dengan cabarannya. Menyampaikan PdP dari hati ke hati memerlukan kesungguhan dan pengorbanan dari tenaga pengajar untuk membina hubungan yang kukuh dengan pelajar. Ini termasuk mengurus emosi, mengenali latar belakang pelajar, dan memastikan bahawa pendekatan pengajaran yang digunakan sesuai dengan keperluan dan kemampuan pelajar. Untuk mengatasi cabaran ini, tenaga pengajar disarankan untuk sentiasa bersedia dan terbuka untuk belajar dan mengadaptasi pendekatan yang berbeza mengikut situasi. Mereka juga perlu terus berkomunikasi dengan pelajar untuk memahami cabaran yang dihadapi oleh pelajar dan membantu mereka mencari penyelesaian.

Kesimpulan

Secara keseluruhannya, PdP dari hati ke hati melalui pendekatan P-TED adalah satu pendekatan yang menyeluruh dan komprehensif dalam membentuk pelajar yang cemerlang dari segi akademik, rohani, dan jasmani. Melalui gabungan pembelajaran teradun dan pendekatan pengajaran yang berteraskan nilai dan akhlak, pelajar dapat belajar dalam persekitaran yang holistik dan kondusif. Ini seterusnya akan melahirkan pelajar yang bukan sahaja mahir dalam bidang akademik, tetapi juga beretika, berintegriti, dan berkemahiran tinggi dalam digital. Oleh itu, pendekatan ini perlu diteruskan dan diperkasakan lagi dalam pendidikan masa kini untuk menghasilkan pelajar yang berkualiti tinggi dan berdaya saing dalam menghadapi cabaran dunia sebenar.

Acknowledgement

Penyertaan bagi PdP dari hati ke hati ini merupakan rentetan daripada tajuk NALI pada tahun 20203 yang lepas iaituPenggunaan pembelajaran teradun dan kolaboratif bagi memperkukuh Kemahiran etika dan digital (P-TED). Tajuk tersebut berjaya merangkul pingat perak.

Rujukan

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ID 34: HRD CARNIVAL: Integrated Experiential Assessment

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Highlights: The HRD Carnival with Integrated Experiential Assessment is a dynamic event designed to assess and enhance students' cognitive and experiential learning. This carnival focused on the field of human resource development (HRD) through immersive, hands-on experiences. Participants take part in various activities such as quizzes, pitching, posters, and video competitions that simulate real-life challenges and allow them to demonstrate and improve their leadership, communication, problem-solving, and teamwork skills. This innovative approach, coordinated by the students, combines assessment with experiential learning and provides valuable insight into participants' skills and growth areas. The HRD Carnival fosters a collaborative environment that encourages interaction and knowledge sharing between HR professionals and participants. Through student leadership, the event seamlessly blends hands-on experience with assessment and ultimately aims to improve HR practices by integrating real-world challenges into the learning process.

Keywords: *Integrated Experiential Learning; Real-Life Simulation; Dynamic Event; Collaboration*

Introduction

The traditional assessment structure in HRD education places significant pressure on students to complete multiple assessments for individual courses, limiting opportunities for integrated learning experiences. There is a lack of collaborative platforms that connect students, industry stakeholders, and multiple courses in a cohesive project environment. This gap hinders students from fully developing essential skills and content knowledge in achieving Program Learning Outcomes (PLOs). Therefore, an integrated approach is needed to foster collaboration, enhance learning outcomes, and motivate active student participation, while also developing key graduate attributes.The HRD Carnival featuring the Integrated Experiential Assessment is an innovative event designed to assess and enhance students' cognitive and experiential learning in the field of Human Resource Development (HRD). This dynamic carnival provides participants with immersive, hands-on experiences through activities such as quizzes, pitching sessions, poster presentations, and video competitions. These activities simulate real-life HR challenges and allow students to demonstrate and hone their leadership, communication, problem-solving and teamwork skills.

By combining assessment and experiential learning integrated through year 1 until year 4 students, the HRD Carnival, coordinated by the HRD students, provides a unique platform for students to gain practical insights into their strengths and areas for growth, especially in Human Resource Development. This integrated approach not only promotes active learning but also fosters collaboration and knowledge sharing between HR professionals and students. The students who manage and coordinate HRD carnival can develop essential leadership, management, and teamwork skills while overseeing teams, managing resources, and coordinating logistics. The HRD carnival provides valuable networking opportunities that allow students to connect with HR professionals and industry experts, which can lead to internships, job prospects, and mentorship. They gain hands-on experience solving problems, applying theoretical knowledge to practical HR challenges, and improving their communication and public speaking skills through presenting ideas and competitions. Through its focus on experiential learning, the HRD Carnival aims to understand HR practices by preparing participants to navigate and excel in real-life HR scenarios, making it a valuable tool for developing future HR leaders.

Project or innovation objectives

The objectives of the HRD Carnival are:

(i) To alleviate students' pressure to complete the assessments for each course.

(ii) To serve as a platform to carry out projects for several related courses offered during the semester.

(iii) Foster collaboration among various stakeholders, particularly the industry, in conjunction with students.

(iv) Improving students' learning outcomes through the PLO involved.

(v) Enhancing the skills and attributes of UTM graduates among students in each cohort is the goal.

(vi) Provide attractive incentives to motivate students to participate actively in school-based activities.

Novelty

The HRD Carnival represents a novel approach to education by integrating experiential assessment within a transformative learning framework, closely aligning with Kolb's experiential learning with transformative learning theory. This innovation leverages the student learning roadmap Experiential Learning and Competency-Based

Education Landscape (EXCEL) under Industry Driven Experiential Learning (IDEAL) frameworks (Ministry of Higher Education, 2021) to guide learners through real-world applications. The HRD Carnival uniquely blends theory (Kolb's experiential learning, transformative learning, and HRD student learning roadmap) with practice by immersing students in industry-relevant scenarios, ensuring they understand and experience the complexities of the field. Furthermore, the HRD carnival exposes students to mini-research activities directly in class, allowing them to engage in the inquiry, data analysis, and presentation processes. These activities foster critical inquiry and practical problem-solving skills, bridging the gap between theoretical knowledge and real-world application. The HRD Carnival thus redefines student engagement by transforming traditional learning spaces into interactive platforms that prepare students to excel in their future careers with a deeper understanding of industry demands and research methodologies.

Creativity

The HRD Carnival embodies creativity by merging integrated experiential assessment with cutting-edge educational frameworks. The underpinning theory for HRD Carnival relies on the combination of experiential learning theory (Kolb, 2009) and transformative learning theory (Mezirow,1997). These theories have then been evolved by the Ministry of Higher Education through the implementation of Experiential Learning and Competency-Based Education Landscape (EXCEL) which serves as a framework aimed at transforming academic programs to produce lifelong learners, innovative adept entrepreneurs, creative practitioners, and change-makers. In HRD Carnival, the element of industry-driven experiential learning (IDEAL) served as the core foundation. This is because HRD Carnival aims to transform students' learning assessment which requires them to integrate with industry and involves a significant amount of experiential learning. Through HRD Carnival, students are expected to be (1) actively involved in the experience (e.g. poster, video, pitching competition, and managing HRD Carnival), (2) able to reflect on the experience (e.g. input from industry about the real task in the workplace through the assessment given like collecting data through interviewing company for creating the poster competition assessment), (3) able to conceptualize the experience (e.g. demonstration by industry worker through guest lecture and feedback by industry judges based on quizzes and competition in improving students' content knowledge and skills), and (4) able to experiment with the new ideas gained from the experience to gain genuine knowledge from an experience (e.g. establish facts behind work process in managing HRD Carnival and doing the courses assessment with industry). On top of IDEAL by EXCEL, HRD Carnival is also rooted in transformative learning theory where the students were expected to be more self-motivated, self-governing, rational, collaborative, and empathetic throughout their whole experience in HRD Carnival. Through HRD Carnival, each student will develop the ability to reflect on things that they may have taken for granted previously or were not quite aware of in the past (e.g. doing a course assessment for the sake of finishing it and getting marks) into something meaningful and more conscious about the course assessment after the involvement of real-world environment like the industry. These holistic educational experiences in HRD Carnival, ensure students who coordinate and participate in HRD Carnival are not only knowledgeable but also skilled and adaptable for their future careers.

Innovativeness

The HRD Carnival marks a significant shift from traditional assessment methods by embracing a research-led and industry-driven approach that immerses students in real-world contexts. Unlike conventional assessments that often focus on theoretical knowledge, the HRD Carnival integrates industry-infused challenges, enabling students to tackle problems directly relevant to current market demands. This approach ensures that learning is both practical and applicable, bridging the gap between academia and industry. Moreover, the HRD Carnival was coordinated by students, encouraging students to take on leadership roles, collaborate with peers, and manage projects, thus fostering essential soft skills such as teamwork, communication, and problem-solving. This innovative model not only enhances learning outcomes but also equips students with the experience and confidence needed to excel in their future careers.

Applicability

HRD Carnival implements blended learning, where it combines online (e.g. online industrial talk, video competition, and quizzes) with in-person activities (industrial talk, poster, and pitching competition), offering a flexible approach that caters to diverse learning styles while ensuring continuous engagement. Outcome-based education is at the core of the HRD Carnival, with each activity meticulously designed to achieve specific learning outcomes (PO3 - PO11) aligned with CLO in each course, ensuring that students not only acquire knowledge but can also apply it in real-world contexts. By emphasizing problem-based learning, the HRD Carnival immerses students in industry-relevant challenges, encouraging them to think critically and solve complex problems, which deepens their understanding and prepares them for future professional scenarios. Additionally, the HRD Carnival incorporates High Impact Education Practices (HIEPs) through its focus on experiential integrated assessments and mini-research activities, providing students with meaningful, hands-on learning experiences that are proven to enhance retention and engagement. This innovative approach not only aligns with but also amplifies the NALI framework, ensuring that students are actively involved in their learning journey, gaining the skills and knowledge necessary to excel in both academic and professional settings.

Impact

The increasing significance of "Functional Work Skills with Focus" (DO3) and "Personal and Entrepreneurial Skills" (DO4) in educational programs can be linked to various interrelated elements that are influencing the contemporary workplace and economy. The fast rate at which technology is advancing has led to a need for graduates who have both academic knowledge and practical, flexible abilities that can be quickly used in many work situations. Employers now highly value functional work abilities due to the transition toward new technologies, and they are looking for applicants who can successfully navigate and utilize these technologies.

Universities are adapting to evolving student expectations and incorporating feedback from corporate partners. Modern students are increasingly looking for an education that offers practical and relevant skills for their future professions, which closely aligns with the aims of these Program Learning Outcomes (PLOs). Simultaneously, companies are offering feedback to educational institutions regarding the significance of these skill sets in the workplace, which is impacting curriculum design and learning results.

The intense competitiveness of the present employment market further enhances the growing importance of these PLOs. With the increasing number of graduates joining the job market, those who possess robust functional work skills and entrepreneurial talents are particularly attractive to prospective employers. These abilities not only improve the chances of getting a job but also provide graduates with the means to create their prospects in case there are few conventional career options available. Finally, the significance of these PLOs is increasing each year as they directly cater to the changing requirements of students, companies, and the global economy. They equip graduates with the skills necessary to navigate and thrive in a progressively intricate and dynamic professional environment.

Research Methodology

HRD carnival has been conducted for three consecutive years which were conducted in the session of 2021/2022 Semester 1 (fully online), 2022/2023 Semester 1 (blended), and 2023/2024 Semester 1 (blended). The total of students involved in these three consecutive semesters is 389 students for 2021/2022 Semester 1, 340 students for 2023/2024 Semester 1, and 436 students for the 2023/2024 Semester 1. There were nine number of courses involved in 2021/2022 Semester 1, six courses involved in 2022/2023 Semester 1, and eleven courses involved in 2023/2024 Semester 1. Figure 1 illustrates the design of HRD Carnival implementation based on each year. In HRD Carnival, a group of students was assigned to coordinate and manage the HRD Carnival. These students were taking courses that related to managing a program, hence the HRD Carnival serves as their assessment method for their course. To begin the HRD Carnival, all the courses and assessments related to the carnival were identified. Then, the managing students will coordinate all the assessment activities in HRD Carnival including industrial talks, quizzes, and competitions. HRD Carnival was started by the Opening ceremony in the earlier week of the semester and some of the industrial talk has been started. In between that, several competitions and activities are happening which include quizzes, poster competitions, and video competitions. The closing ceremony of the HRD Carnival was conducted around the final weeks of the semester with some more industrial talk and other competitions such as poster and pitching competitions. Throughout the activities in HRD Carnival, a total of ten experts from industries were involved in giving their insights. In addition, HRD Carnival also gets involvement from the International College of Yayasan Melaka (ICYM) as our HRD franchise program.

Finding and discussion of the project

Overall, 83.1% think HRD Carnival is excellent, with 16.9% thinking it is fair. As a result, the students who enrolled in the program had a more positive perception and acceptance. Aside from that, no students scored poorly on the HRD Carnival. Meanwhile, the majority of students (93%) agree that the HRD Carnival should be a yearly event at the School of Human Resource Development and Psychology. In addition, the data in Table 1 show an increase in KPI from PO3 to PO11 for all courses (by year of study) involved in the HRD Carnival over the last three intakes. These findings demonstrated that the successful implementation of HRD Carnival resulted in improved functional work, personal and entrepreneurial skills, and ethics and professionalism skills, which outperformed traditional assessments.

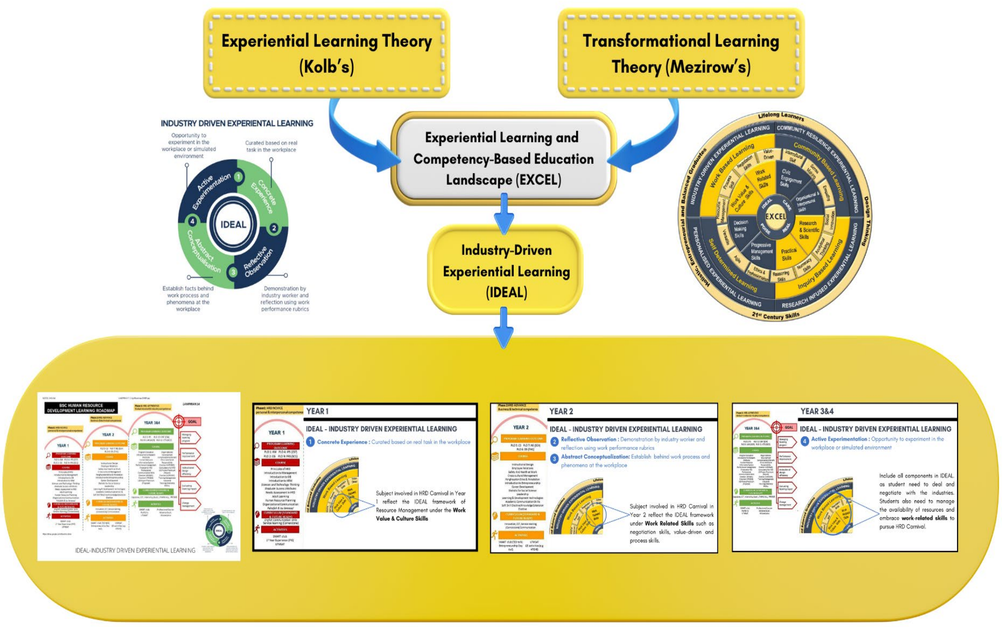

Figure 1: The design of HRD Carnival implementation

Table 1: Differences of KPI among POs for three different intakes by year of study.

YEAR	Courses	Intake	Knowledge & Understanding (C1)	Cognitive Skills (C2)	Functional Work Skills (C4)						Personal & Entrepreneur Skills (C4)		Ethics and Professionalism Skills (C5)
			PO1 (KW)	PO2 (CG)	PO3 (PS)	PO4 (IPS)	PO5 (CS)	PO6 (DS)	PO7 (NS)	PO8 (LAR)	PO9 (PRS)	PO10 (ENT)	PO11 (ETS)
YEAR 1	SHMR 1063 Introduction to Management	20232024	0.85	0.62							1.00↗		
		20222023	0.54	0.93							0.98↗		
		20212022	0.68	0.88							0.82		
	SHMR 1073 Introduction to OB	20232024	0.71	0.93		0.96↗							
		20222023	0.72	0.88		0.85↗							
		20212022	0.75	0.86		0.85							
	SHMR 1083 Introduction to HRM	20232024	0.63	1.00		1.00↗							
		20222023	0.72	0.90		0.92↗							
		20212022	0.75	0.94		0.66							
YEAR 2	SHMR 2023 Instructional Design	20212022	0.64					0.90↗					
		20202021	0.63					0.89↗					
		20192020	0.80	0.94				0.87					
	SHMR 2033 Industrial Relations Law	20212022	0.72	0.84				0.91↗					
		20202021	0.70	0.84				0.90↗					
		20192020	0.67	0.83				0.90					
	SHMR 2103 Safety And Health at Work	20212022	0.66	0.90									1.00↗
		20202021	0.71	0.72									0.99↗
		20192020	0.73	0.82									0.98
YEAR 3	SHAR 3013 Program Evaluation	20202021	0.74	0.83	0.78↗								
		20192020	0.66	0.77	0.78↗								
		20182019	0.78	0.80	0.78								
	SHAR 3023 HR Information System	20202021	0.86	0.93								0.92↗	
		20192020	0.73	0.82								0.88↗	
		20182019	0.68	0.83								0.87	
	SHMR 3033 Intro to RM	20202021	0.76	0.74					0.92↗				
		20192020	0.79	0.84					0.83↗				
		20182019	0.74	0.75					0.81				
YEAR 4	SHAR4033 Compensation and Benefit	20192020	0.81	0.73					0.97				
		20182019	0.72	0.80									
		20172018	Not Offered										
	SHAR3073 Training Management	20192020	0.86	0.95↗				0.97↗					
		20182019	0.77	0.94				0.83					
		20172018	Not Offered										

Commercialization potential

The HRD Carnival can be further commercialised by developing a handbook focusing on integrated experiential-based assessment. Once copyrighted, this handbook could become a valuable resource for educators from a variety of institutions. Furthermore, the framework developed may be copyrighted and included in the handbook.

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ID 35: Implementation of the Agile Approach in Film Production Subject: A Case Study of Public Vocational High School 10 Bandung

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Highlights: This study explores the implementation of the Agile approach in film production management elements within the Film Production subject at Public Vocational High School 10 Bandung. Through a case study, Agile methods were applied to enhance learning effectiveness through adaptive and iterative techniques. The results indicate that Agile values and principles, such as short iterations and continuous feedback, can be effectively implemented, improving student collaboration and flexibility in facing changes. This implementation encourages students to be more proactive and adaptive, preparing them for the dynamic film industry. The study provides evidence that Agile can be successfully applied in vocational education, particulary in film production management element.

Keywords: *Agile; Film Production Management; Vocational Education; Collaboration.*

Introduction

The film industry is characterized by its dynamic and ever-evolving nature, requiring educational institutions to adopt innovative teaching methodologies that equip students with the necessary skills to thrive in this competitive field. Traditional pedagogical approaches often fall short in bridging the gap between academic training and the practical demands of the film industry, leading to graduates who may lack the hands-on experience and adaptability required for real-world film production. To address this challenge, this study investigates the implementation of the Agile approach in the Film Production subject at Public Vocational High School 10 Bandung. Agile methodologies, renowned for their adaptability, iterative processes, and focus on continuous improvement, have been widely adopted in various industries, particularly in software development. However, their application in film production education remains underexplored. This study aims to fill this gap by integrating Agile values and principles into the film production curriculum, thereby enhancing learning effectiveness, fostering student collaboration, and increasing flexibility in managing production projects. Ultimately, the goal is to prepare students more effectively for the dynamic and fast-paced environment of the film industry.

Content

This project aims to revolutionize the Film Production Management curriculum at Public Vocational High School 10 Bandung by incorporating Agile methodologies. The primary objectives are to enhance learning effectiveness, improve student collaboration, increase flexibility, and better prepare students for the dynamic demands of the film industry. Specifically, the project seeks to:

Enhance Learning Effectiveness: By implementing Agile techniques, the project aims to create a more adaptive and iterative learning environment. This involves breaking down the learning process into manageable iterations, allowing for continuous feedback and improvements.

Improve Collaboration: Agile practices emphasize teamwork and communication, which are crucial in film production. The project aims to foster better collaboration among students, enhancing their ability to work together on film production projects.

Increase Flexibility: Film production often involves unexpected changes and challenges. By equipping students with Agile skills, the project aims to improve their ability to adapt to these changes and develop resilience.

Prepare for Industry Demands: The project aims to ensure that students are well-prepared for the dynamic needs of the film industry by providing practical, hands-on experience with Agile methodologies.

The NALI (Novelty, Applicability, Limitations, Impact) approach is central to the research, emphasizing the innovation and relevance of Agile methodologies in the educational context:

Novelty: This project represents one of the first attempts to systematically integrate Agile methodologies into a film production management curriculum at the vocational education level. It explores uncharted territory in educational innovation.

Creativity: By adapting Agile principles traditionally used in software development, the project creatively applies them to the context of film production, requiring significant customization and innovation.

Innovativeness: The project introduces a new pedagogical approach that moves away from traditional, linear teaching methods towards a more flexible, iterative learning process.

Applicability: Agile methodologies are highly adaptable, making them suitable for the dynamic and collaborative nature of film production. This project will demonstrate their applicability in an educational setting.

Impact: The implementation of Agile practices is expected to significantly enhance student engagement, collaboration, and adaptability, resulting in better-prepared graduates who can effectively navigate the film industry.

The research methodology involves several key phases:

Design and Development: The project begins with the creation of an Agile-based curriculum for the Film Production Management subject. This includes developing lesson plans, project modules, and evaluation criteria that align with Agile principles.

Training: Teachers are provided with comprehensive training sessions to familiarize them with Agile methodologies and their application in the classroom. This ensures that educators are well-equipped to implement the new curriculum effectively.

Implementation: The Agile-enhanced curriculum is executed in a controlled classroom environment. Students work on film production projects in iterative cycles, known as sprints, which allow for regular assessment and feedback.

Data Collection: Data is gathered through various methods, including surveys, interviews, classroom observations, and analysis of project outcomes. This data helps assess the effectiveness of the Agile approach.

Analysis: The collected data is analyzed to identify trends, strengths, and areas for improvement. Statistical methods are used to measure the impact of Agile methodologies on student performance and engagement.

Feedback and Iteration: Regular feedback sessions with students and teachers are conducted to refine the approach and make necessary adjustments. This iterative process ensures continuous improvement.

Preliminary findings from the project indicate several positive outcomes:

Enhanced Student Engagement: Students are more engaged and motivated when learning through Agile methods, as evidenced by increased participation and enthusiasm in class activities.

Improved Collaboration: Students working in Agile teams show better collaboration and communication skills, leading to more cohesive project outputs and a stronger sense of team responsibility.

Greater Flexibility: Agile practices enable students to adapt more readily to changes and challenges, demonstrating improved problem-solving skills and resilience.

Discussion: The study highlights the potential of Agile methodologies to transform vocational education by aligning teaching practices more closely with industry requirements. It also underscores the need for ongoing training and support for teachers to fully realize the benefits of this approach.

The successful implementation of Agile methodologies in the Film Production Management curriculum at Public Vocational High School 10 Bandung could have broader implications:

Commercialization Potential: The approach could be extended to other vocational and technical education programs, creating opportunities for educational institutions to adopt similar methodologies.

Scalability: The project model is scalable and adaptable to different educational contexts, making it a versatile solution for various disciplines and industries.

Collaboration with Industry: Establishing partnerships with film production companies and industry professionals can enhance the practical relevance of the curriculum and provide students with valuable networking opportunities.

Future Research: Further studies could explore the long-term impact of Agile methodologies on student career outcomes and industry success, providing deeper insights into the effectiveness of this innovative educational approach.

By integrating Agile methodologies into the Film Production Management curriculum, Vocational High School 10 Bandung aims to set a precedent for modern, industry-relevant education that prepares students for successful careers in the dynamic field of film production.

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ID 36: ScenarioDeThink: Enhancing Student Learning Performance and Practical Skills in Counseling

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Highlights: ScenarioDeThink is an innovative approach designed to enhance students' learning performance and practical skills in counseling courses. Utilizing scenario-based learning and design thinking, it aims to improve students' learning performance and counseling skills through role-plays and interactive activities. Implemented with 45 students in two sections of an introductory counseling course, the program includes simulations, classroom role-plays, and an "explorace" activity with six themed checkpoints. These learning activities, designed through a double-loop process by both instructors and students, promote experiential learning, active participation, and practical application of counseling theories and skills, providing a more engaging and effective educational experience.

Keywords: *Scenario-Based Learning; Design Thinking; Counseling; Learning Performance*

Introduction

Counseling education requires a balance between theoretical knowledge and practical skills which can be challenging to achieve through traditional teaching methods. To address this, ScenarioDeThink was developed as an innovative pedagogical approach aimed at enhancing students' learning performance and practical skills in counseling courses. By using ScenarioDeThink, students can gain a deeper understanding, increased motivation, and sustained attention in their learning process. This is because sometimes students lack attention especially when learning about theory in the class. Thus, this approach addresses the issue of students' disengagement, particularly when faced with theory-heavy content, by integrating active, scenario-based learning with design thinking principles.

ScenarioDeThink approach combines scenario-based learning which is led by the instructor with double-loop design thinking, where students play an active role in designing and developing learning activities. Through interactive scenarios, role-plays, and problem-solving tasks, students are encouraged to apply theoretical knowledge in a real work environment, especially in counseling settings. Integrating design thinking empowers students to actively engage in their learning by researching to develop activities such as the *explorace* challenge, fostering creativity, critical thinking, and collaboration. Thus, ScenarioDeThink was developed to make the learning environment more hands-on, relevant, and enjoyable to cater to students' attention, motivation, and engagement in the classroom.

Objective

The objectives of ScenarioDeThink are:

- To enhance students' learning performance using ScenarioDeThink in counseling courses.
- To improve students' practical counseling skills by using ScenarioDeThink in counseling courses.

Novelty

ScenarioDeThink is a cutting-edge innovation tailored for counseling courses, integrating scenario-based learning with double-loop design thinking to create a dynamic and reflective learning environment. The approach uses real-life counseling scenarios to enhance students' problem-solving skills, allowing them to practice client interactions, ethical decision-making, and therapeutic strategies in a safe, controlled setting. The novelty lies in the double-loop application of design thinking for instructors and students. Instructors use the first-loop design thinking process to iteratively design and refine these scenarios based on feedback, ensuring they are aligned with students' evolving needs. Meanwhile, students engage in the second-loop design thinking process, which involves brainstorming, prototyping, and testing counseling techniques within the scenario, fostering creativity and adaptability. Moreover, ScenarioDeThink integrates research activities into the learning experience, where students gather data, analyze counseling outcomes, and reflect on their approaches. This exposure to research equips students with critical skills for evidence-based practice, enhancing their competence as future counselors.

Creativity

ScenarioDeThink enhances creativity in counseling courses by integrating the theory of situated learning by Lave and Wenger (1991) with the design thinking approach by Keller (2009). Situated learning immerses students in authentic counseling scenarios, allowing them to acquire skills through real-world experiences and reflective practice. This method fosters a deep connection between theory and practice, as students learn by engaging in meaningful, context-based activities. By incorporating double-loop Keller's design thinking, the approach encourages both instructors to design learning and students to experience learning processes through engaging in iterative problem-solving, including exploring, prototyping, and refining counseling strategies. This combination nurtures innovation, adaptability, and critical thinking, promoting an active and immersive learning environment

Innovativeness

The innovativeness of ScenarioDeThink is the combination of scenario-based learning and a double-loop design thinking framework to teach counseling courses for psychology students. The role of scenario-based learning gives the vibes of a real environment to students in handling counseling sessions. Additionally, the implementation of double-loop design thinking gives students room to improve their problem-solving and practical skills, especially in counseling courses. It is proven by the student's feedback as shown below:

"Explorace dapat membantu saya dalam mengenal pasti tentang asas kaunseling seperti confrontation, paraphrasing and summarizing."

"Explorace ini berkait dengan apa saya belajar di dalam kelas, ia sangat membantu saya dalam mengapalikasikan kemahiran di dalam kelas di luar kelas."

"Sebagai fasi saya perlu membuat sedikit research dengan apa yang sesuai dengan kaunseling serta permainan ini. Oleh sebab itu la, saya boleh ingat sampai sekarang."

"Ya, memang saya ada buat sedikit research about basic counselling. Oleh sebab saya betul-betul asah bakat saya sebab saya masih terkapai-kapai dalam belajar kaunseling. Tetapi alhamdulillah saya faham and research tu dapat membantu saya untuk bagi markah kepada setiap peserta."

"Lebih memahami dengan lebih dalam dan lebih ingat akan skill kaunseling yang ada dalam explorace ini. Sangat membantu dalam final exam."

Applicability

ScenarioDeThink adopts a student-centered approach by placing learners in scenario-based counseling situations where they must apply critical thinking and decision-making skills, enabling them to take an active role in their learning journey. Students take ownership of their learning through interactive, scenario-based exercises that mimic real-world counseling challenges, enhancing their problem-solving and decision-making skills. This active involvement fosters a deeper understanding of counseling theories and practices. Scenario-based learning is at the core of ScenarioDeThink, where students navigate authentic counseling situations. This immersive approach promotes student experience in learning, bridging the gap between theory and practice. Additionally, ScenarioDeThink aligns with outcome-based education by focusing on specific, measurable learning outcomes, especially for students learning performance and counseling practical skills. By integrating student-centered learning, scenario-based experiences, and outcome-driven goals, ScenarioDeThink offers a comprehensive and impactful approach to developing future-ready counselors.

Impact

The innovative ScenarioDeThink approach significantly enhances student learning performance by immersing them in real-life counseling scenarios, fostering active engagement and critical thinking. Through this method, students hone practical counseling skills such as confrontation, reflection, paraphrasing, summarizing, empathy, and questioning, while reinforcing ethical considerations. These scenarios simulate complex client situations, enabling learners to practice and refine their techniques in a safe environment. Furthermore, it also cultivates critical thinking, decision-making, and empathy, which are crucial for future counselors. By involving students in the design and execution of activities like *explorace*, the approach encourages collaborative learning and creativity, ultimately resulting in improved practical skills, confidence, and readiness for real-world counseling scenarios.

Research Methodology

The sample of this study was the students from two sections of Introduction to Counseling in Semester 2, with a total student of 45. At the beginning of the semester, students were briefed by the instructor about the learning process, especially about the activities and assessments that were conducted throughout the semester. Figure 1 illustrates the whole teaching and learning process using ScenarioDeThink to enhance students' learning performance and practical skills in counseling sessions.

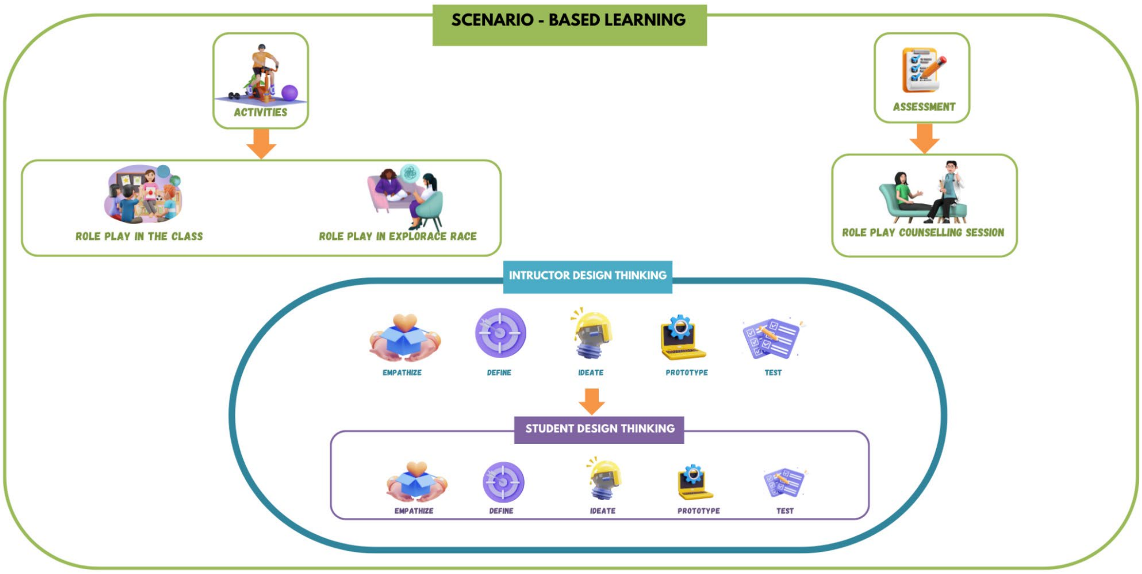

Figure 1: Teaching and learning process of ScenarioDeThink Framework

As mentioned above, ScenarioDeThink uses scenario-based learning which is divided into two categories, activities and assessment. For the assessment, the instructor gives instructions about the assessment that students need to do for this semester. Students are required to do counseling simulation through role-play in the group project and using techniques and skills in counseling sessions. The students will do counseling simulation in the group and do the role play based on the real issue or scenario by others' experience. The students will choose to do individual counseling, group counseling, or family counseling. During the simulation, the instructor will observe the process, techniques, and skills that have been used by the students.

For the activities in the class, instructors use two types of assessment which are role play in the class and role play in *explorace*. For the role-play in the classroom, the instructor will give a lecture first and give some role-play in the class. The instructor will randomly assign students to do role play with the instructor to become a client or counselor. In addition, the instructor also assigned students to do role play in the classroom to play as counselor and client based on the theory that has been learned as an activity after learning the theory.

Next, ScenarioDeThink uses a design thinking framework to develop activities for role play in *explorace*. In ScenarioDeThink, there are double-loop design thinking frameworks which are for instructor and student. The first loop of design thinking in ScenarioDeThink is based on the instructor which consists of five elements explained as follows:

1. **Empathize:** In this stage, the instructor will do some research based on students' needs. The instructor observes students' needs in learning counseling subjects and the observation is done through one semester.
2. **Define:** The instructor will identify the problem and students' needs. For this stage, the instructor identifies that there is too much theory for traditional teaching and learning in counseling subjects as well as a lack of student attention in the classroom. Thus, the instructor identifies that the teaching and learning process must be more interactive and practical to get student attention and be more interesting.
3. **Ideate:** The third stage is where the instructor needs to challenge assumptions and create ideas. For this stage, the instructor uses scenario-based learning (activities and assessment) and a design thinking framework to create ScenarioDeThink. At the same time, the instructor also considers the possible challenge that will be faced which is time and commitment because all the students are final year students.
4. **Prototype:** In this stage, the instructor needs to start creating the solution by applying scenario-based learning in which the instructor uses role-play with students in the classroom (activity) as well as after the explorace (assessment). The instructor also uses a design thinking framework for both the instructor and the student.
5. **Test:** This is the stage where the instructor will implement the idea in the current semester. For this ScenarioDeThink, the instructor uses two sections as an experiment group and one section as a control group.

The second loop of design thinking is referred to as the student learning process which is explained as follows:

Empathize: The student needs to understand the knowledge and theory of the course interactively and practically. They also need to implement practical knowledge in real-life situations.

Define: The problem faced by students was they were not experts on the theory and lack of background knowledge about the course. Thus, the student needs practical experience.

Ideate: The instructor assesses the student which student needs to conduct and design the *explorace*. The students need to find suitable games and activities based on the theme given. The possible challenges that the student will face are the location of the *explorace*, time, duration between one checkpoint, and match between the game and content.

Prototype: In this stage, the student will test the design game between facilitators.

Test: For the last stage, students will implement the *explorace*.

The instructor gives a briefing to 12 students that will act as facilitators to handle the *explorace*. The instructor gives a theme for the student to research and design the activities and games that can be used in the *explorace*. The game and activities must match the content, theory, and skills that have been taught in the classroom. The *explorace* is designed by the students and has six checkpoints which are Counseling Tic-Tac-Toe, Role-Play Interview Counseling Session, Ethical Dilemma Challenge, Ethics Escape Room, Skills Relay Race, Counseling Skills Scavenger Hunt. After completing the *explorace*, participants that have higher scores and the fastest will get the reward.

Finding and Discussion

The findings in Table 1 show that the students in Group 1 and Group 2 are much higher in learning performance for the subject Introduction to Counseling (Group 1 – 100%; Group 2 – 92%). This demonstrates that most of the students in this course get Grade A after learning using ScenarioDeThink. Looking at practical counseling skills, the students with ScenarioDeThink achieve a high level which is 100% for Group 1 and 92% for Group 2. These findings show that the students now are fully equipped with the aim of this course to make sure they can practically apply counseling skills in a real working environment.

To compare, students who did not implement ScenarioDeThink in their teaching and learning process, have a lower number for learning performance which is 79%. The practical counseling skills of the students without ScenarioDeThink are also slightly lower than the group of students who use ScenarioDeThink (84%).

Table 1: Students' learning performance and practical counseling skills.

	Group	Learning Performance	Practical Counseling Skills
With ScenarioDeThink	Group 1	100%	100%
	Group 2	92%	92%
Without ScenarioDeThink	Group 3	79%	84%

Commercialization Potential

To facilitate the seamless integration of ScenarioDeThink into classrooms, we will develop comprehensive training materials, including detailed guides and interactive workshops. These resources will be complemented by ready-to-use lesson plans and templates, designed to empower educators with practical tools for immediate application. To ensure the uniqueness and integrity of the approach, we will secure intellectual property protection through copyrights. Additionally, partnerships with respected educators will be established to endorse and validate the framework, further enhancing its credibility. Strategic marketing and outreach efforts, such as Mental Health ShamZye Aims and ATMA Psychology Center will be implemented to drive widespread adoption in industrial settings.

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ID 39: Transforming Macroeconomics: Research-Driven Learning

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Highlights: The project "Transforming Macroeconomics: Research-Driven Learning" empowers students by integrating hands-on research into their education. It enhances critical thinking, bridges theory with real-world applications, and encourages self-directed learning. Students gained practical skills, engaged in real-time economic analysis, and saw their work published in proceedings, boosting their academic credentials. The project aligns with NALI by promoting active, student-centered learning and has significant sustainability value by fostering lifelong learning and employability

Keywords: *Research-Driven Learning; Critical Thinking; Real-World Application*

Introduction

The "Transforming Macroeconomics: Research-Driven Learning" project revolutionizes traditional macroeconomic education by embedding real-world research into the curriculum. This innovative approach shifts the focus from purely theoretical study to practical, hands-on analysis of current economic trends, particularly within the ASEAN region. Students are encouraged to take ownership of their learning through independent research, fostering critical thinking and a deeper understanding of complex economic issues.

Through this project, students not only develop practical skills in data analysis and problem-solving but also see their efforts recognized through the publication of their research in formal proceedings. This recognition not only boosts their academic credentials but also provides them with invaluable experience that bridges the gap between academic study and real-world economic application, preparing them for future careers in the field.

Figure 1: Poster of the AMRA'24

Project objectives

Encourage Hands-On Research: Engage students in practical macroeconomic analysis to apply theoretical concepts to real-world economic issues.

Develop Critical Thinking: Enhance students' ability to critically analyze economic trends and make informed decisions based on data-driven insights.

Bridge Theory and Practice: Facilitate the connection between academic theory and practical application, allowing students to understand the real-world implications of macroeconomic policies and trends.

Promote Student-Centered Learning: Empower students to take ownership of their education through self-directed research, fostering independence and lifelong learning skills.

Relevance of Sustainable Development Goals

The project aligns with SDG Goal 4: Quality Education and SDG Goal 8: Decent Work and Economic Growth by fostering a learning environment that emphasizes practical, research-driven education. By engaging students in real-world economic analysis, the project contributes to their understanding of sustainable economic practices and equips them with the skills necessary for promoting inclusive and sustainable economic growth. This approach ensures that students are prepared to contribute meaningfully to achieving global sustainable development objectives.

Innovativeness

The "Transforming Macroeconomics: Research-Driven Learning" project introduces a novel approach by embedding research directly into the learning process, allowing students to learn by doing rather than through traditional theoretical study. This method encourages students to actively engage with real-time economic issues, particularly within the ASEAN region, making their education relevant and impactful. The project also promotes student-centered learning, empowering students to take control of their education through self-directed research, thereby fostering independence, critical thinking, and a deeper connection between academic concepts and their practical applications.

Significance of Novelty

The project stands out for its pioneering integration of research directly into macroeconomics education, a unique approach that shifts the focus from passive learning to active, hands-on engagement. By encouraging students to apply macroeconomic theories to current ASEAN economic trends, the project fosters a deeper understanding of real-world economic issues. This approach not only enhances critical thinking and problem-solving skills but also provides students with tangible, practical experience that directly contributes to their academic growth and future employability. The novelty lies in the real-time application of theory to practice, making the learning process more dynamic and impactful.

Impact on Students' Learning

The "Transforming Macroeconomics: Research-Driven Learning" project has a profound impact on students' educational experience. By engaging in hands-on research and real-world economic analysis, students significantly enhance their critical thinking and problem-solving abilities. The project fosters deeper engagement with course material, leading to a better understanding of complex macroeconomic concepts. Additionally, the practical skills developed through this approach, such as data analysis and independent research, greatly improve students' academic performance and prepare them for future careers. The publication of their work in formal proceedings further boosts their confidence and academic credentials, providing recognition for their efforts and contributions.

Sustainability Value for the Students

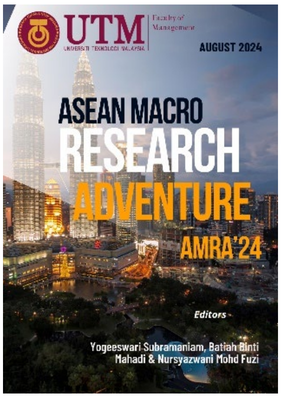
The project instills lasting sustainability values in students by equipping them with critical skills and knowledge that extend beyond the classroom. Through active participation in research and real-world economic analysis, students develop a strong foundation in critical thinking, problem-solving, and data analysis, which are essential for lifelong learning and adaptability in a rapidly changing world. This experience not only enhances their employability but also prepares them to contribute meaningfully to sustainable economic practices. By bridging theory with practical application, the project fosters a mindset oriented toward continuous learning and sustainable development, ensuring that students are well-prepared to address future challenges in their professional lives.

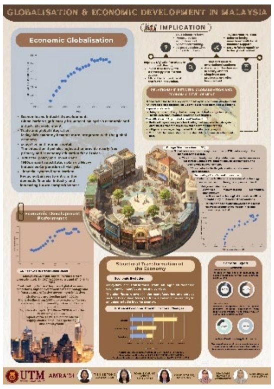
Applicability to NALI

The "Transforming Macroeconomics: Research-Driven Learning" project aligns seamlessly with the New Academia Learning Innovation (NALI) framework by promoting active, experiential education. The project's focus on research-led learning encourages students to engage directly with real-world economic challenges, fostering independent, critical thinking and self-directed learning. By bridging the gap between theory and practical application, the project exemplifies NALI's commitment to innovative, student-centered teaching methods. This approach not only enhances students' academic outcomes but also equips them with practical skills that are directly applicable to real-world situations, making the learning process more dynamic and relevant.

Celebrating Academic Excellence

The "Transforming Macroeconomics: Research-Driven Learning" project celebrates academic excellence by showcasing students' research through formal proceedings publication. This recognition highlights the students' ability to conduct rigorous macroeconomic analysis, reflecting their high academic achievement and dedication. The opportunity to have their work published boosts students' confidence and academic credentials, reinforcing the value of their contributions to the field. Additionally, the project has been recognized with awards, further emphasizing the significant impact and quality of the students' work and serving as a testament to their hard work and innovative thinking.





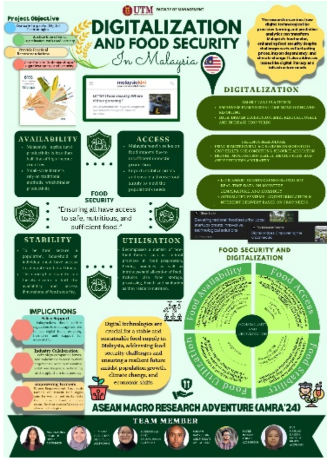


Figure 2: Award-Winning Research

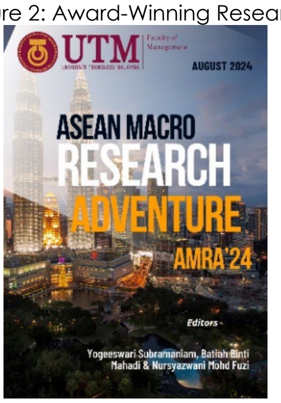
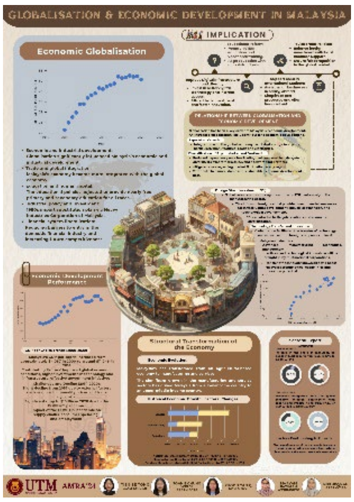


Figure 3: Students' work was published as a proceeding publication.



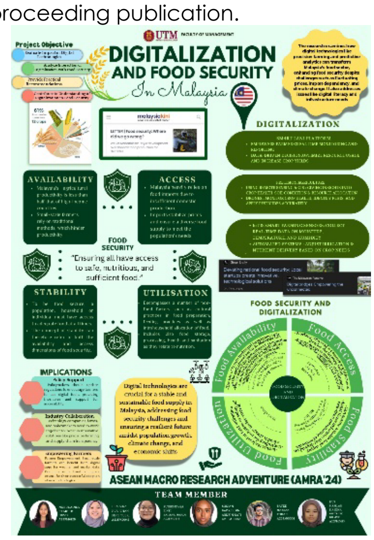


Figure 4: Poster Presentation

Other relevant information

Silver Award: International Development Research & Innovation Virtual Exhibition (idrive 2024) Digital Solutions for Food Security Across Dimensions

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ID 43: Malaysian Sign Language Real-Time Tutorial Using AI

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Highlights: Individuals with hearing and speech impairments in Malaysia face communication challenges due to insufficient resources for learning Malaysian Sign Language (MSL). The Malaysian Sign Language Real Time Tutorial (MASRETT) addresses this gap by providing an online platform that aids in learning MSL and reducing communication barriers between disabled and non-disabled individuals. Using the Artificial Intelligence (AI) technology, Convolutional Neural Network (CNN) for sign recognition, MASRETT improves accessibility. However, various MSL data collection and more efficient algorithms need to be done to enhance the performance of real time MSL detection using AI as in future work.

Keywords: *Real Time Tutorial; Malaysian Sign Language (MSL); Artificial Intelligence (AI); Convolutional Neural Network (CNN)*

Introduction

Communication challenges faced by individuals with hearing and speech impairments in Malaysia are compounded by the limited availability of effective resources for learning Malaysian Sign Language (MSL). This gap not only hinders the social inclusion of the deaf community but also affects their ability to interact meaningfully in various social, educational, and professional settings. To address this issue, the Malaysian Sign Language Real Time Tutorial (MASRETT) has been developed as an instructional platform aimed at reducing communication barriers (Chong et al., 2021). MASRETT provides virtual learning opportunities for MSL, bridging the gap between disabled and non-disabled individuals and promoting better social integration. The platform employs Agile software development methodology, enabling continuous refinement and improvement of its features. An Artificial Intelligence (AI) technology, Convolutional Neural Network (CNN) model is integrated to recognize and interpret sign language gestures in real time. This study aims to assist the hearing disabled people by using Artificial Intelligence (AI) for MSL recognition. ultimately improving accessibility and effectiveness of MSL learning for a broader audience in future. However, current findings reveal that MASRETT's sign recognition accuracy using CNN is limited to 33% recognition, underscoring the need for advanced algorithms and comprehensive data to enhance its performance. Future works can include hybrid models for better and accurate real-time MSL recognition.

Content

The Malaysian Sign Language Real Time Tutorial (MASRETT) aims to address the communication challenges faced by individuals with hearing and speech impairments in Malaysia. The objectives are to develop a virtual platform for learning Malaysian Sign Language (MSL) using AI technology which is Convolutional Neural Network (CNN) algorithms for real-time sign recognition. The aim is to enhance MSL learning accessibility, and to reduce communication barriers. MASRETT implements AI technology, which is CNN algorithms into a real-time tutorial platform, enhancing the accessibility of MSL learning. The innovativeness lies in its real-time feedback mechanism using webcams, which facilitates practical sign language learning. Its impact is significant in bridging communication gaps and promoting inclusiveness in Malaysian society. The Agile software development methodology was utilized to iteratively design and develop MASRETT. The system design for this web application is shown in Figure 1.

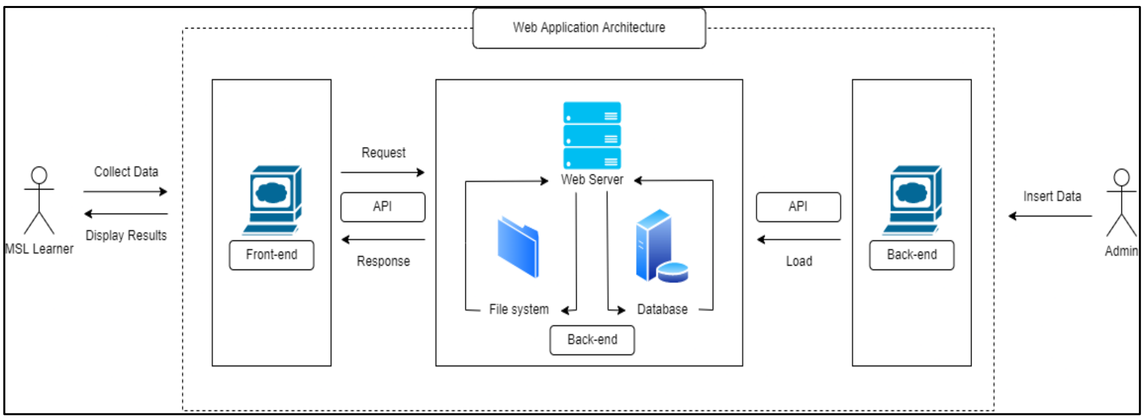

Figure 1: The MSL Real Time Tutorial Web Architecture

CNN algorithms were employed for the recognition of MSL gestures using data collected from collective sign language samples. The system's architecture supports real-time sign detection, allowing users to practice and receive immediate feedback. MASRETT was found to enhance the accessibility and effectiveness of MSL learning, particularly for those with limited access to traditional classes. However, the CNN algorithm recognized only 33% of real-time signs, indicating limitations in the dataset and the need for more efficient models. Table 1 shows the initial results of MSL real time detection for 12 data sets.

Table 1: Initial results of MSL real time detection for 12 data sets

No.	MSL Pose	Pass/Failed	Success Rate
1	Hi	Pass	0.97
2	Saya	Failed	0.0
3	Kamu	Failed	0.0
4	Betul	Failed	0.0
5	Salah	Pass	0.87
6	Apa	Failed	0.0
7	Berapa	Failed	0.0
8	Mana	Failed	0.0
9	Boleh	Pass	0.93
10	Tidak boleh	Failed	0.0
11	Minta Maaf	Failed	0.0
12	Terima kasih	Pass	0.94

Future work will focus on improving the algorithm and expanding the dataset to achieve higher recognition rates. The datasets from Johari et al. (2023) can be experimented and more collection of data sets will be conducted in collaboration with Persatuan Jurubahasa Isyarat Malaysia. Hybrid model can be developed to overcome the weaknesses. MASRETT has strong commercialization potential as an educational tool, offering a free platform that supports MSL learners, particularly those who cannot access formal classes.

Acknowledgement

Special acknowledgment to the Ministry of Higher Education Malaysia (MOHE) for financial support through Fundamental Research Grant Scheme (FRGS) Ref: FRGS/1/2024/ICT02/UTM/02/10, Vot. No: R.J130000.7828.5F748. Thank you to the Research Management Center and Faculty of Computing, Universiti Teknologi Malaysia (UTM) for thorough research support. Special thanks to Persatuan Jurubahasa Isyarat Malaysia and Persekutuan Orang Pekak Malaysia (MFD).

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ID 44: The Pills to Plants: Eco-Friendly Disposal FiestaFun - A Sustainable Approach to Medicine Waste Management

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Highlights: The "Pills to Plants" program, conducted from 5 November 2023 – 8 February 2024, combines logistics management education with community engagement to promote sustainable medicine disposal practices. Through reverse logistics, digital outreach, and interactive activities, the program educates both the community from outside and inside the university and the primary school students, fostering environmental stewardship and practical skills development. The initiative empowers students to lead and educate their communities and encourages a culture of sustainability among younger generations, using creative, engaging, and fun activities to teach important environmental lessons.

Keywords: Medicine Disposal; Reverse Logistics; Reflective Learning; Community Engagement; Sustainability

Introduction

The "Pills to Plants: Eco-Friendly Disposal FiestaFun" program, led by students from UTM's Bachelor of Management (Marketing) program, addresses the environmental and public health risks associated with improper pharmaceutical disposal. It applies reverse logistics principles from the logistics management curriculum to create a real-world, sustainable medicine disposal system.

Grounded in Kolb's Experiential Learning Theory (1984), the program emphasizes hands-on activities, reflection, and practical application, allowing students to deepen their understanding of logistics concepts. It also aligns with Education for Sustainable Development (ESD) (UNESCO, 2017), promoting sustainability, critical thinking, and reflective learning through initiatives like the "Green Hero Diary" and community outreach.

Additionally, the program supports Malaysia's National Environmental Policy (2002), which advocates for sustainable waste management and environmental stewardship. By educating both university and primary school students, it fosters a sense of responsibility towards safe medicine disposal and environmental sustainability.

Project or Innovation Objectives

The "Pills to Plants" program was designed with several objectives to achieve its educational and community impact goals:

1. **Integrate Practical Logistics Management Skills:** To apply reverse logistics concepts by designing and implementing a community-based medicine disposal initiative, providing students with hands-on experience that bridges theoretical knowledge with practical application.
2. **Promote Awareness and Safe Disposal Practices:** To educate the broader community, including university and primary school students, about the importance of proper medicine disposal and its impact on health and the environment.
3. **Empower Younger Generations Through Engaging Activities:** To foster environmental responsibility among primary school students through interactive and fun activities, such as quizzes, coloring contests, and the "Green Hero Diary," which encourage practical learning and sustainable practices.
4. **Leverage Digital Tools for Broader Engagement:** To utilize social media platforms like Instagram, TikTok, and Facebook to extend the program's reach and engage diverse audiences in sustainability practices.
5. **Enhance Community Health Awareness:** To provide free health screenings and informative talks on medicine disposal and health practices, in collaboration with Alpro Pharmacy, to highlight the connection between environmental health and public health.

Activities from the Timeline Poster

The poster as shown in Figure 1 below visually represents the "Pills to Plants" program timeline and key activities and outlines a structured sequence of activities designed to progressively build awareness, engagement, and learning outcomes. Below are the details of every activity:

a) **Pre-Survey (5-14 November):** The program began with a pre-survey to assess baseline knowledge and attitudes toward medicine disposal among participants. This survey provided critical data to tailor subsequent educational activities effectively.

b) **School Engagement (10 December at SK Taman Suria):** Primary school students were involved in interactive sessions, such as educational talks, quizzes, and a coloring contest focused on safe medicine disposal. This activity was designed to be both fun and educational, fostering early engagement with environmental practices. Additionally, the interactive learning sessions on "Green Hero Diary," are prominently featured, showcasing the program's efforts to involve younger students, underscoring the program's innovative outreach methods

Figure 1: Timeline of the Program

a) **Digital Campaign (15 November - 22 December):** A robust social media campaign ran parallel to the school activities, utilizing Instagram, TikTok, and Facebook to disseminate educational content and engage a wider audience. The digital outreach included challenges like the TikTok Challenge, videos demonstrating proper disposal practices, and aligning with NALI's creativity and engagement principles.

b) **TikTok Challenge (10-24 December):** This challenge encouraged participants to use their creativity to share and promote sustainable practices via social media from the program platform, Medimanage. The TikTok Challenge also fostered digital literacy among students, demonstrating NALI's emphasis on using technology to enhance learning.

c) **FiestaFun Day (9 January):** A central event at the Faculty of Management, UTM, which brought together students, faculty, and community members for a day of interactive learning. The event featured:

   i. Learning Stations where participants could engage in hands-on demonstrations about medicine disposal and its environmental impact.

   ii. Games and Contests like quizzes, designed to make learning about environmental stewardship enjoyable for the participants.

   iii. Engagement with Partners: Booths from sponsors and collaborators like Alpro Pharmacy provided additional resources and information, highlighting the importance of community partnerships in sustainability efforts.

   iv. TikTok Challenge Award Ceremony: Celebrating creative contributions and reinforcing the impact of digital engagement on environmental education.

   v. Games and Contests: Activities like quizzes and coloring activities, designed to make learning about environmental stewardship enjoyable for younger participants.

   vi. Talk and Free Health Screening Booth by Alpro Pharmacy: This booth provided free health screenings to participants, including blood pressure checks and basic health consultations, along with informative talks on the importance of proper medicine disposal. This initiative underscored the connection between environmental sustainability and public health, aligning with NALI's emphasis on holistic education that integrates multiple disciplines and real-world applications

d) **Post-Survey (10-13 January):** The program concluded with a post-survey to measure the impact of the activities on participants' knowledge and attitudes, revealing significant improvements and demonstrating the effectiveness of the innovative educational approach.

NALI Approach Implemented in the Program

The "Pills to Plants" program exemplifies the New Academia Learning Innovation (NALI) framework by incorporating several key educational strategies that foster innovative, reflective, and hands-on learning experiences. The program aligns with NALI principles through the following elements:

a) **Hands-On, Real-World Learning (Applicability):** The program provided students with practical, hands-on experience in applying logistics concepts, specifically reverse logistics, to a real-world challenge—sustainable medicine disposal. This follows Kolb's Experiential Learning Theory by engaging students in concrete experiences and allowing them to reflect and conceptualize the knowledge gained from these experiences. The program also aligns with ESD principles, encouraging students to reflect on their actions and take responsibility for promoting sustainability within their communities.

b) **Student-Led Activities (Creativity and Innovativeness):** A core component of the NALI approach is empowering students to take ownership of their learning experiences. The program was driven by student-led initiatives, such as organizing community engagement activities, conducting educational outreach, and managing digital campaigns on platforms like TikTok and Instagram. This student-centered approach encouraged leadership, creativity, and collaboration; key competencies fostered by NALI.

c) **Social media for Education (Innovativeness and Impact):** The program's innovative use of social media platforms aligns with NALI's emphasis on integrating technology into education. By utilizing Instagram and TikTok for educational outreach and community engagement, the program created an interactive and engaging learning environment. The TikTok Challenge, which encouraged participants to produce creative content promoting sustainable practices, exemplified the use of modern digital tools to enhance learning and community participation.

d) **Focus on Sustainability (Novelty and Impact):** Sustainability is a critical component of the NALI framework, which promotes educational initiatives that address real-world challenges. The program's focus on safe medicine disposal and environmental stewardship directly supports NALI's objective to foster socially responsible and environmentally conscious graduates. Activities like the "Green Hero Diary" encouraged participants, especially primary school students, to reflect on their actions and understand their role in promoting sustainability.

e) **Teamwork and Collaboration (Applicability and Impact):** The program encouraged teamwork and collaboration among students, as highlighted in the poster. NALI emphasizes collaborative learning environments where students work together to solve problems and achieve common goals. The team-based approach in planning and executing the FiestaFun Day and other community activities promoted cooperation, communication, and collective problem-solving skills, essential for effective teamwork in real-world contexts.

f) **Promotes Lifelong Learning (Impact):** Reflective practices such as the "Green Hero Diary" and post-survey analysis supported the ESD framework by promoting continuous learning and self-assessment among participants. By encouraging students to think critically about their contributions to sustainability, the program fosters lifelong learning and environmental stewardship, both core tenets of ESD.

g) **Impact on Knowledge and Awareness (Impact):** The poster's data on knowledge increments shows significant improvements in participants' understanding of logistics and sustainability topics. For example, a 24.42% increase in understanding reverse logistics and a 32.38% increase in awareness of pharmaceutical waste management were recorded. These outcomes reflect the NALI principle of impactful learning, where educational activities lead to measurable knowledge gains and behavioral changes.

Research Methodology

The program's impact was assessed through a comprehensive research methodology:

a) **Pre-and-Post Surveys:** Conducted among online 100 respondents to evaluate changes in community knowledge and attitudes towards medicine disposal before and after participating in the program. The surveys shown in Table 1 illustrate the impact of the program on participants' knowledge related to medicine disposal and logistics concepts. It shows the mean scores from pre- and post-surveys conducted with online participants. The knowledge increment percentages highlight the effectiveness of the educational activities in improving understanding across key areas.

Table 1: Knowledge Improvement on Medicine Disposal and Reverse Logistics

Topics	Pre-Survey (Mean)	Post Survey (Mean)	Knowledge Increment	%
Logistics and Reverse Logistics	3.48	4.33	0.85	24.42
Pharmaceutical Waste	3.15	4.17	1.02	32.38
Harmful Effects of Pharmaceutical Waste	3.50	4.29	0.79	22.57
Reason for Pharmaceutical Waste	3.48	4.28	0.80	22.99
Ways to Reduce Pharmaceutical Waste	3.84	4.41	0.57	14.84

b) **Reflective Diaries ("Green Hero Diary"):** Used to encourage continuous self-assessment and reflection among both university and primary school students, reinforcing learning outcomes related to sustainability.

c) **Social Media Analytics:** Engagement metrics from digital campaigns were analyzed to measure the reach and effectiveness of the educational content, demonstrating the success of digital tools in promoting sustainable behaviors.

Findings and Discussion

The "Pills to Plants" program effectively integrated logistics management education with community engagement, achieving significant educational and community impacts. The program's outcomes can be categorized into three main areas of impact on student learning:

i. Real-World Application:

- Practical Experience in Logistics Concepts: The program provided students with the opportunity to apply logistics management theories, specifically reverse logistics, in a real-world context. By designing and implementing a system for the safe collection and disposal of unused or expired medications, students were able to bridge the gap between theoretical knowledge and practical skills. This hands-on experience helped students understand the complexities of logistics operations and the importance of sustainable practices in supply chain management.
- Enhanced Problem-Solving Skills: Engaging in a project with real-world implications required students to think critically and solve problems effectively, reinforcing their understanding of logistics principles and their application to environmental sustainability.

ii. Skill Development:

- Critical Thinking and Leadership: The program's student-led initiatives, such as organizing the FiestaFun Day and conducting community outreach activities, enhanced students' critical thinking and leadership skills. By taking charge of the planning and execution of these events, students learned to manage resources, coordinate with partners, and make strategic decisions to achieve program objectives.
- Communication and Collaboration: Students developed strong communication skills by interacting with diverse stakeholders, including primary school students, community members, and sponsors like Alpro Pharmacy. The program also fostered collaboration among students, encouraging teamwork and the exchange of ideas to promote sustainability practices.

iii. Social Responsibility:

- Fostering Environmental Stewardship: The program instilled a strong sense of environmental and social responsibility in students by highlighting the importance of sustainable practices in daily life. Through activities such as the "Green Hero Diary" and interactive learning sessions, students were encouraged to reflect on their actions and understand their role in promoting sustainability within their communities.
- Empathy and Community Engagement: By engaging with younger students and organizing health awareness activities, such as the talk and free health screening booth by Alpro Pharmacy, university students developed empathy and a commitment to contributing positively to society. This aligns with the NALI principle of nurturing responsible and reflective learners who are aware of their societal roles.

Other Relevant Information

Commercialization Potential: The program demonstrates strong potential for broader adoption, particularly in educational institutions seeking to integrate sustainability into their curricula. The innovative combination of logistics education, community service, and digital engagement makes it a scalable model for environmental education.

Conclusion

The "Pills to Plants" program successfully integrates logistics management education with community engagement and sustainability practices. By focusing on reverse logistics and involving both university and primary school students in practical, hands-on activities, the program fosters a deeper understanding of environmental responsibility and sustainable practices. The innovative approach and successful engagement strategies demonstrate the program's potential as a model for future educational initiatives that promote sustainability and social responsibility across diverse communities.

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ID 46: Educator Digital Resources 21st Century Learning

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Highlights: This study addresses challenges faced by Malaysian educators in accessing centralized resources tailored for 21st-century teaching. Despite educational reforms, teachers struggle with limited support for innovative activities. The study proposes EDR-21st Century, a comprehensive digital platform providing easy access to diverse teaching methods, activities, and resources aligned with modern educational frameworks and SKPM Standard 4. By offering a centralized portal, the platform aims to enhance teaching effectiveness and student engagement, supporting holistic development and preparing students for success in the digital age. The platform's goal is to streamline resource gathering, empowering educators and improving educational quality in Malaysia.

Keywords: *Centralized resources; 21st-century teaching methods; Fun learning methods; Educator Digital Resources; Digital toolkit.*

Introduction

The importance of 21st-century pedagogical approaches in teaching and learning is highly relevant in the context of modern education. With the advancement of technology and rapid changes in the industry, teachers are tasked with adapting their teaching methods to meet the diverse needs of students and prepare them for future challenges. The 21st-century pedagogical approach emphasizes not only the transmission of knowledge but also the development of critical skills such as critical thinking, creativity, teamwork, communication, and digital literacy. However, many educators struggle to find the time to develop interactive, 21st-century learning lesson plans due to the demanding nature of their roles.

Moreover, there is a lack of structured strategies and accessible resources to support teachers in mastering 21st-century teaching tools and methods. Without a centralized platform offering guidance and materials, teachers often lack the development opportunities needed to integrate critical skills such as creativity, collaboration, and digital literacy into their classrooms. To address these challenges, it is essential to provide teachers with easily accessible resources that can streamline the preparation of effective, engaging lesson plans. By empowering educators with the right tools and strategies, we can ensure that students are equipped with the skills needed to thrive in an increasingly complex and digital world. Ultimately, these efforts will contribute to the creation of a civil and advanced society in line with the "Malaysia Madani" vision.

Content

EDR 21st Century is an innovative portal designed to streamline and enhance the teaching and learning experience by providing a centralized platform with comprehensive educational resources. This portal is easily accessible through a single link, created using the MyLink platform, which consolidates multiple links into one for simplicity and efficiency. The portal integrates MyLink with Google Sites to offer an interactive and user-friendly interface, making it ideal for educators at all levels. The theoretical foundations of Educational Design Research (EDR) in the context of 21st-century learning are deeply rooted in various educational theories, including Constructivist Learning Theory, Multiple Intelligences Theory, Bloom's Taxonomy, the TPACK framework, and the 21st Century Skills Framework. Each of these theories contributes to a comprehensive understanding of how EDR can facilitate effective learning experiences in modern educational settings.

Constructivist Learning Theory posits that learners actively construct knowledge through experiences and reflections. This theory aligns with EDR's emphasis on interactive and participatory learning methods, which encourage student-centred activities. According to the literature, constructivist approaches foster deeper engagement and understanding among students by allowing them to explore concepts through hands-on experiences and collaborative learning ("Constructivist Learning Theory", 2012). This is particularly relevant in mathematics education, where constructivist teaching methods have been shown to enhance students' problem-solving abilities and conceptual understanding ("Constructivist Learning Theory", 2012). Multiple Intelligences Theory, proposed by Howard Gardner, suggests that individuals possess various types of intelligences, such as linguistic, logical-mathematical, spatial, and interpersonal (Waterhouse, 2013). EDR integrates diverse teaching approaches that cater to these different intelligences, ensuring that all students' strengths are addressed. For instance, by incorporating activities that appeal to various intelligences, educators can create a more inclusive learning environment that recognizes and values the unique capabilities of each student (Tanto, 2024). This approach not only enhances engagement but also promotes a deeper understanding of content across different learning styles.

Moreover, Bloom's Taxonomy provides a framework for categorizing learning objectives into cognitive levels, ranging from basic recall of facts to higher-order thinking skills such as analysing, evaluating, and creating (Relator, 2022). EDR supports teachers in designing activities that promote these higher-order thinking skills, which are essential for preparing students for complex problem-solving and critical thinking tasks in the 21st century. By aligning instructional strategies with Bloom's Taxonomy, educators can ensure that learning experiences are not only comprehensive but also progressively challenging, thereby fostering deeper cognitive engagement (Relator, 2022). The TPACK

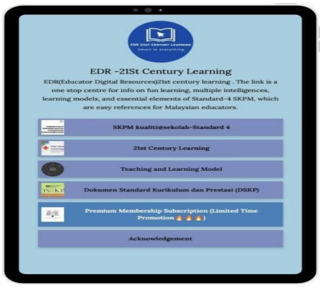
(Technological Pedagogical Content Knowledge) framework emphasizes the intersection of technology, pedagogy, and content knowledge as essential for effective teaching in the digital age (Relator, 2022). EDR facilitates the integration of digital tools with pedagogical strategies, helping educators to seamlessly incorporate technology into their teaching practices. Research indicates that teachers who possess a strong TPACK are better equipped to design and implement technology-enhanced learning experiences that engage students and enhance their understanding of content (Drajati et al., 2021; Tian et al., 2017). The TPACK framework also underscores the importance of adapting teaching methods to leverage technology effectively, which is crucial in contemporary educational contexts where digital literacy is paramount (Voogt et al., 2012).

Lastly, the 21st Century Skills Framework focuses on developing essential skills such as critical thinking, collaboration, creativity, and digital literacy (Shafie et al., 2019). EDR supports the cultivation of these skills by promoting learning environments that encourage collaboration and innovation. By integrating project-based learning and real- world problem-solving into the curriculum, EDR prepares students for success in modern learning environments and future careers (Shafie et al., 2019). This alignment with 21st-century skills ensures that students are not only knowledgeable but also capable of applying their learning in practical and meaningful ways. In conclusion, the theoretical foundations of EDR in 21st-century learning are multifaceted and interconnected. By drawing on Constructivist Learning Theory, Multiple Intelligences Theory, Bloom's Taxonomy, the TPACK framework, and the 21st Century Skills Framework, EDR provides a robust framework for designing effective educational experiences that meet the diverse needs of learners in today's dynamic educational landscape.

Steps to use:

Step 1: Accessing the Portal: Open your technological device (computer, tablet, or smartphone). Click on the link: https://mylink.la/edr21 to access the EDR 21st Century portal.

Step 2: Navigating the Portal



Explore the homepage and familiarize yourself with the layout.

Use the navigation menu to access different sections, such as Teaching and Learning Modules, 21st Century Learning approaches, and DSKP documents.

Step 3: Utilizing the Resources

i. SKPM Kualiti @ Sekolah: Access the self-assessment instruments to evaluate your teaching performance according to Standard 4

ii. 21st Century Learning Approaches: Explore various interactive activities like Bingo-Fun Learning Activity, Total Physical Response, Inside-Outside Circle, and others to enhance student engagement and learning.

iii. Teaching and Learning Modules: Browse through structured frameworks such as inquiry-based learning, project-based learning, and flipped classrooms to find methodologies and strategies that suit your teaching style.

Step 4: Premium Subscription
Consider upgrading to the Premium EDR 21st Century Learning Subscription for access to additional resources. Navigate to the in-app purchase section and follow the prompts to unlock premium lesson plans and other valuable tools tailored to the 21st-century learning framework.

Innovation Objectives

Enhancing Teaching Effectiveness: By providing a centralized platform, the EDR aims to streamline the process of gathering resources, helping educators access diverse teaching methods and activities that align with modern educational frameworks

i. Supporting Holistic Development: The platform is designed to improve student engagement and support holistic development, preparing students for success in the digital age

ii. Empowering Educators: EDR focuses on empowering educators by offering easily accessible resources that enhance their teaching practices, allowing them to implement student-centered and interactive learning experiences

iii. Commercial Viability: Another key objective is to introduce a sustainable business model through premium subscriptions, adding value to the platform while generating revenue

The NALI

i. Novelty: The creation of the Educational Digital Resource (EDR) 21st-Century Learning platform represents a novel approach to overcoming the challenges faced by Malaysian educators in accessing centralized, modern teaching resources. The platform consolidates resources that align with 21st-century educational frameworks, making it easier for teachers to design engaging and innovative lesson plans.

ii. Creativity: The platform incorporates interactive teaching methods such as inquiry-based learning and project- based learning. These methods encourage creativity by engaging students in critical thinking and problem-solving through activities like the "Running Dictation Activity" and various fun learning techniques such as Bingo and Total Physical Response.

iii. Innovativeness: EDR enhances accessibility through the integration of MyLink and Google Sites, offering an interactive, user-friendly portal. This digital solution simplifies access to a wide array of teaching materials and modules, supporting educators in implementing cutting-edge teaching practices.

iv. Applicability: The platform provides a centralized resource for educators, enabling them to easily integrate 21st- century teaching approaches into their classrooms. It is designed to be adaptable across various educational levels, ensuring its broad applicability.

v. Impact: The one-group pretest-posttest design study results suggest that the EDR platform has a significant impact on improving teaching outcomes. It has helped teachers transform their lesson plans, making them more student- centered and interactive, thereby better preparing students for success in the digital age

Research Methodology

The research methodology employed in this study involves a one-group pretest-posttest design conducted in a secondary school in Masai, Johor. The study focuses on comparing lesson plans and teaching outcomes before and after the implementation of the Educational Digital Resource (EDR) 21st Century Learning platform. By analyzing the same group of teachers and students before and after using the platform, the study aims to evaluate its effectiveness in enhancing teaching practices and student engagement.

The key steps include:

i. One-group pretest-posttest Design study: A comparison of lesson plans was conducted to assess the improvements in teaching with the use of EDR.

ii. Data Collection: Data was collected to analyze the differences in teaching effectiveness and student outcomes between the traditional lesson plans and those developed using EDR resources.

iii. Evaluation: The study evaluates how the platform helps educators transform their teaching practices by fostering continuous improvement and aligning with educational standards

Finding and discussion of the project or innovation

The findings and discussion of the Educational Digital Resource (EDR) 21st Century Learning project are centered around the effectiveness of the platform in transforming teaching practices and improving student outcomes. Below are the key points:

Comparison of Lesson Plans: The study involved a comparison between traditional lesson plans and those developed using resources from the EDR platform. It was observed that the lesson plans created with EDR were more dynamic, interactive, and student centered. These plans integrated 21st-century skills, such as collaboration, critical thinking, and active learning, which were lacking in the traditional approaches.

Implementation of 21st-Century Skills: The platform enabled teachers to incorporate modern pedagogical models, like the 5E instructional model (Engage, Explore, Explain, Elaborate, and Evaluate), into their lessons. This resulted in a more comprehensive and engaging learning experience, with activities like "Running Dictation," which promoted active participation and collaboration.

Impact on Student Outcomes: The shift towards student-centered approaches using the EDR platform was linked to improved student engagement and outcomes. The continuous feedback and performance tracking mechanisms within the platform, such as classroom-based assessments (CBA), played a critical role in supporting ongoing improvement.

Commercial Potential: Beyond the educational impact, the EDR platform presents a significant commercial opportunity in the EdTech sector. The introduction of premium subscriptions adds value by providing access to curated lesson plans and additional resources tailored for 21st-century learning. This also contributes to the platform's sustainability and growth

Data Analysis

The comparison between the two lesson plans highlights significant differences in the comprehensiveness of designing 21st-century-based learning activities with the implementation of the EDR 21st platform. The figure below shows the initial lesson plan before the implementation of EDR 21st century platform.

Initial Lesson Plan: The traditional lesson plan relied on teacher-centered activities where students primarily followed instructions with limited opportunities for active participation. Though the plan included group work and problem-solving tasks, the activities were more passive and lacked the interactive, student-centered approach necessary for developing 21st-century skills.

Lesson Plan with EDR: The lesson plan designed with EDR resources was more comprehensive, following the 5E instructional model (Engage, Explore, Explain, Elaborate, Evaluate). This plan incorporated activities that promoted active participation, collaboration, and critical thinking. For example, the "Running Dictation Activity" required students to move around the classroom, gathering and sharing information in pairs, which fostered collaboration and problem- solving. The analysis shows that using the EDR platform led to a significant shift towards a more interactive and engaging learning experience. The incorporation of 21st-century skills such as critical thinking, creativity, and collaboration was particularly evident in the activities, making the lesson plans more effective in engaging students and enhancing their learning outcomes.

Results & Discussion

A one-group pretest-posttest design study in a secondary school in Masai, Johor, had been tested for the effectiveness of the Educational Digital Resource Platform (EDR 21st Century Learning). The study compared lesson plans before and after implementing EDR to see improvements in teaching. The data collected helped analyze the differences and plan for future enhancements. From our observation and comparison between lesson plans before and after implementing EDR, teachers are proven to transforming their teaching and improving student outcomes. This shows that EDR is being helpful in becoming a main source for teachers to keep fostering continuous improvement and aligning with educational standards. EDR equips Malaysian educators with essential 21st-century teaching skills, making it an invaluable asset in modern education. EDR also offers a significant commercial opportunity in the EdTech sector. It integrates seamlessly with tools like MyLink and Google Sites, enhancing accessibility and interactivity. By providing self-assessment tools and digital observation data, EDR supports educators' professional development and ensures they meet national guidelines. A key feature of EDR is its diverse teaching models, including inquiry-based and project-based learning, which foster critical thinking, creativity, collaboration, and communication. These skills are crucial in today's digital age, preparing both Malaysian public-school teachers and students for the future workforce.

EDR offers a wide range of interactive learning activities to engage modern learners. The platform emphasizes 21st-century skills, ensuring students are actively developing the abilities needed for their future careers. This makes EDR a powerful tool that meets the evolving needs of education. To enhance the user experience and generate additional revenue, EDR has introduced premium subscriptions. These provide access to curated lesson plans designed for 21st-century learning, adding significant value. This premium offering not only generates revenue but also builds user loyalty and engagement, crucial for EDR's sustainability. In conclusion, the Educational Digital Resource Platform (EDR 21st Century Learning) has the potential to revolutionize teaching by integrating digital resources into instruction. Its innovative teaching methods, alignment with educational standards, and focus on 21st-century skills position it as a forward-thinking tool for educators. With the added commercial benefits of premium subscriptions and comprehensive professional development, EDR is set to lead the way in providing high-quality, engaging educational resources as the sector evolves.

Conclusion

In conclusion, this innovation study tries to tackle the challenges by educators who struggle to find resources aligned with the demands of 21st-century learning, limiting their ability to design innovative and engaging teaching activities. Besides, the EDR will also allow educational administrators who involved in curriculum development and implementation face challenges in supporting teachers due to the lack of dedicated links or resources. The new "EDR 21st-Century Learning" web platform could help teachers prepare meaningful lessons more efficiently to provide quality education that meets diverse students' needs. As a one-stop digital resource platform, it may allow teachers to access quality educational materials, gain valuable information related to the 21st-century learning approach, and thus become more effective in conducting student-centered lessons that are able to develop the 4Cs. With the implementation of this innovation, it is hoped that educators will experience a significant shift in their lesson preparation processes, potentially reshaping their approach to teaching.

Award Received

This project, titled 'Educator Digital Resources 21st Century Learning', has received the Top Innovation award and Gold

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ID 47: Risalah Panduan Pembelajaran Matematik -Inovasi Alat Bantu Mengajar Matematik Pengguna

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Sorotan: Matematik Pengguna adalah salah satu tajuk baharu dalam Kurikulum Standard Sekolah Menengah bagi subjek Matematik. Risalah Panduan Pembelajaran Matematik dibangunkan untuk meningkatkan pemahaman dan kemahiran penyelesaian masalah pelajar dalam topik Matematik Pengguna seperti Simpanan, Pelaburan, Kredit, dan Hutang. Inovasi ini tercetus berdasarkan pemerhatian ke atas guru dan pelajar semasa aktiviti di dalam bilik darjah dan data keputusan Ujian Akhir Sesi Akademik atau UASA. Keistimewaan Risalah Panduan Pembelajaran Matematik ini dapat meningkatkan kemahiran murid dalam menguasai konsep, kaedah dan penyelesaian masalah melibatkan Simpanan dan Pelaburan, Kredit dan Hutang. Ini dapat dibuktikan secara empirikal menerusi hasil kajian yang menunjukkan peningkatan signifikan pencapaian pelajar kumpulan eksperimen. Dapatan kajian ini, risalah panduan ini membantu pelajar dalam pembelajaran Matematik Pengguna yang seterusnya berpotensi untuk diaplikasikan seumpamanya kepada tajuk matematik yang lain.

Kata kunci: *Risalah Panduan Pembelajaran Matematik; Penyelesaian Masalah Matematik; Simpanan dan Pelaburan; Kredit dan Hutang; Pencapaian.*

Pengenalan

Dalam era membangun masyarakat madani, sistem pendidikan Malaysia menekankan pentingnya dalam melahirkan pelajar yang adil, berpengetahuan, kreatif, dan berakhlak mulia, selaras dengan Falsafah Pendidikan Kebangsaan. Hasrat ini dicerminkan dalam usaha kerajaan menyediakan sistem pendidikan berkualiti untuk menghadapi cabaran globalisasi. Kurikulum Matematik digubal untuk membentuk pelajar yang berfikrah matematik, pemikiran logik, menggalakkan penyelesaian masalah, dan mengintegrasikan kemahiran matematik dalam kehidupan sebenar, seperti yang terkandung dalam Kurikulum Standard Sekolah Menengah (KSSM).Namun, pelajar menghadapi cabaran dalam memahami topik Matematik Pengguna, khususnya Simpanan dan Pelaburan, serta Kredit dan Hutang. Kesukaran ini disebabkan oleh faktor kematangan, kurangnya bahan sokongan, dan pendekatan pengajaran guru secara tradisional. Kajian menunjukkan keperluan untuk bahan pembelajaran kreatif seperti risalah pembelajaran yang boleh membantu pelajar memahami konsep, mengaplikasikan rumus, dan menyelesaikan masalah secara efektif. Risalah Panduan Pembelajaran Matematik merupakan bahan yang praktikal, mudah dirujuk, dan menyokong pelajar dalam menguasai topik Simpanan dan Pelaburan, Kredit dan Hutang. Risalah ini berfungsi sebagai panduan lengkap, memudahkan pelajar untuk berinteraksi dengan kandungan matematik yang kompleks. Dengan penggunaan risalah, pelajar bukan sahaja mampu memahami konsep-konsep yang diajar tetapi juga lebih yakin dalam menghadapi pentaksiran dan cabaran kewangan di masa hadapan. Oleh itu, inovasi dalam bentuk risalah pembelajaran ini bukan sahaja membantu meningkatkan pemahaman dan pencapaian pelajar dalam matematik tetapi juga menjadi sumber rujukan yang mudah dan memberikan pengalaman yang bermakna untuk pelajar mendalami dunia kewangan yang penting dalam kehidupan dan mempersiapkan mereka menghadapi kehidupan dunia sebenar.

Objektif Inovasi

Inovasi ini dibangunkan bagi mencapai dua objektif seperti di bawah.

i. Memudahkan pelajar untuk memahami konsep, kaedah dan dapat menyelesaikan masalah Matematik Pengguna.

ii. Meningkatkan pencapaian pelajar dalam pentaksiran berkaitan topik Matematik Pengguna, khususnya dalam soalan-soalan yang melibatkan pengiraan dan aplikasi rumus.

Pendekatan NALI yang Dilaksanakan

Kebaruan (*Novelty)*

Risalah ini memperkenalkan pendekatan baharu dalam pengajaran matematik melibatkan kewangan dengan memberikan kaedah, rumus dan contoh situasi kehidupan sebenar yang dihadapi oleh pelajar, seperti cara menguruskan simpanan, memahami pelaburan, dan mengelola kredit serta hutang. Menerusi konsep "one-stop centre" yang diperkenalkan, risalah ini mampu bertindak sebagai sumber rujukan utama untuk pelajar memahami dan menguasai topik Matematik Pengguna. Direka secara ringkas, padat, dan komprehensif, risalah ini memastikan semua maklumat penting disampaikan dengan jelas dan mudah difahami oleh pelajar. Sebagai alternatif kepada buku teks, risalah ini menawarkan pendekatan yang lebih praktikal dan mudah diakses untuk membantu pelajar dalam pembelajaran kendiri. Selain itu, ia menggabungkan elemen teknologi moden seperti kod QR untuk mengakses sumber-sumber digital tambahan, menjadikannya lebih dinamik dan interaktif. Jadual 1 menunjukkan keunikan dan perbezaan antara Risalah Panduan Pembelajaran Matematik dengan buku teks yang sedia ada untuk pelajar dalam proses pembelajaran di dalam bilik darjah.

Jadual 1: Perbezaan Risalah Panduan Pembelajaran Matematik dengan Buku Teks

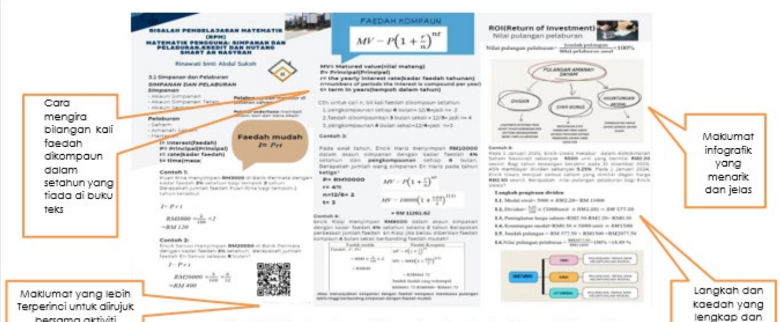
Aspek	Risalah Panduan Pembelajaran	Buku Teks
Reka bentuk	Ringkas, padat, berfokus kepada informasi penting, rumus dan visual yang menarik.	Lebih panjang, dengan teks yang banyak.
Kandungan	Fokus kepada konsep asas, panduan, ringkasan maklumat, rumus dan contoh-contoh soalan yang terarah.	Meliputi keseluruhan kurikulum.
Rumus	Disediakan kaedah bagaimana mencari nilai *n* untuk faedah kompaun.	Tiada di dalam buku teks
Format	Satu muka surat sahaja depan belakang seperti brosur. Lebih fleksibel, boleh dicetak, berwarna dan mempunyai kod QR.	Memuatkan semua tajuk dalam sebuah buku teks yang menjadikannya sangat padat
Aksesibiliti	Mudah diakses, cepat dan mudah alih kerana hanya sekeping sahaja.	Buku yang tebal, lebih daripada 30 muka surat hanya untuk topik Matematik Pengguna
Penggunaan	Digunakan sebagai alat bantu pembelajaran tambahan, sesuai untuk rujukan cepat dan ringkas.	Digunakan sebagai bahan utama dalam pembelajaran, menyeluruh dan sistematik.
Interaktif	Lebih interaktif dengan visual, warna dan infografik.	Lebih kepada pembacaan dan Latihan individu
Masa penggunaan	Lebih singkat dan cepat untuk membuat rujukan semasa ulangkaji.	Pelajar perlu mencari, meneliti setiap muka surat dan mengambil masa yang lama

Kreativiti

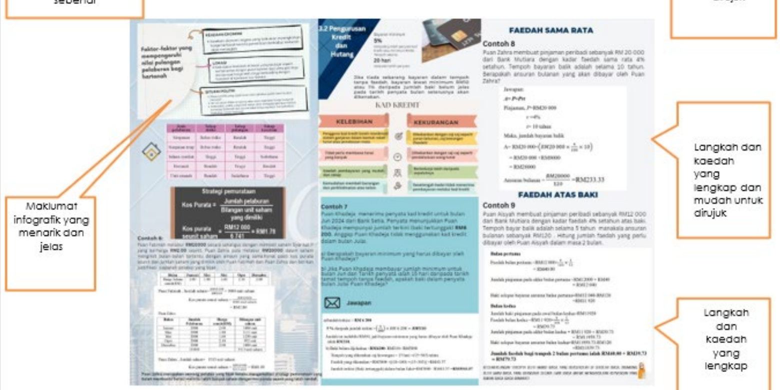
Risalah ini memanfaatkan kreativiti dalam penyampaian maklumat dengan menggunakan infografik yang menarik, rumus yang penting, maklumat yang penting untuk diingat dan simulasi kewangan yang mudah diakses oleh pelajar. Pendekatan berpusatkan pelajar yang menggalakkan penerokaan dan penyelesaian masalah secara bebas dan kendiri juga merupakan aspek penting dalam meningkatkan kreativiti pelajar. Risalah ini juga boleh diakses dengan lebih mendalam sumber informasi maklumat Matematik Pengguna dan dunia kewangan sebenar dengan menggunakan kod QR.

Inovasi

Inovasi risalah ini terletak pada penggunaan alat digital dan teknologi seperti kod QR yang membolehkan pembelajaran berterusan di luar kelas, serta susunan kandungan yang fleksibel dan boleh disesuaikan mengikut keperluan individu. Selain itu risalah yang ringan dan mudah dibawa ke mana-mana sahaja, penuh dengan contoh soalan beserta jawapan bagi setiap subtopik melibatkan tajuk Simpanan dan Pelaburan, Kredit dan Hutang. Rajah 1 menunjukkan muka hadapan Risalah Panduan Pembelajaran Matematik dan Rajah 2-pula adalah muka belakang Risalah Panduan Pembelajaran Matematik.



Rajah 1: Muka hadapan Risalah Panduan Pembelajaran Matematik



Rajah 2: Muka belakang Risalah Panduan Pembelajaran Matematik

Kegunaan Dan Impak Inovasi ke atas Pengajaran dan pembelajaran

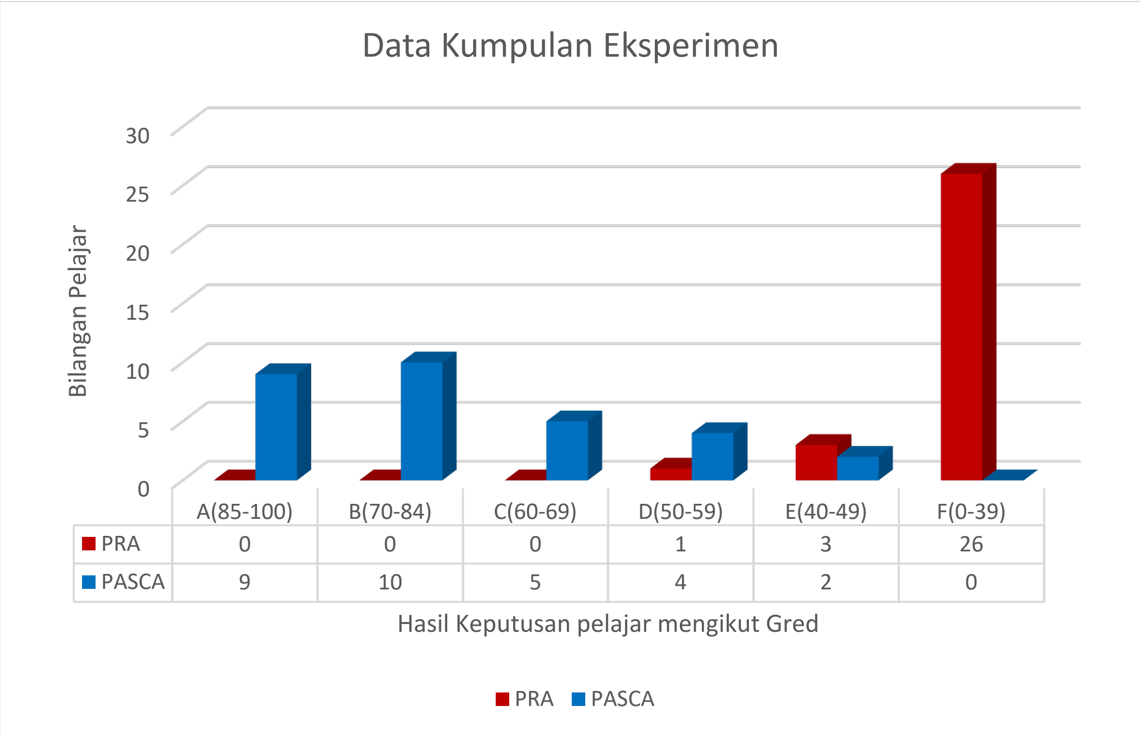
Impak utama dalam kajian bagi penggunaan risalah ini menunjukkan beberapa kesan yang signifikan dalam konteks pengajaran guru dan pembelajaran pelajar. Dari segi pengajaran, risalah ini memudahkan guru dalam menyampaikan konsep-konsep Matematik Pengguna dengan lebih sistematik dan berstruktur serta rumus dan langkah -langkah yang penting yang melibatkan aplikasi kewangan. Ia juga menjimatkan masa dan usaha dalam penyediaan bahan pengajaran. Risalah ini juga membantu guru mengenal pasti kelemahan pelajar dengan lebih cepat, sekaligus membolehkan intervensi yang lebih tepat dan berkesan dilakukan. Bagi proses pembelajaran, risalah ini meningkatkan kefahaman dan keupayaan pelajar dalam menyelesaikan masalah matematik dengan menyediakan panduan yang jelas dan langkah-langkah pengiraan yang mudah diikuti. Pelajar juga dapat manfaat dalam penggunaan risalah ini kerana risalah ini bukan sahaja dapat meningkatkan motivasi dan minat mereka terhadap subjek Matematik Pengguna, tetapi juga membolehkan mereka menjalankan pembelajaran kendiri dengan lebih berkesan kerana risalah boleh di bawa ke mana sahaja dan seterusnya membawa kepada pencapaian yang lebih baik dalam pentaksiran.

Kaedah Kajian

Kajian ini melibatkan 60 pelajar tingkatan tiga di dua buah sekolah yang berbeza di daerah Pasir Gudang, Johor, untuk menilai dan membandingkan keberkesanan aktiviti pembelajaran Matematik Pengguna menggunakan Risalah Panduan Pembelajaran Matematik berbanding menggunakan buku teks. Ujian Pra diberikan kepada pelajar kumpulan kawalan dan eksperimen sebelum risalah ini digunakan di dalam bilik darjah. Risalah digunakan sepenuhnya oleh pelajar kumpulan eksperimen sewaktu proses pembelajaran dan pengajaran sepanjang tempoh lima minggu. Selepas tempoh lima minggu , ujian pasca dijalankan ke atas kedua-dua kumpulan pelajar untuk mengukur keberkesanan penggunaan Risalah Panduan Pembelajaran Matematik terhadap tahap pencapaian pelajar dalam pembelajaran Matematik Pengguna.

Dapatan Kajian dan Perbincangan

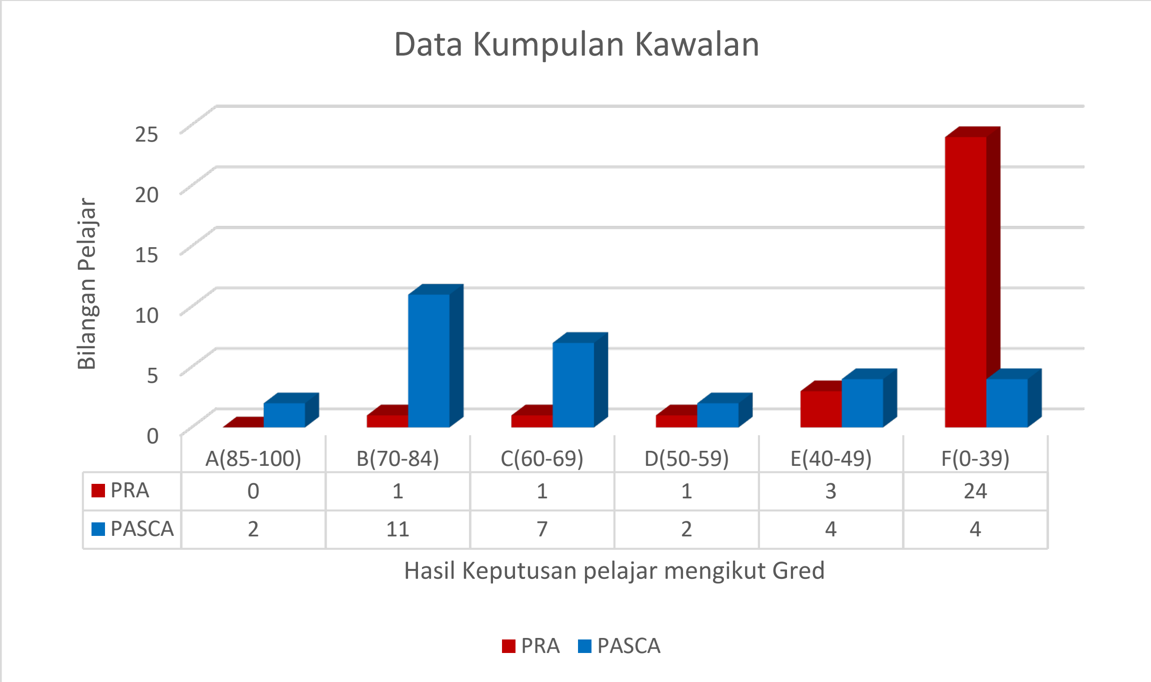
Berdasarkan kajian dan analisis data yang telah dibuat terhadap pencapaian pelajar apabila menggunakan Risalah Panduan Pembelajaran Matematik, min bagi ujian pra kumpulan eksperimen bagi 30 orang pelajar adalah18.17 dan ujian Pasca adalah 74.17. Rajah 3 menunjukkan dapatan dari kajian yang telah dijalankan bagi kumpulan eksperimen. Kumpulan eksperimen menggunakan Risalah Panduan Pembelajaran Matematik sepenuhnya dalam bilik darjah. Peratus lulus sekurang-kurangnya gred D bagi ujian pra untuk kumpulan ini dengan peratus kelulusan hanya 17 % manakala ujian pasca yang telah dijalankan 100 % lulus, manakala bagi ujian pra tiada seorang pelajar memperolehi gred A tetapi selepas ujian pasca, seramai 9 orang pelajar memperolehi gred A. Ini dapat dibuktikan semua pelajar dalam kumpulan eksperimen menguasai tajuk Simpanan dan Pelaburan, Kredit dan Hutang dengan menggunakan Risalah Panduan Pembelajaran Matematik.



	A(85-100)	B(70-84)	C(60-69)	D(50-59)	E(40-49)	F(0-39)
PRA	0	0	0	1	3	26
PASCA	9	10	5	4	2	0

Rajah 3: Data Pra dan Pasca Pencapaian Pelajar Kumpulan Eksperimen

Rajah 4 menunjukkan dapatan dari kajian yang telah dijalankan bagi kumpulan kawalan. Kumpulan kawalan menggunakan pendekatan secara tradisional dan menggunakan buku teks sepenuhnya. Peratus lulus sekurang-kurangnya gred D. Bagi ujian pra untuk kumpulan ini hanya 20 % manakala ujian pasca yang telah dijalankan 86.67% lulus. Empat orang pelajar tidak menguasai tajuk Matematik Pengguna: Simpanan dan Pelaburan, Kredit dan Hutang.



Rajah 4: Data Pra dan Pasca Pencapaian Pelajar Kumpulan Kawalan

Analisis data menunjukkan bahawa penggunaan Risalah Panduan Pembelajaran Matematik yang dibangunkan berjaya meningkatkan pencapaian pelajar dalam pentaksiran topik Matematik Pengguna, terbukti melalui peningkatan skor dalam soalan pengiraan dan aplikasi rumus. Risalah ini mudah dirujuk baik di dalam mahupun di luar bilik darjah, memudahkan pelajar menjalankan pembelajaran kendiri dan memperkukuh pemahaman mereka. Secara keseluruhan, dapatan kajian ini mengesahkan bahawa inovasi Risalah Panduan Pembelajaran Matematik yang dibangunkan adalah efektif dalam meningkatkan pencapaian, minat, motivasi pelajar, serta pelajar dapat menguasai kemahiran matematik bagi tajuk Matematik Pengguna. Menurut Rahmi et al., (2023) , pembelajaran menggunakan risalah juga mendorong pembelajaran kendiri dengan menyediakan sumber rujukan yang boleh diakses oleh pelajar pada bila-bila masa. Dengan panduan yang diberikan di dalam risalah ini, pelajar akan lebih mudah dalam memahami dan mengaplikasikan konsep-konsep matematik (Choirunnisa et al., 2022).

Potensi Komersial

Inovasi Risalah Panduan Pembelajaran Matematik ini memiliki potensi komersial yang tinggi kerana ia memenuhi keperluan bagi bahan bantu mengajar yang berkesan dan menarik dalam subjek matematik. Risalah ini dapat digunakan oleh pelajar dari pelbagai peringkat pendidikan, dari pelajar menengah rendah hingga menengah atas serta oleh guru sebagai alat bantu mengajar, menjadikannya produk dengan pasaran yang luas. Selain itu, risalah ini boleh disesuaikan mengikut keperluan kurikulum dan tahap pembelajaran, serta dikembangkan untuk topik-topik Matematik Pengguna yang lain seperti Pengurusan Kewangan, Insurans dan Percukaian kerana ia dapat meningkatkan daya tarikannya kepada pengguna yang memerlukan bahan lebih khusus. Dengan peningkatan teknologi dalam pendidikan, risalah ini juga berpotensi untuk dipasarkan secara digital melalui platform e-pembelajaran, membolehkan akses yang lebih luas. Potensi kolaborasi dengan institusi pendidikan serta kepelbagaian penggunaannya, termasuk ibu bapa yang ingin menyokong pembelajaran anak-anak mereka, menjadikannya relevan dalam sektor pendidikan formal dan informal. Tambahan pula, dengan penyesuaian kepada pelbagai bahasa dan budaya, risalah ini boleh dipasarkan di peringkat antarabangsa, memberikan peluang untuk menjangkau pasaran global. Secara keseluruhannya, risalah ini menawarkan penyelesaian praktikal dan berkesan untuk cabaran dalam pengajaran dan pembelajaran matematik, menjadikannya produk inovasi yang berpotensi tinggi di pasaran.

Kesimpulan

Risalah Panduan Pembelajaran Matematik merupakan inovasi pembelajaran dan pengajaran Matematik yang berstruktur, padat, ringkas, padat, berfokus kepada informasi penting, rumus dan visual yang menarik. Risalah ini berfokus kepada konsep asas, panduan, ringkasan maklumat, rumus dan contoh-contoh soalan. Risalah yang mempunyai satu muka surat sahaja depan belakang seperti brosur, lebih fleksibel, boleh dicetak, berwarna dan mempunyai Kod QR. Inovasi ini juga telah terbukti berkesan dalam meningkatkan pencapaian pelajar dalam menguasai tajuk melibatkan kewangan dan membantu guru dalam proses pengajaran dan pembelajaran dalam bilik darjah. Produk inovasi ini juga diharapkan disambut baik oleh Kementerian Pendidikan Malaysia untuk menjadikan pelajar berfikrah matematik, lebih meminati subjek matematik dan seterusnya dapat menguasai konsep matematik itu sendiri.

Penghargaan

Penulis mengucapkan terima kasih dan penghargaan kepada semua pelajar yang terlibat dalam kajian untuk Inovasi ini, ahli akademik Sekolah Pendidikan Fakulti Sains Sosial dan Kemanusiaan UTM dan ahli jawatankuasa NALI 2024.

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ID 50: From Campus to Community: Integrating Service Learning in Software Engineering through Real-World Schools Projects

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Highlights: This project at Universiti Teknologi Malaysia integrates Project-Based Learning (PBL) within a Service-Learning framework to enhance Software Engineering students' education. By developing software solutions for local schools, students bridge theoretical knowledge with practical application while fostering social responsibility. Collaborating with educational stakeholders, they apply software engineering principles and engage in reflective practices to address both technical and societal challenges. The project enhances technical competencies, problem-solving skills, teamwork, and empathy, preparing students to become well-rounded professionals committed to societal well-being in the field of software engineering.

Keywords: *Project-Based Learning; Service Learning; Software Engineering*

Introduction

This project at the Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia, integrates Project-Based Learning (PBL) within a Service Learning framework to elevate the educational experience of Software Engineering students. By bridging the gap between theoretical knowledge and practical application, the initiative fosters social responsibility and civic duty among students. They are tasked with developing software solutions for real-world problems faced by local communities, particularly schools needing systems to improve their administration and education processes. Throughout the project, students collaborate with educational stakeholders, applying engineering principles while engaging in reflective practices to better understand both technical and societal challenges.

The project aims to enhance technical competencies by providing students with hands-on experience in software development, allowing them to apply campus classroom knowledge to real-life situations. By working on these community-focused projects, students also develop teamwork, communication, and problem-solving skills. The approach encourages continuous reflection on the ethical and societal implications of their work, promoting a deeper understanding of the social impact of their technical solutions. This experience not only sharpens their technical abilities but also nurtures a sense of responsibility toward societal well-being (NCBI, 2023).

What sets this project apart is its interdisciplinary approach, combining multiple core subjects—System Analysis and Design, Database, Human-Computer Interaction, and Application Development—into a cohesive learning experience. Previously, PBL and Service Learning were confined to individual subjects, limiting opportunities for students to engage with complex, real-world challenges in a holistic manner (Marx et al., 2021). By integrating these subjects, the project provides a more comprehensive educational experience, enabling students to tackle multifaceted problems and develop the diverse skill set necessary for success in a rapidly evolving field (Bédard et al., 2012). Figure 1 illustrates how from one community or school, four different types of deliverables are produced.

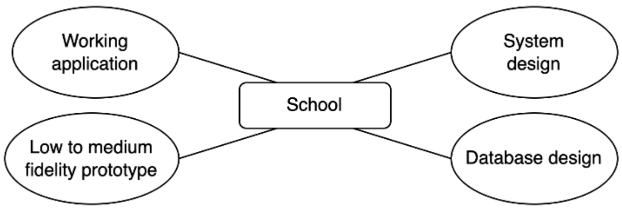

Figure 1. Project-based learning with one school with different deliverable types

Project Objectives

The objectives of the project are as follows:

i. To provide Software Engineering students with hands-on experience in developing software solutions by applying theoretical knowledge and engineering principles to address real-world problems encountered by local communities and non-profit organizations.

ii. To instill a sense of civic duty and social responsibility in students by engaging them in service-learning projects that directly contribute to the well-being and development of society.

iii. To develop students' teamwork, communication, and reflective skills by involving them in collaborative projects with community stakeholders, encouraging continuous reflection on the ethical and societal implications of their work.

NALI Approach

The NALI approach has been used in this project to promote an active, student-centered approach to education, with an emphasis on creativity, innovation, and real-world applicability. The discussion of the NALI approach adopted is as follows.

Novelty of the Project

The novelty of Project-Based Learning (PBL) lies in its ability to actively engage students in real-world problem-solving, fostering critical thinking, creativity, and collaboration. Unlike traditional methods, PBL in NALI's framework emphasizes student agency, where learners take ownership of their education by working on meaningful projects that connect academic content with practical applications. This approach aligns with NALI's goals of producing graduates who are not only knowledgeable but also equipped with the skills and competencies necessary for success in a rapidly changing world. For the implementation of PBL with service-learning framework, the students applying classroom knowledge to real-life problems and combining multiple subjects' requirements which are:

- System Analysis and Design
- Database
- Human-Computer Interaction
- Application Development

Previously, the implementation of PBL service-learning was confined to a single subject, meaning that students only engaged with real-life applications and service projects within the scope of one subject. This approach restricted the opportunities for integrating various subject requirements and deliverables within a single discipline, limiting the depth and breadth of student engagement with complex, real-world challenges (Thomas, 2000) (Bell, 2010) (Krajcik & Blumenfeld, 2006).

Creativity of the Project

Creativity in this project is centered on how students approach the design and development of system solutions to address the specific challenges faced by the current systems used in schools and develop user-centered designs. Creativity begins with students deeply understanding the existing problems within the schools' administrative and educational systems. This might involve interviewing school staff, observing current processes, and gathering feedback from end-users (teachers, administrators, and students). Examples of main challenges faced by schools are keeping track of students' daily attendance and homework submission record and reporting of students' academic progress and performance to parents. The creative process undergone by the students in designing potential solutions to the stakeholders is detailed below:

- Problem Understanding: Creativity begins with students deeply understanding the existing problems within the schools' administrative and educational systems. This might involve interviewing school staff, observing current processes, and gathering feedback from end-users (teachers, administrators, and students).
- Ideation: Once the problems are understood, students engage in brainstorming sessions where they are encouraged to think broadly and generate a wide range of potential solutions.
- Collaboration: Creativity is further enhanced through collaboration. As students work in teams, they share diverse perspectives, building on each other's ideas. This collaborative environment often leads to the cross-pollination of ideas, where a concept from one team member inspires another to think of a new approach or solution.
- Prototyping and Testing: Students translate their ideas into system prototypes. Prototyping allows students to experiment with different designs and functionalities, pushing the boundaries of what is possible within the project's constraints. Creativity is further demonstrated as students test these prototypes with real users (school staff and students) and gather feedback. Based on this feedback, they iterate on their designs, refining and improving the software to better meet the users' needs (Le and Wubbels, 2018). This iterative process encourages students to continuously think creatively about how to enhance their solutions, often leading to more innovative and effective outcomes.

Innovativeness of the Project

This project also benefits from allowing students greater freedom in selecting their projects or setting their service-learning goals, which can significantly boost their engagement and creativity. Providing students with the autonomy to choose their community partners or define the focus of their projects increases their personal investment in the outcomes, leading to a more meaningful and motivated learning experience. Additionally, integrating technology into PBL can greatly enhance the educational process. Digital tools and platforms, such as project management software, collaborative tools, and data analysis applications, can make the experience more interactive and dynamic while also equipping students with valuable digital skills (Rockenbaugh, 2011).

Focusing on contemporary, real-world issues can make projects more relevant and motivating for students. When students work on problems that have an immediate impact or are relevant to their own lives or communities, they are likely to be more engaged and committed to finding effective solutions. Encouraging collaboration between different academic disciplines or with external experts can provide a richer learning experience. This interdisciplinary approach allows students to gain diverse perspectives and develop new skills, enhancing their overall understanding and ability to tackle complex problems. Implementing regular feedback sessions with peers, instructors, or community partners can help students refine their projects and learn iteratively. This immediate feedback enables students to refine and enhance their projects continuously, resulting in improved outcomes and a more profound learning experience (Boss & Krauss, 2022).

Applicability of the Project

PBL and Service Learning significantly enhance the applicability of system development education by providing students with practical, real-world experiences. PBL allows students to engage in system development projects that address schools' problems and needs, enabling them to apply theoretical knowledge to solve actual problems. This hands-on approach helps students understand the practical aspects of system design, development, and implementation, thus improving their ability to handle complex, real-world challenges. By working on real systems, students gain valuable skills in managing project requirements, technical constraints, and user needs, which are directly transferable to professional settings (Duch et al., 2001).

Impact of the Project

This project integrates Project-Based Learning (PBL) within a Service-Learning framework, offering Software Engineering students a transformative experience by working on real-world projects that address local community needs, particularly in schools. It enhances students' technical skills, teamwork, problem-solving abilities, and fosters a deeper understanding of ethical and societal implications, cultivating a strong sense of social responsibility. On a broader scale, the project positively impacts the community by improving school administrative and educational processes, strengthening university-community ties, and serving as a model for interdisciplinary and community-engaged learning with lasting benefits for both students and the community (Jacoby, 2015).

Research Methodology

This project adopts the service-learning methodology by (Musa et al., 2017) that contains of 3 phases. The discussion of each phase is as follows.

Phase 1: Service-Learning Planning, Analysis and Design

This phase consists of several steps. Step 1 was forming the dedicated and committed committee, which the roles among others are as liaison to the community, lecturer, program coordinator, that the involvement of each one the key towards the success of the project. Step 2 was conducting feasibility study where this involved identifying the courses and ensuring the integration across the courses would work between the students. This study adopts *senpai-kohai* (mentor-mentee) approach where each school was teamed by 1 senior team (Application Development) with 2 junior teams (Database, System Analysis and Design, Database). In addition, recognizing the type of service-learning projects to be conducted, where we went for direct services. Operational, Financial and Technical, are also part of Step 2, where resources, funding resources and IT equipment were planned and considered.

Phase 2: Service-Learning Delivery

This phase established the community engagement with the selected six schools around Kuala Lumpur and Selangor. LOI was prepared for all schools and signed as the symbol of commitment between the parties. This project diligently followed four iterations of agile development approach, where throughout the 15-week-long semester, a series of physical visits, and virtual meetings in between, are conducted.

Phase 3: Evaluation, Reflection and Monitoring

As four-iterations were carried out, there are four evaluation rounds took place with one final evaluation. The formative evaluation gathered feedback to improve the next iteration, while the summative evaluation summed up the responds by the community. The students performed reflection at the end of the project about their experiences engaging with the community. The monitoring began once the developed applications are installed at the respective schools.

Results and Discussion

Within a semester, six senior teams from Application Development course successfully delivered six working software applications, which five have been successfully installed in the respective schools in the Klang Valley. In addition, there are also 12 alternatives low to medium fidelity design prototypes developed as the outcome from Human-computer Interaction course, 12 suggested database design and 12 proposed system analysis and design, with each school receives 2 respectively. At the end of the semester, each school can interact with 3 project outcomes, 1 is the working system and 2 are the interactive prototypes. The details of the deliverables are summarized in Table 1.

Table 1: A summary of the deliverables for each school

School Name and Location	Working Applications by the Seniors	Other Deliverables by the Juniors
Sekolah Menengah Islam ABIM, Sungai Ramal, Kajang	Co-curricular Tracking System: A web-based and mobile-based curriculum tracking system	Low to medium fidelity interactive prototype x 2, database design x 2, system analysis and design x 2
Sekolah Menengah Kebangsaan Sungai Pusu, Kuala Lumpur	Sungai Pusu Attendance System (SPAS): A web-based attendance management system with barcode scanner	Low to medium fidelity interactive prototype x 2, database design x 2, system analysis and design x 2
Sekolah Kebangsaan Saujana Utama, Sungai Buloh	Student Portal: A web-based student management system	Low to medium fidelity interactive prototype x 2, database design x 2, system analysis and design x 2
Sekolah Menengah Agama Riyadhatul A'mal, Kuala Lumpur	SMART Management Portal: A web-based student management	Low to medium fidelity interactive prototype x 2, database design x 2, system analysis and design x 2

School Name and Location	Working Applications by the Seniors	Other Deliverables by the Juniors
	system and academic resource tracker	
Sekolah Rendah Islam Al-Amin Wilayah Persekutuan, Kuala Lumpur	Turquoise: A web-based/mobile-based character development evaluation system	Low to medium fidelity interactive prototype x 2, database design x 2, system analysis and design x 2
Sekolah Menengah Kebangsaan Orkid Desa, Kuala Lumpur	EduBabble: A web-based comprehensive textbook management system (not installed)	Low to medium fidelity interactive prototype x 2, database design x 2, system analysis and design x 2

This project effectively integrates Project-Based Learning (PBL) within a Service-Learning framework, and it has been formally registered for Intellectual Property rights, specifically copyright, for all six working developed projects. By combining PBL and Service Learning, students work on real-world problems, creating software solutions that address the needs of local schools. This approach not only enhances students' technical and collaborative skills but also fosters a deeper understanding of the ethical and societal implications of their work. The registration of copyright ensures that the intellectual property rights of these software solutions are protected, acknowledging the originality and innovation involved in their development.

Furthermore, the successful installation of the five projects in the schools demonstrates this initiative's practical impact. The software solutions developed by the students are now actively used in the schools, directly contributing to improved administrative and educational processes. This implementation highlights the effectiveness of the project in bridging academic knowledge with real-world applications. It also reinforces the value of academic-community collaborations, showcasing how such projects can lead to tangible benefits for educational institutions while providing students with meaningful, real-world experiences.

Acknowledgement

We extend our sincere gratitude to the management at MJIIT for their unwavering support, the dedicated teachers from the participating schools for their invaluable and continuous feedback, and the students whose hard work and commitment were instrumental in the success of this project. Additionally, we would like to thank the rest of the project team members for their collaboration, dedication, and valuable contributions throughout the project.

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ID 51: Backward Design is the New Forward in Learning and Teaching Approach to Reduce Anxiety among Students

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Highlights: Students enrolled in the landscape architecture (LA) program often express feelings of detachment and lack of pride in their studies, particularly among first-year students. Recently, the program has seen an increase in reports of anxiety among students. In response to this issue, this project aims to alleviate anxiety through an innovative teaching approach known as Backward Design (BD). According to the findings, a significant majority of students (84.62%) reported that they experienced a satisfying learning experience due to the BD delivery style of the lessons. Given that a satisfying learning experience can lead to reduced anxiety, it follows that the implementation of BD learning processes has effectively decreased students' anxiety regarding lesson outcomes by 84.62%.

Keywords: *Backward design; Reduced anxiety; Teaching approach*

Introduction

The landscape architecture (LA) program often struggles with a perception problem, particularly among first-year students who may feel detached and undervalued compared to their peers in architecture programs. This phenomenon was seen in the LA program's students enrolment of year 2022 and 2023. The feelings of detached can stem from a lack of awareness regarding the unique contributions and significance of LA program in shaping sustainable and aesthetically pleasing environments. In an era where interdisciplinary collaboration is increasingly essential, LA program offers a distinctive perspective that integrates ecological, cultural, and social dimensions into the design process. By fostering a sense of pride and attachment to the field, lecturers can help students appreciate the critical role they play as stewards of the environment, capable of influencing the quality of life in communities. Therefore, it is crucial for students to recognize that each discipline, especially LA field, plays a vital role in addressing the complexities of our built and natural environments.

Background

The landscape architecture (LA) program is currently facing significant challenges, particularly regarding the mental well-being of its students. A notable concern is the increasing reports of anxiety among students, especially upper years students, who are overwhelmed by the substantial workload and numerous assignments inherent in the program. This anxiety is often exacerbated by a perceived lack of passion for the field, leading students to question the purpose and relevance of their assignments. Many students feel disconnected from their studies, comparing themselves unfavorably to peers in architecture programs and viewing their own efforts as aimless.

The high volume of assignments can create a sense of drowning for students, particularly when they struggle to see the connection between their assignments and future career paths. The feelings of disconnected can foster feelings of frustration and helplessness, as students struggle with the pressure to perform while simultaneously questioning the value of their work. When assignments are perceived as irrelevant or disconnected from real-world applications, students may become disengaged, leading to a cycle of procrastination and increased anxiety (Wyrostek & Haefner, 2008).

To address these issues, it is crucial for lecturers to foster a supportive learning environment that emphasizes the unique contributions of LA program. By clearly articulating the relevance of assignments and how they align with professional practice, lecturers can help students develop a sense of purpose and pride in their work. This can be done using the Backward Design teaching approach by ensuring that assignments are meaningful and directly tied to learning outcomes. This approach not only helps students understand the significance of their assignments but also equips them with the skills and knowledge necessary to thrive in their future careers.

Backward Design as Teaching Approach

Backward Design envisioning the clear learning objectives upfront prior to learn the lessons, which is by identifying the essential skills and knowledge LA students need to acquire throughout their studies. By establishing these goals upfront, lecturers can design a curriculum that is purpose-driven and aligned with landscape industry standards (Maldonado, 2022). This approach can foster a sense of pride and attachment to the LA program, particularly among first-year students, who may feel overshadowed by architecture programs. When students recognize how their learning contributes to real-world applications, their motivation and engagement increase.

Backward Design requires lecturers to develop assessments that directly measure student progress toward the established learning objectives (Llerena, 2020). This alignment ensures that students are not merely completing tasks for the sake of course requirement but are engaging in activities that genuinely contribute to their understanding and skill development. Examples of assessments for LA students can include design projects, critiques, and presentations that reflect their learning outcomes. The Backward Design framework provides a structured pathway for learning, allowing lecturers to scaffold instruction effectively (Mohammed et. al, 2022). This structure is particularly beneficial in a complex field like landscape architecture, where students must integrate knowledge from various disciplines, including ecology, design, and urban planning. Lecturers can help students develop a comprehensive understanding of the field by carefully planning learning activities that build on one another. Backward Design encourages students to engage in higher-order thinking (Mohammed et. al, 2022). LA students can be prompted to analyze, synthesize, and evaluate information as they work toward their learning objectives. This critical thinking is essential for their future roles as designers and planners, where they must navigate complex challenges and propose innovative solutions.

VR Create a Focused Environment

Using Virtual Reality (VR) as an educational tool offers unique advantages that go beyond simply watching a video normally. While it is true that VR can be seen as a gimmick or a distraction for some students, it also provides several significant benefits that can enhance learning experiences (Vats & Joshi, 2022). VR creates an immersive environment that captures students' attention more effectively than traditional videos (Calvert & Abadia, (2020). When students feel like they are part of the content, they are more likely to stay engaged and focused.

There are few reasons why this project uses VR in delivering the class content. The first reason is while students may use their phones during traditional video viewing, VR headsets can create a focused environment by blocking out external distractions. This can help students concentrate better on the learning material. The second reason is VR experiences can guide students through structured learning pathways, reducing the likelihood of wandering attention that can occur with traditional videos. Therefore, this project will experiment how VR can enhance learning experience in the class.

Conventional Teaching Style meets Digital Native Students

The LA program faces a significant challenge in engaging and exciting students, particularly first-year enrollees who are digital natives. The conventional teaching styles, such as teacher-centered approach, employed in the program often clash with the expectations and learning preferences of these students, leading to an incompatible teaching and learning experience. To address this gap, this project aims to experiment with an innovative teaching approach that combines the Backward Design method with Virtual Reality (VR) technology (Figure 2).

Traditional teaching methods, such as lectures and textbook-based learning, may not resonate with today's digital native students who are accustomed to interactive, multimedia-rich environments. These students have grown up with technology and expect learning experiences that are engaging, immersive, and relevant to their lives. The Backward Design approach emphasizes starting with clear learning objectives and aligning assessments and instructional activities to achieve those goals. By adopting this method, lecturers can create a more purposeful and engaging curriculum that addresses the needs and interests of digital native students. Integrating VR technology into the Backward Design framework can significantly enhance the learning experience for LA students. VR allows for the creation of immersive, interactive environments that bring abstract concepts to life. Students can virtually explore design scenarios, experiment with different solutions, and receive immediate feedback, fostering a deeper understanding of landscape architecture principles.

Method

This Backward Design teaching approach (Figure 1) is tested to the first-year students because they will be the best sample group to be exposed with the LA output. Students were exposed with three learning goals in the class which are a) Identify Desired Results; b) Determine Acceptable Evidence; and c) Plan Learning Experiences and Instruction. At the beginning of the class, students will be given two types of desired results, which are a) first result of upon program completion (long-term outcome) and b) second is result upon lesson completion (short-term output). Then, the students were shown what is expected of them to deliver upon every lesson. And finally, students will be given class activities, assignments and assessments related to the desired outcome that have been explained.

Evidences

These evidences were based on the Backward Design teaching approach, the following evidence were gathered to prove the approach was successful.

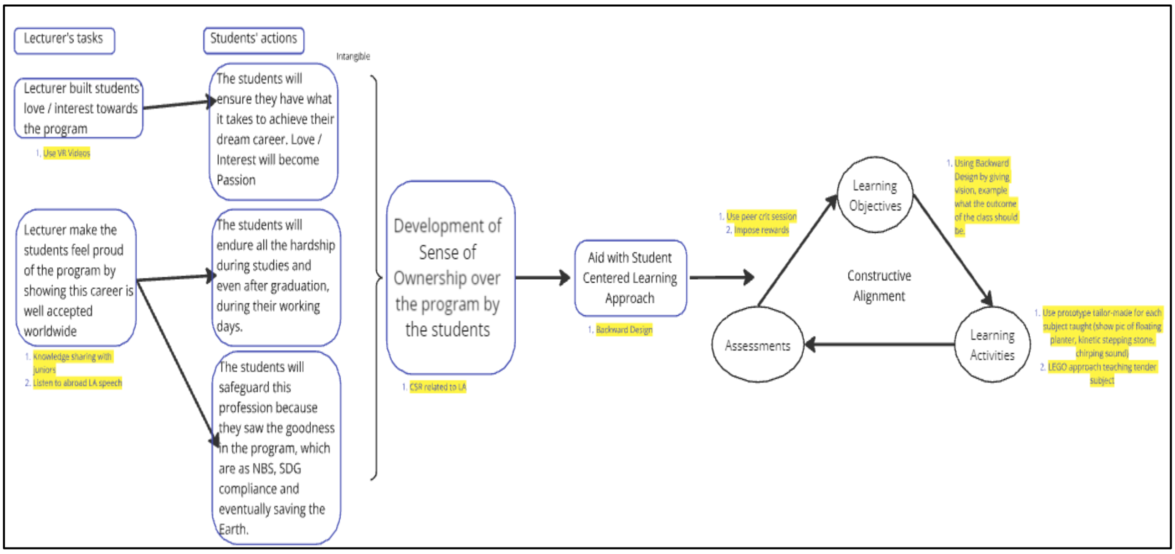

Figure 1: Project flow of implementation of Backward Design teaching approach among the first year LA students

Students Performance

Students' performances under the Backward Design teaching approach were analyzed based on the grades obtained from the two semesters. One semester was from the previous semester of year 2022/2023, which the lesson was delivered using conventional teaching approach. And the second semester of year 2023/2024 was taken from the current semester, which the lesson was delivered using the Backward Design teaching approach. High grades indicate positive constructive alignment.

Based on the line chart in Figure 2, there was an improvement seen in the students' grades. The result for 2023 was showing that the students' grades were ranging from A until C- (Figure 1, upper chart). This shows that the teaching style of the lecturer did not manage to capture some of the students' attentions causing them to not managing to showcase their newly learned skills through the assignments, hence the grades were low. However, there was an improvement in the next semester, which is 2024, where the students' grades were ranging from A until B+ (Figure 2, lower chart). In that semester, the new teaching approach was implemented which was the Backward Design. The good grades were the manifestation of how well the students accepting the mentioned teaching approach.

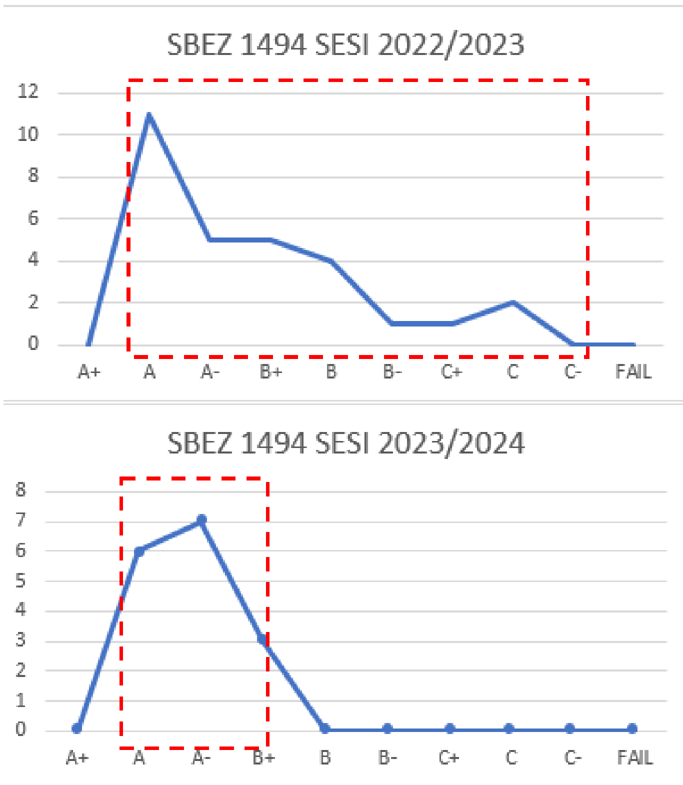

Figure 2: LA Students' grade comparisons with two batch of first-years from 2023 and 2024

Results and Findings

Students' performances based on Table 1, students' responses towards lecturer's teaching style have been thematically analyzed. The lesson was dissected into three stages, namely the early stage of lesson, middle stage of lesson and end stage of lesson. During the early stage of the lesson, 70.83% of students gained *new knowledge* through the Backward Design Teaching style approach. *New knowledge* refers to the information or insights that expand or modify existing understanding of students within a particular field or context. Whereas, 20.83% of them thought the teaching style had *exceeded their expectation*. *Exceed expectation* refers to the act of a lecturer's teaching style was beyond the standard requirements or anticipated outcomes by students in the educational settings. 21.47% of the students agreed that they found the lesson delivered was using an *engaging teaching style*. *Engaging teaching style* refers to instructional approaches that actively involve students in the learning process, fostering their interest, participation, and motivation.

During the middle stage of the lesson, students were already familiar with the teaching style. Therefore, 21.74% of students were focusing on the *types of in-class activities* used by the lecturer. *Type of in-class activities* refers to the activities that can be used to engage students and enhance their learning experience. They were captivated with the types of activities used by the lecturer, for example, the use of case studies, group discussions, and presentations. Furthermore, 26.09% of students agrees that the class was engaging due to the *gamification* of the questions making them more focused and more alerted. *Gamification* refers to the strategic application of gaming design elements in non-gaming contexts to motivate and engage students. The games invoked their competing spirit by the stimulating the adrenaline rush, eventually making them always at the edge of their seat. Other than the engaging teaching style, 13.04% students also agreed that receiving *rewards*, such as foods, gifts and snacks, intrigues their engagement in the class. *Rewards* refers to something was given by the lecturer to the students in recognition of their effort, or achievement. Among all the teaching efforts, 8.70% of the students thought that one of the reasons why students able to comprehend the lesson was due to the *lecturer's teaching persona*. *Lecturer's teaching persona* refers to the distinct characteristics, behaviors, attitudes, and teaching styles that define a lecturer's approach to education and their interactions with students. Students describe the lecturer's ability to simplify complex concept, fostering non-judgmental class ambience, and easy to negotiate problems, providing them positive environment to learn.

Lastly, during the end stage of the lesson, majority of the students (84.62%) agreed that they have achieved the *satisfied learning experience* through the lesson delivery style. *Satisfied learning experience* refers to a positive and fulfilling educational journey where students felt that their needs, expectations, and desires have been met during the learning process. And only a handful of 15.38% of students felt they *needed more activities* to help them better comprehend the lesson. *Needed more activities* refers to the recognition or expression of a desire for additional engagement opportunities, tasks, or experiences within a particular context, such as education settings. If satisfied learning experience leads to reduced anxiety, therefore, all of these learning journey have been found to reduce students' anxieties towards the lesson outcome by 84.62%. It is because when students feel that they are achieving their learning goals and making progress, they experience a sense of accomplishment. This positive reinforcement can boost their confidence and reduce anxiety about their ability to succeed in the course (Wyrostek & Haefner, 2008). A satisfied learning experience provides students with evidence of their competence, which helps alleviate performance-related anxiety.

Table 1: The written responses of students towards lecturer's lesson delivery

Stage of the lesson	Major theme	Percentages occurred in the students' responses	
Early stage of lesson	New knowledge gained	100%	70.83%
	Exceed expectation		20.83%
	Engaging teaching style		8.33%
Middle stage of lesson	Gamification	100%	26.09%
	Types of in-class activities		21.74%
	New knowledge		17.39%
	Engaging teaching style		13.04%
	Rewards		13.04%
	Lecturer's persona		8.70%
End stage of lesson	Need more activities	100%	15.38%
	Satisfied learning experience		84.62%

Conclusion

In conclusion, the relationship between reduced anxiety and a satisfied learning experience reciprocal. While reduced anxiety can lead to greater satisfaction, a satisfied learning experience can also contribute to lower anxiety levels by fostering a sense of accomplishment, relevance, supportive relationships, effective coping strategies, and positive emotions. By addressing both factors, educators can create a learning environment that promotes academic success and emotional well-being for their students.

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ID 53: EDA Tool-assisted learning for Digital Electronics among freshmen

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Highlights: EDA tools are necessary for current digital circuit design in order to effectively utilise their capabilities. One of the courses offered for freshmen of Electrical Engineering is Digital Electronics. It is expected of this newcomer who has just entered the world of higher education to do well for this subject i.e analysing and creating digital circuits. The use of design and analysis software i.e Quartus EDA tool in this study is appropriate for educational purposes, since it helps students rapidly enhance their design skills while keeping in mind the ultimate necessity to use industry-standard tools. This paper aims to show the opinion of the freshmen about the effectiveness of the tool to assist them better comprehend digital logic design.

Keywords: *Digital electronic; EDA tool; tool-assisted learning; freshmen*

Introduction

Students can explore various approaches when implementing logic modules such as multiplexers, adders, comparators, flip-flops, counters, and registers by studying core topics in the Digital Electronics course, such as logic gates, Boolean algebra, Karnaugh maps, and logic simplification (Rafiquzzaman, 2014). After then, these modules are connected to one another in a hierarchical structure to create a bigger system that can carry out practical tasks like data processing, control, and timing.

Due to the one-way nature of teaching, traditional lectures that simply make reference to the slide notes are no longer possible (Daniel, 2012). According to feedback from the lecturer presenting the course, the students frequently memorise information without fully comprehending its workings. For engineering students in particular, student engagement is essential to guiding teaching and learning (T&L) methods towards a more student-centered approach (Ribeiro, 2018).

Quartus EDA tool is an open source software for design and development of digital system developed by Altera (now part of Intel) (Intel, 2024). Quartus II was widely used in the field of digital design and field-programmable gate array (FPGA) development before it was succeeded by Intel Quartus Prime as the primary design software for Intel FPGAs. The purpose of this survey, which is given to first-year students enrolled in Digital Electronics classes in their first semester of study, is to evaluate the efficacy of tool-assisted learning. Students in this course must master design techniques while simulating and implementing circuits using Quartus EDA tool (Reis, 2023). The aptitude of students to use this industry-standard tools is observed, as the design of contemporary digital circuits necessitates their full utilisation. The goal is to evaluate the efficacy of tool-assisted learning based on students' reflections about how effective the tool can help them understand the material more fully and boost their self- confidence toward their design knowledge.

Objectives

The objectives highlighted in this paper are as follows.

1. To study the effectiveness of EDA tool-assisted learning framework for Digital Electronic course.
2. To show the student's reflection as the freshmen in applying an industry-standard tool to improve the course learning.

The novelty idea presented in this paper as follow;

- The use of hands-on practices using an industrial-standard tool i.e Quartus EDA tool (Reis, 2023) is fully emphasized to freshmen as an early efforts to improve the learning process for this course. The idea is implemented through a structured exercise with precise design specifications. Students must apply the design framework, self-understand the specifications, and use the tool to create a solution that satisfies the design requirements. Concepts and theories that students have learnt in class will be directly implemented with the help of the tool by complementing this task.

Some innovativeness from this idea are as follows:

1. Compared to lectures based on notes alone, freshmen were exposed to a framework that uses industry-standard tools at a very early stage so that they get an early exposure to the reality of the integrated circuit design process.
2. Students are able to improve their understanding of this course because the EDA tooi-assisted learning method opens up space for them to explore circuit design activities not only at the simulation level but is able for them to produce a physical prototype that displays a real world circuit function i.e traffic light circuit.

Application design;

During learning, students will apply a creative process called digital design to determine the collection of digital logic components to perform a specific function. Figure 1 summarizes the framework of digital design process. It starts with the specification stage where students needs to understand the design requirements i.e how many input-ouput involve and relationship between them. Students need to translate the relationship through a truth table and Boolean expression. In the design entry stage, a description of the digital circuit is entered into the design software called schematic capture. It is a graphical method for entering logic circuits directly for small circuits or hierarchically for larger circuits. After the designs are entered, they are compiled to extract netlist, which describe the connection between individual logic components (gate). The netlists become inputs to functional simulation or timing simulation. During functional simulation, a circuit is tested to verify its logic operation without regard to timing analysis, whereas, timing simulation tells the designer how fast signals go through the gates and how fast the circuit can operate. Students have two options in this stage either they can achieved the design result through simulation only (waveform) or implement the design on specialized physical hardware (working prototype). If they chose for the physical implementation, in the final stage which is logic synthesis, the netlist which passes the simulation stage is mapped to the actual chip where the function of the circuit can be seen on physical prototype i.e circuit connection on breadboard.

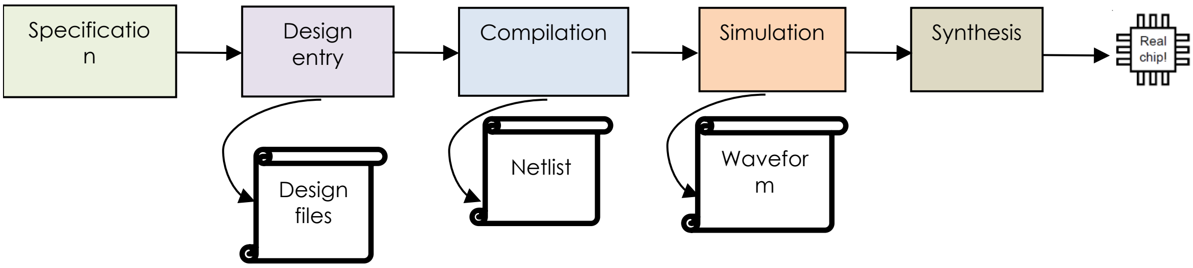
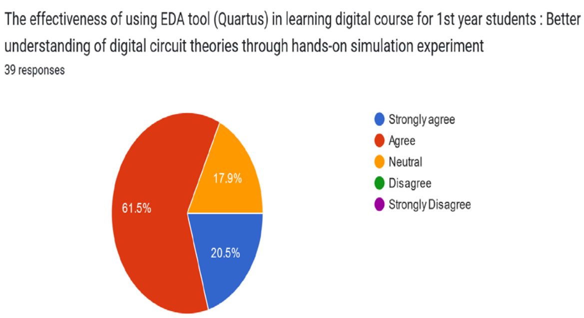
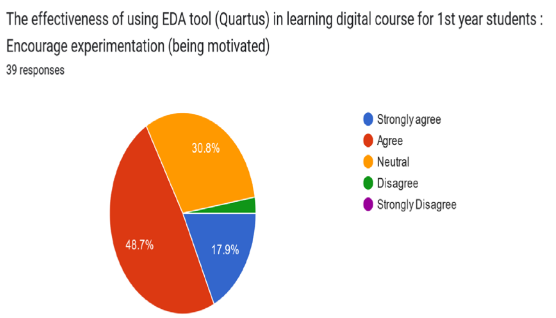
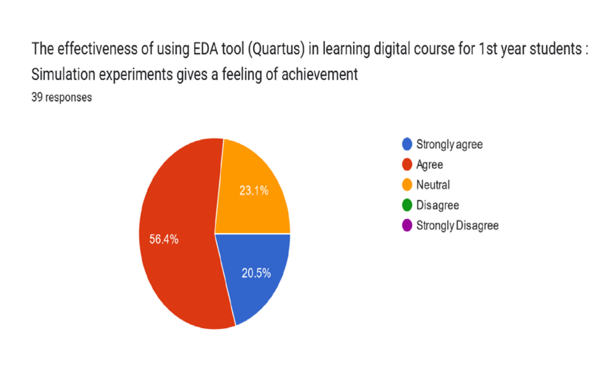


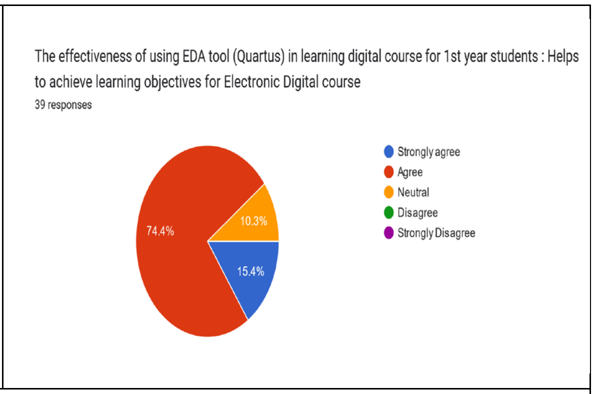
Figure 1: Digital design process framework

Findings

Figure 2 shows reflections from students regarding how well the tool supported their learning, how well they understood the course material both before and after using it, and whether the technology was appropriate for their first-year learning. From the findings, the majority of students agree that EDA tool-assisted learning is suitable for freshmen like them even though the tool has standard instrument for the industry. Table 1 presents student reflection toward their confidence of their design knowledge after completing mini project which require them to apply EDA tool-assisted learning. Based on their engagement for this project, they believe that using the tool-assisted learning approach has greatly increased their sense of accomplishment and self-confidence in their capacity to apply the knowledge they have learnt in the classroom and take on more challenging projects in the future. Although they first encountered some challenges when utilizing the common industrial instrument, they were able to get over the problems and get the desired outcomes.

The effectiveness	
	





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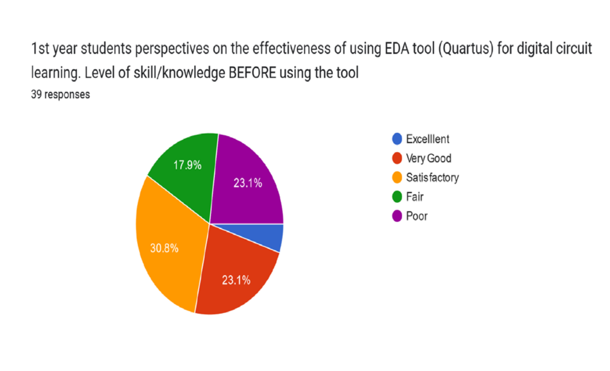
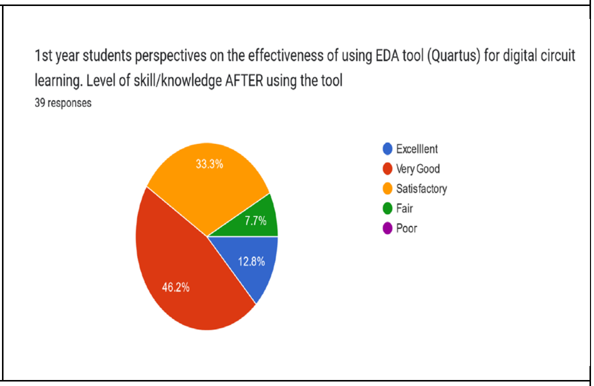
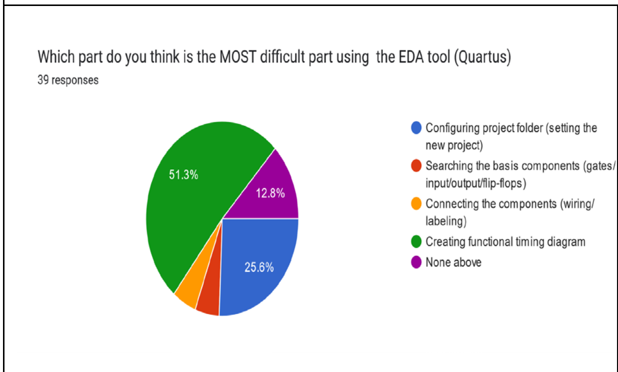




Students remarks



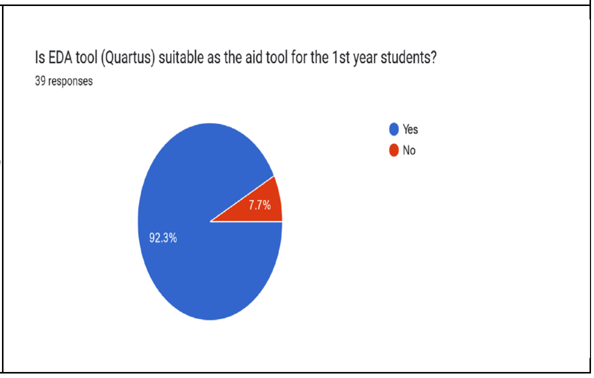


Figure 2: Students' reflections in terms of the effectiveness of the tool in assisting their learning, their perspectives to the level of knowledge to the course materials before and after utilizing the tool and their thoughts to the suitable of the tool in the learning as a freshman

Table 1: Students' reflection on their self-confidence after completing a mini project through the application of tool-assisted learning

Student	Reflection
1	Completing this project has given us a great sense of achievement and boosted our self-confidence in our abilities. We were able to apply our knowledge of digital logic to create a functional circuit, which has given us the confidence to tackle more challenging projects in the future
2	The use of Quartus software and simulation, along with the use of truth tables and Karnaugh maps, make the design process organized and efficient.
3	Completing the project and seeing the results gave me a sense of accomplishment and improved my self-confidence.
4	I am happy when doing this project because I had learnt many things through this project. In this project I learnt that how to use Quartus to draw logic circuit and simulate it. Apart from that, I had learnt also to analysis the timing diagram.
5	This mini project has increased my self-confidence and self-responsibility in executing daily tasks and other group projects from different courses as well.
6	Working on a mini project with a team requires clear and effective communication, especially when discussing the design and implementation of the circuit. Good communication can help avoid misunderstandings and ensure that everyone is on the same page.

7	Self-confidence is crucial when working on a little project of a combinational circuit in an electrical digit subject since it enables the person to approach the task with a positive attitude, trust in their abilities and expertise, and feel capable of finishing the project. Without self-confidence, a person can feel overwhelmed, hesitant, or doubt their capacity to finish the project, which would sap their enthusiasm and make it challenging to get things done.
8	Overall, the little project was a good learning experience, and I am more confidence in my abilities as a software engineer as a result
9	The Quartus enables us to analyse and synthesis our circuit design and simulate its reaction to different stimuli.
10	Learning new knowledge about using Quartus is one of the best things. I hope that good things that are able to produce students who excel in learning and think of thoughtful ideas in applying the knowledge learned can continue in the future.
11	I was confident that our project become a successfull project. I was responsibility to prepared and make a video about how to use make a circuit and tested it on Quartus Prime. I explained it well done and posted it on YouTube to make the lecture easily to access.
12	Personally, I have experienced and enjoyed working with my group. I have learn how to brainstorm a problem and properly learn how to make a schematic diagram, Quartus and waveform.
13	One important thing that I realized during this assignment is i got to increase my self-confidence. This is because every person in this group needs to express their views and opinion to solve this problem.
14	So far, I think the Quartus is so helpful for students 1st like us and it makes me easier to gain knowledge about Digital Electronics.
15	The creation of a combinational circuit mini project can raise your confidence since it gives you the chance to use the information and abilities you have acquired in the classroom to solve a practical problem.
16	This assignment helped me to understand more about this course that we learned this year.
17	The usage of Intel Quartus Prime Lite Software had lot of error raising issues while doing timing simulation in the initial stages. However, we were able to overcome all of it by self-analysing and proper reference from the lecturer.

Conclusion

The results indicate that students were able to get a deeper understanding of integrated circuit design, a topic taught in the Digital Electronic Design course, by utilising EDA tool-assisted learning. Understanding the course is aided by the positive feedback from students who have used the design framework, which incorporates some practical exercises. Students also value the tool-assisting learning style since they find it to be more engaging than standard lectures. In the future, a more comprehensive and well-structured data analysis will be carried out, drawing from the students' reflections.

Acknowledgement

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ID 54: A Project-Based Exploration of VLSI Design, Ethics, and Industry-Standard Tools

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Highlights: A project-based learning assignment is designed for third-year students who are majoring in Electronic System Design and Microelectronics. This hands-on experience involves exploring logic gates, Boolean algebra, and circuit implementation. However, the project presents challenges in balancing complex design considerations and mastering industry-standard EDA tools. To support them in navigating these complex tasks, a milestone achievement framework has been implemented to support them in navigating these complex tasks. This framework is assisted with a blended learning approach, ensuring students effectively navigate the project completion using industry-standard EDA tools. Learning outcomes are assessed through milestones achievement and evaluated using technical and output visualization rubrics.

Keywords: *Mentor Graphics EDA; VLSI design; project-based learning; hands-on experience*

Introduction

Basic Digital VLSI Design covers topics like Metal-oxide Semiconductor (MOS) transistors, Complementary Metal-oxide Semiconductor (CMOS) inverter design, combinational and sequential logic circuits, registers, and interconnects. However, the complexity of these topics sometimes makes it difficult to fully explain them in traditional face-to-face classes, leading to student comprehension gaps. Furthermore, limited class hours can contribute to lower learning outcomes. To address these challenges, innovative teaching methods are needed to enhance student understanding and engagement.

The rapid evolution of technology, driven by Industry 4.0 and the rise of artificial intelligence (AI), demands a new breed of engineers proficient in digital Very Large-Scale Integration (VLSI) design as reported by Al-Maadeed et. al (2020) and Li, Li, and Zhou (2022). These engineers will be at the forefront of developing the next generation of intelligent systems, from autonomous vehicles to advanced medical devices, all powered by sophisticated integrated circuits as reported by Aziz et. al (2020). To meet this challenge, a project-based learning experience specifically tailored for third-year Electronics System Design and Microelectronics students. The core of this learning experience lies in hands-on projects focused on custom schematic-driven layouts. Students embark on a journey of discovery, exploring the building blocks of digital circuits: logic gates, boolean algebra, and circuit implementation. They learn to translate abstract concepts into tangible, functional circuits, building them from the ground up. This process fosters a deep understanding of digital design principles, pushing students beyond theoretical knowledge and into the realm of practical application. Reddy et. al (2020) also mentioned that this approach extends beyond circuit design to encompass design for testability (DFT). The students learn to incorporate testability features into their designs, ensuring that the complex integrated circuits they create can be thoroughly tested and validated. This critical skill is essential for developing reliable and robust systems, particularly in AI-powered applications where even minor errors can have significant consequences.

The project-based learning approach guides students through the entire design flow, from schematic capture to simulation, verification, and layout. They gain proficiency in using industry-standard Siemens Mentor Graphics EDA tools, gaining valuable experience with software used in real-world VLSI design environments. This hands-on experience prepares them for the complexities of advanced VLSI design courses and equips them with the skills needed to thrive in the competitive field of integrated circuits (I.C). This direction is also adapted the review written by Singh, A. K., Kumar, A., & Singh, R. K. (2023). To ensure a comprehensive learning experience, student learning outcomes are assessed through a series of milestones. These milestones incorporate relevant technical and output visualization rubrics, providing a structured framework for evaluating progress and ensuring mastery of key concepts. This robust assessment system allows students to track their growth, identify areas for improvement, and ultimately gain confidence in their abilities as digital VLSI designers.

Methodology

This paper examines the effectiveness of blended learning in project-based assignments for a Basic Digital VLSI Design course. The study analyses the impact of this approach on student learning outcomes, focusing on a cohort of 86 third-year Bachelor of Electronics Engineering students at the Faculty of Electrical Engineering in 2023/2024. The learning outcomes are then compared with learning outcomes achievement in academic year 2021/2022 and 2022/2023.

This project-based learning assignment challenges students to design and test complex digital circuit design using industry-standard software. They learn to create circuits, optimize their size and performance, and test their functionality. This hands-on experience equips them with the practical skills and knowledge needed for a successful career in digital VLSI design. The program emphasizes ethical design considerations, encouraging students to think about the broader impact of their work and ensure their designs are responsible and sustainable. This approach aligns with the program learning outcome (PLO5) of designing solutions for complex engineering problems while considering ethical and societal implications.

Figure 1 shows the framework used to visualize the flow of associating the blended learning method with project-based assignments. In general, the project-based assignment started with the design planning, followed by methods used for delivery the learning and lastly the assessment. Students are provided with a brief face-to-face project description and then grouped into teams of three. Each team is given one week to develop a design proposal based on a given complex boolean equation, including a truth table and stick diagram. Students attend short online meetings with lecturers to receive feedback and approval on their pre-circuit design based on a provided schedule. Upon approval, students can begin implementing the schematic and layout of the circuit using Siemens Mentor Graphics EDA tools. These tools are easily accessible via the *AnyDesk* platform from student hostels or any location with internet access. Lecturers also provide tutorial videos on implementing circuit design using the dedicated EDA tool for this project.

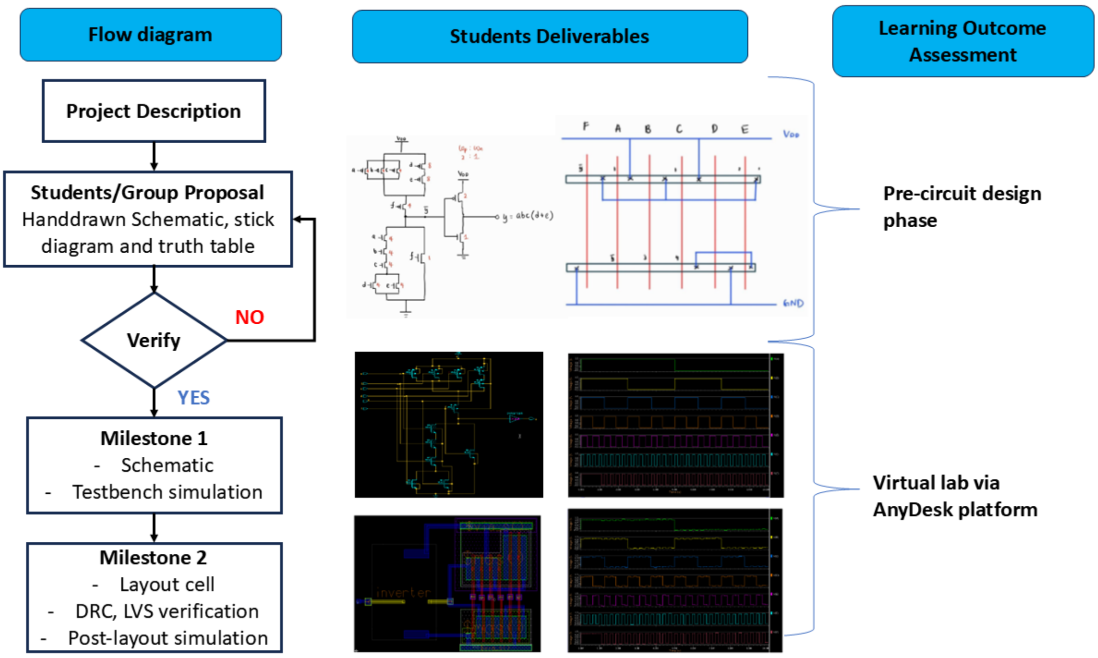

Figure 1: Framework of Project-based Assignment Implementation and Analysis

Pre-circuit Design Phase

The pre-design phase sets the stage for the project-based learning experience, laying the groundwork for students to embark on their VLSI design journey. This phase involves a combination of theoretical instruction and practical application, preparing students for the challenges ahead. Lecturers provide a comprehensive briefing on the project, outlining the specific requirements, design goals, and performance targets. This includes defining the target technology, desired functionality, and any constraints on power consumption, area, or performance. Students are introduced to the industry-standard EDA tools they will be using throughout the project. This includes hands-on demonstrations and tutorials on the specific features and functionalities of the chosen EDA software, ensuring they are comfortable navigating the software environment. To foster a deeper understanding of the underlying design principles, students are guided through hand calculations for key design parameters. This includes calculating the layout fill factor, estimating delay, and analyzing power management strategies. These exercises help students grasp the theoretical concepts that underpin the design process. Each group of students is assigned a unique and complex Boolean expression. This serves as the foundation for their design, requiring them to analyze the expression, understand its logic, and translate it into a functional circuit. Students create stick diagrams to visualize the layout of their circuit before embarking on the actual schematic design. This step allows them to explore different layout options, optimize the placement of components, and estimate the overall size and complexity of the final design. Students construct a truth table that accurately reflects the functionality of their circuit design. This serves as a crucial verification step, ensuring that their design meets the specified logic requirements. The truth table also allows them to predict the output behavior of the circuit for different input combinations, which can be further validated through pre- and post-layout simulations. Students schedule short online meetings with their lecturers to present their design proposals and receive feedback. This allows for early identification of potential issues, clarification of design choices, and guidance on optimizing the design before moving into the implementation phase.

Milestone 1: Schematic Design and Simulation

In Milestone 1, students transition from their pre-approved design proposal to the actual implementation phase. They use the Pyxis environment within Siemens Mentor Graphics EDA tools to create a schematic diagram of their circuit, carefully placing and connecting logic gates and components based on their previous stick diagram and truth table. To test the functionality of their design, they create a testbench that simulates the circuit's behavior under various input conditions. Next, they perform a series of simulations to analyze the circuit's performance characteristics, including functional simulation to verify logic against the truth table, timing simulation to assess propagation delays and signal transitions, and power simulation to evaluate power consumption. Finally, students document their design process and simulation results in a technical report, including a clear schematic diagram, a detailed description of the testbench, and a comprehensive analysis of simulation data. This report also includes a comparison of simulation results with the truth table, highlighting any discrepancies or unexpected behavior, and a discussion of the circuit's performance characteristics and potential areas for improvement. Successful completion of Milestone 1 demonstrates the students' ability to translate their design concept into a functional schematic, test its behavior, and analyze its performance, laying the foundation for the next phase of the project.

Milestone 2: Layout Design and Verification

In Milestone 2, students take their schematic design from Milestone 1 and transform it into a physical layout using schematic-driven layout (SDL) techniques. They use the EDA tool to place and route components (transistors, gates, etc.) according to the schematic, carefully adhering to design rules and layout constraints. To ensure their layout meets these rules, they perform Design Rule Checks (DRC) and Electrical Rule Checks (ERC), identifying and correcting any violations. They also perform Layout vs. Schematic (LVS) verification to ensure the layout accurately reflects the schematic design. After creating the layout, students perform post-layout simulations to assess the circuit's performance in the physical layout. This includes functional simulation to verify the layout's functionality, timing simulation to analyze the circuit's timing behavior, and power simulation to evaluate power consumption. Throughout this process, students have access to a printed manual, online consultation with lecturers via WhatsApp, email, or online meetings, and recorded videos by Isaak, S. (2020) demonstrating SDL techniques. They also schedule online meetings with lecturers to discuss their progress and receive feedback. Finally, students document their layout design process and simulation results in a technical report, including a layout diagram, summaries of DRC, ERC, and LVS results, simulation data, and a discussion of the circuit's performance. The technical report is graded based on a rubric that assesses the quality of the layout design, compliance with design rules, accuracy of verification, simulation results, and technical writing. Successful completion of Milestone 2 demonstrates the students' ability to translate a schematic design into a physical layout, ensuring it meets design rules and accurately reflects the schematic, while also emphasizing the importance of verification and simulation in ensuring the design's functionality and performance.

Results: Learning outcome assessment

A blended learning framework for a project-based VLSI circuit design assignment effectively addressed the challenges of using industry-standard tools. The study, which focused on a complex full-custom circuit design utilizing Silterra 130 nm CMOS technology and Mentor Graphics, demonstrated consistent high achievement in CLO3/PLO5, along with strong performance in CLO/PLO1 and CLO2/PLO3, across three academic sessions (2021/2022, 2022/2023, and 2023/2024). As shown in Table 1, a slight dip in CLO3/PLO5 achievement was observed in 2022/2023 due to a lack of foundational MOSFET knowledge and circuit analysis skills in some students, the implementation of virtual labs with a blended learning approach resulted in consistent KPI achievement of ≥ 0.65 for all CLOs/PLOs in 2022/2023 and 2023/2024, compared to fully face-to-face project-based performance in 2021/2022. This highlights the effectiveness of combining virtual labs, face-to-face, and online learning in providing hands-on experience with industry-grade tools like Mentor Graphics. The successful completion of more complex designs in 2023/2024 further emphasizes the adaptability and effectiveness of virtual machine implementation for project assignments.

These findings suggest that blended learning frameworks can significantly enhance student engagement and learning outcomes in VLSI design, even in the face of unforeseen challenges. The integration of virtual labs and industry-standard tools allows students to gain valuable experience and develop essential skills, ultimately contributing to their success in the field of microelectronics. The project-based assignment itself was evaluated using a rubric that assessed students' understanding of the design problem and their objectives, their application of theoretical knowledge to make design decisions, their use of a logical and systematic design process, their ability to clearly present results using graphs, tables, or figures, their verification of data and explanation of findings, their justification of design choices and results, their production of a clear and concise report, and their proper citation of sources. This comprehensive evaluation ensured that students developed a strong foundation in VLSI design and were prepared for success in the field.

Table 1: Course Learning Outcome and Program Learning Outcome CLO/PLO achievements

Academic Session	CLO1/PLO1	CLO2/PLO3	CLO3/PLO5	Assessment Criteria (M1 & M2)	
				Criteria	Marks
				Pre-circuit completion and objectives	0 - 5
2021/2022	0.63	0.72	0.93	Decide design work to meet specifications.	0 - 5
				Implement a systematic design approach to generate logic circuit/full custom layout	0 - 5
2022/2023	0.68	0.77	0.84	Accurate display of results using graph/table/figure with proper labelling.	0 - 5
				Verify data and highlight the findings.	0 - 5
2023/2024	0.76	0.66	0.91	Neat and unambiguous report writing/presentation.	0 - 5

Conclusions

The blended learning framework for VLSI circuit design proved effective in addressing challenges associated with industry-standard tools. The integration of virtual labs, face-to-face, and online learning consistently improved student performance, particularly in CLO3/PLO5, demonstrating the value of hands-on experience with industry-grade tools like Mentor Graphics. The successful completion of complex designs further highlights the adaptability and effectiveness of virtual machine implementation. These findings suggest that blended learning frameworks can significantly enhance student engagement and learning outcomes in VLSI design, ultimately contributing to their success in the field of integrated circuit VLSI design.

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ID 55: IBS TECH_AR

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Highlights: The Industrialised Building System (IBS) represents a significant advancement in construction methods, providing numerous benefits such as faster construction times, cost savings, and enhanced quality control. By prefabricating components in a controlled environment and minimizing on-site labour, IBS addresses several common issues in traditional construction methods. The DCC30082 Industrialised Building System (IBS) in Sustainable Construction note has been enhanced through the integration of Augmented Reality (AR) technology via IBS Tech AR. This innovative approach was developed using Autodesk Revit and visualised in augmented reality through Augin application, and presented using Canva application has offered an interactive learning experience to users. The adoption of AR technology in teaching IBS has a transformative effect on both student learning and academic performance. By making complex IBS structures more understandable and engaging, AR fosters a more inclusive and effective educational environment. This innovation not only improves students' comprehension and performance but also equips them with valuable skills for their future careers in construction.

Keywords: *Industrialised Building System (IBS); Augmented Reality (AR); interactive learning*

Introduction

IBS Tech_AR is the integration of Autodesk Revit software, Augin application, and Canva applications in the context of an Industrialized Building System (IBS) classroom. Autodesk Revit is utilized for detailed design and modelling of IBS components, enabling precise and efficient creation of industrial building systems. Augin is an application used to preview and interact with these models in augmented reality (AR), allowing for immersive visualization and evaluation. Finally, Canva is used to present the project outcomes, offering a visually appealing and easily understandable summary of the design and AR experience. This approach streamlines the design process, enhances visualization, and facilitates effective communication of project results.

The novelty of IBS Tech_AR lies in its sophisticated use of modern technologies to create an integrated, interactive, and practical educational experience that aligns closely with current industry standards. This integration showcases a modern approach to teaching and presenting architectural and construction concepts, leveraging advanced technology to enhance educational outcomes and professional presentations. This combination of technologies can make learning in IBS Classrooms are more dynamic, practical, and aligned with industry practices. Students will be able to visualization and understanding the IBS through interactive learning, and prepared students to the real-world applications and career.

Content

Objective of Project

1. Development of ***IBS Tech_AR*** for IBS course using Autodesk Revit software and Augin Application.
2. Apply ***IBS Tech_AR*** with Topic IBS Steel Frame Installation Manual for subject DCC30082 Industrialised Building System (IBS) in classroom.
3. Get feedback ***IBS Tech_AR*** from students in classroom and industries by using questionnaire and interview.

The **novelty** of IBS Tech AR include:

1. **Integrated AR and 3D Modelling**: By combining Autodesk Revit's advanced 3D modelling capabilities with Augin's AR preview, IBS Tech AR offers a unique approach to visualizing complex building systems in a more interactive and immersive way. This integration goes beyond traditional methods, providing a dynamic experience that enhances spatial understanding and design comprehension.
2. **Interactive Learning**: The use of AR for real-time, interactive exploration of 3D models is a significant advancement over conventional 2D representations or static visualizations. This interactive element allows students to engage with the material in a more meaningful way, enhancing learning outcomes.
3. **Enhanced Presentation Capabilities**: Integrating Canva for creating polished, professional presentations adds a modern touch to the final stage of the learning process. It enables researcher to present their work with high-quality visuals and layouts, bridging the gap between technical modelling and effective communication.
4. **Cross-Platform Innovation**: The novelty also lies in leveraging the strengths of three distinct platforms—Autodesk Revit for design, Augin for AR visualization, and Canva for presentation. This cross-platform

approach introduces a cohesive and holistic educational tool that combines diverse technological advances in a novel way.

2. **Real-World Application**: The approach mirrors industry practices by integrating design, visualization, and presentation tools commonly used in professional settings. This not only makes learning more relevant but also better prepares students for real-world applications in the construction and architecture fields.

Overall, the novelty of IBS Tech AR lies in its sophisticated use of modern technologies to create an integrated, interactive, and practical educational experience that aligns closely with current industry standards.

Impact to student learning

The use of ***IBS Tech AR***, can significantly enhance student learning in several ways:

1. **Visualization and Understanding:** Autodesk Revit allows researcher to create detailed 3D models of building systems, providing a clear visual representation of complex structures. Augin's capabilities enable researcher to view these models in an augmented reality environment, making it easier to understand the design elements.
2. **Interactive Learning**: Augmented reality can make learning more interactive and engaging. Students can explore and manipulate virtual models in a more immersive way, leading to a deeper understanding of the material compared to traditional 2D diagrams or static presentations.
3. **Real-World Skills**: Familiarity with industry-standard tools like Autodesk Revit and professional presentation software like Canva prepares students for real-world applications and careers in the building and design industries.

Overall, this combination of technologies can make learning more dynamic, practical, and aligned with industry practices.

Research Methodology

The method of research will be used as shown below:

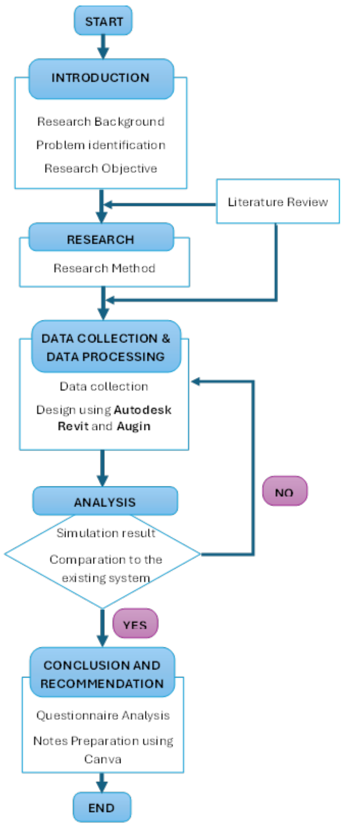

Figure 1: Flowchart for the Research Methodology

Finding and discussion

Implementing IBS Tech AR aligns with the goals of Industry Revolution 4.0 by integrating cross-platform technology into education and industry practices. By doing so, IBS Tech AR can enhance student learning, address industry needs, and create a new revenue stream for PolyCC, especially Politeknik Port Dickson. By implementing IBS Tech AR in classroom, academics can effectively utilize their expertise in BIM and AR to offer valuable services to the industry, enhancing real-time project visualization and problem-solving capabilities. This approach not only helps address industry needs but also generates income for Politeknik Port Dickson through the Centre of Technology (COT) and Lifelong Learning Education (PSH), while providing students with innovative learning experiences.

Other relevant information

IBS Tech AR has registered Copyright with Notification Number: **CRLY2024M04369** under the Copyright Act 1987.

The **commercial potential** of using IBS Tech AR

1. **Enhanced Training Solutions**: Offering a comprehensive training solution that combines Autodesk Revit application and Augin can appeal to educational institutions and corporate training programs. This integration provides a modern, effective way to teach building systems, which can be marketed to schools, universities, and industry professionals seeking cutting-edge training tools.
2. **Increased Market Demand**: As the construction and architecture industries increasingly adopt digital tools and AR, there is a growing demand for training programs that use these technologies. IBS Tech AR can position itself as a forward-thinking solution that meets this market need.
3. **Professional Development**: The combination of these tools can be marketed for professional development and continuing education. Companies in the building and construction sectors can use this technology to upskill their workforce, offering a potential revenue stream through specialized training programs.
4. **Innovative Product Offerings**: The ability to showcase projects in AR and present them professionally using Canva can set the technology apart from competitors, offering a unique value proposition that can be leveraged for marketing and sales.

Overall, IBS Tech AR has strong commercial potential by addressing the needs for modern, interactive training and professional development in the building and design sectors.

Acknowledgement

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ID 59: Engaging Academia and Industry in Teaching Operations Research Through Work-Based Learning

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Highlights: The integration of Work-Based Learning (WBL) into one of a mathematics subject - Operations Research (OR) aim to enhance students' learning experiences by bridging academic theory with current industry practices and real-world application. Throughout the industrial talk by industry professionals in classroom, the undergraduate students benefit from sharing sessions and gaining valuable perspectives and practical knowledge. Complementing this, industrial visit is organized to allow students to observe and engage with real-world operations, expanding their understanding of how OR principles are applied. This WBL program enriches academic knowledge and equips students with practical skills, preparing them to tackle real-world challenges effectively.

Keywords: *Operation Research; Work-Based Learning; Real-world Applications*

Introduction

Operations Research (OR) involves complex problem-solving techniques crucial for decision-making in various industries. Traditional classroom settings often struggle to convey the practical relevance of OR concepts. This study investigates how engaging with industry professionals can bridge this gap through Work-Based Learning (WBL).

WBL is increasingly recognized as an important element in current university education. As described by Garnett (2005), WBL is a process that integrates university-level thinking with work experiences to facilitate the recognition, acquisition, and application of individual and collective knowledge, skills, and abilities. This approach is designed to achieve specific qualified outcomes that benefit not only the learner but also the employer and the university. An increased emphasis on work-based learning is evident in Malaysia universities, reflecting a broader trend towards integrating practical experiences into academic programs. According to Atkinson (2016), WBL involves learning within real work environments through active participation in work activities and interactions, thereby connecting academic theory with practical application.

In the context of mathematics education, particularly in teaching and learning of Operational Research (OR), WBL plays a critical role where it provides students with the opportunity to apply their OR knowledge to real-world industry scenarios, bridging the gap between theoretical concepts and practical application. This practical exposure is crucial for enhancing their understanding and preparing them for future careers. In the Department of Mathematical Sciences of Faculty of Science in Universiti Teknologi Malaysia, two Work-Based Learning (WBL) initiatives were introduced for OR subjects: Linear Programming (LP) and Inventory Control and Queuing Theory (ICQ), aimed at second-year undergraduate students in the Bachelor of Science in Industrial Mathematics program. In the 2023/2024 academic year, the WBL programs were implemented with an industrial talk integrated into the LP course, and an industrial visit arranged for the ICQ course. The program's effectiveness and impact were formally evaluated, with student feedback and reflections on these WBL activities analyzed to gauge their effectiveness and overall impact.

NALI Approach: Work-Based Learning (WBL) Initiative

The implementation of Work-Based Learning (WBL) provides students with the opportunity to apply OR concepts to real-world industry scenarios where the hands-on experience is essential for deepening undergraduate mathematics students' understanding and equipping them for future careers. According to Ferrández-Berrueco et al. (2016), the WBL activities should incorporate key elements such as design, delivery, evaluation, and alignment with market needs in the planning of work-based learning initiatives. Our WBL programs were initiated based on a recent source by NCICTE (2017), comprehensive WBL programs should include three essential components: aligning classroom learning with workplace experiences, applying academic, technical, and employability skills in a real work environment, and receiving guidance from mentors either in the classroom or the workplace The objectives of this WBL initiative include:

i. To enhance students' learning experience through the engagement of industry partners.

ii. To offer real-world experience that increases students' confidence in future career.

iii. To assist students in building social century skills, exploring career interests, and defining their roles in society.

Industrial Talks in Linear Programming (LP) Course

In this approach, industry experts were invited to deliver lectures and presentations on real-world applications of Linear Programming (LP). The session provided students with insights into how LP techniques are utilized in industry settings, enhancing their understanding and appreciation of the subject matter.

The program was conducted during first semester of the 2023/2024 academic year by identifying industries that utilize LP techniques in real-world applications. A comprehensive study revealed that the oil and gas sector is a significant user of LP, employing it for tasks such as resource allocation, production scheduling, and cost optimization. Therefore, a representative from the oil and gas industry with expertise in applying LP in operations was invited to give an industrial talk. The purpose of the talk was to provide students with insights into the practical use of LP within the industry, demonstrating its relevance to real-world challenges and decision-making processes. To further enhance the learning experience, the session was designed to encourage active interaction between the industry representative and the students. A dedicated question-and-answer session allowed students to ask questions and gain a deeper understanding of LP's role in the oil and gas sector. Additionally, group activities were organized to enable students to collaborate on solving practical LP problems that mirrored challenges encountered in the industry. These activities promoted teamwork, communication skills and problem-solving skills while reinforcing the application of LP concepts learned in class.

Industrial Visits in Inventory Control and Queuing Theory (ICQ) Course

Students were taken on visits to companies where Inventory Control and Queuing Theory (ICQ) is actively applied. These visits included guided tours and interactive sessions with company personnel, allowing students to observe and analyze the practical implementation of ICQ concepts.

The program was held in second semester of 2023/2024 academic year. An industry visit was organized for the same group of students who enrolled in Inventory Control and Queuing Theory (ICQ). The visit was to a manufacturing company that produces stationery products for a specific brand. The aim of the visit was to integrate theoretical and practical learning in inventory management and queuing theory, allowing students to observe first-hand how these concepts are applied in an industrial setting. Students toured the factory, witnessing the production process from raw materials to finished products, while gaining insight into the inventory management strategies that ensure smooth production operations. The visit also featured a work-based learning session led by the Managing Director, who shared his expertise on inventory management, queuing theory, and production scheduling. The session concluded with a question-and-answer session, providing students with the opportunity to further explore the knowledge gained. This visit not only deepened students' understanding of the practical applications of course theory but also exposed them to the latest technologies and innovations in inventory and queue management. It served as a crucial step in preparing students for the challenges of the professional world. Figure 1 reveals the group photos after the site visits.

Figure 1: Group photo with the industry representative after the visit

Results and Discussion

After each WBL program, questionnaires were administered to assess the impact of the initiatives on students' learning experience in OR subjects. The feedback provides valuable insights into the effectiveness of integrating real-world industry exposure into the curriculum.

Industrial Talks

Industrial talks program demonstrates significant positive impacts on student learning and engagement, particularly in bridging academia and industry. Based on survey responses, more than 90% of the students valued the exposure to real-world applications of Linear Programming (LP), emphasizing its practical use in industries namely oil and gas. For many students, seeing how theoretical concepts were implemented to solve industry problems provided a more tangible understanding of LP. Based on written feedbacks obtained, most of participants appreciated the Q&A session, where the speaker shared personal industry experiences, further enhancing their grasp of how LP is applied in professional settings. Additionally, the students also highlighted the case study activity as one of the most beneficial parts of the program. This interactive element allowed them to work on real-world industry scenarios, applying LP concepts to optimize decision-making processes. Through these activities, students developed critical thinking skills, and a deeper understanding of how mathematical models are employed in operational decisions within industries. Overall, the program successfully engaged students in applying their academic knowledge in a practical context, preparing them for future careers in OR.

Clearly it can be seen that the implementation of industrial talks in the LP course resulted in enhanced student engagement and a noticeable increase in motivation. By inviting industry experts to share real-world applications of

LP techniques, students were able to draw a stronger connection between the theoretical concepts learned in class and their practical use in professional settings. This exposure not only made the coursework more relevant but also sparked interest in the subject. Moreover, the industry-led discussions provided concrete examples that clarified complex LP topics, allowing students to better grasp abstract concepts and apply them more effectively. The practical insights offered during these sessions played a crucial role in deepening students' overall understanding of the material.

Industrial Visits

In meanwhile, the students' feedback obtained after an industrial visit showed a significant positive impact on their learning experience. Most of the students expressed that the factory tour and the exposure to real-world processes were highly beneficial in enhancing their understanding of production and inventory management. The students appreciated the opportunity to see how theoretical concepts from their course, such as queuing theory and inventory control, were applied in an actual industrial setting. Furthermore, based on their written comments, the students highlighted an interactive Q&A session with industry experts as a crucial part of the visit, helping them to clarify their knowledge and gain insights into current industry practices. Additionally, feedback indicated that students felt more inspired to explore further studies in production scheduling, inventory control, and other related areas due to the practical exposure provided by the visit.

The industrial visits provided students with invaluable real-world exposure to inventory control and queuing systems, significantly enriching their understanding of the material covered in the Inventory Control and Queuing Theory (ICQ) course. The students gained firsthand experience of how theoretical concepts are applied in practical settings. The visits included guided tours and interactive discussions, which enabled students to connect their academic knowledge with industry practices. These experiences not only reinforced their theoretical understanding but also enhanced their problem-solving and analytical skills, as they were encouraged to analyze real-world scenarios and apply course concepts to address practical challenges. This immersion in an industrial environment deepened their comprehension and bridged the gap between classroom learning and professional practice.

Conclusion

This study presents a novel approach in integrating WBL into the OR subjects within the Department of Mathematical Sciences, Faculty of Science, Universiti Teknologi Malaysia. The initiative shows significant contributions in several key areas. The incorporation of WBL into Linear Programming (LP) and Inventory Control and Queuing Theory (ICQ) courses introduced a unique pedagogical approach that connect academic theories with industry practices. This integration successfully broadens traditional classroom boundaries by incorporating industry professionals and real-world scenarios. This is also aligned with one of New Academia Learning Innovation Model (NALI).

Other than that, these WBL programs reflects a creative alignment with the course content. By merging practical experiences that directly relate to theoretical concepts, the initiative enhances student engagement and provides a dynamic learning experience. Indirectly, innovation approach that lies in its structured interaction between academia and industry promote a continuous feedback loop that informs and refines the academic content. So that, the courses will remain relevant and responsive to industry needs. Finally, feedback and reflections indicate that students gained a deeper understanding of OR concepts through practical exposure, which provided valuable insights into current industry practices, better preparing them for future career opportunities. The success of the program demonstrates that bridging the gap between theory and practice plays a key role in advancing teaching and learning in higher education.

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ID 60: "Magic Bag Project": Enhancing Multiple Intelligence Skills among Pre-School Students through Project-Based Learning

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Highlights: Project-Based Learning (PjBL) is an educational methodology emphasizing active exploration and resolution of real-world problems, enhancing key 21st-century competencies such as problem-solving, creativity, critical thinking, and interpersonal skills. PjBL supports inclusive education by accommodating diverse learning styles and abilities, ensuring every student can engage effectively. It aligns with Howard Gardner's Multiple Intelligences (MI) theory, which recognizes various forms of intelligence. The Eco Print project, designed for kindergarten students, integrates MI into a semi-individual PjBL framework, serving as a foundational step towards more collaborative projects and enhancing student engagement and performance. The method used of the project is case study in which the project was applied in one kindergarten school in Bandung, Indonesia. The project was successful since it impacted many MI such as Verbal-Linguistic Intelligence, Logical-Mathematical Intelligence, Visual-Spatial Intelligence, Bodily-Kinaesthetic Intelligence, music, Naturalistic Intelligence and Interpersonal Intelligence.

Keywords: *Project Based Learning; Multiple Intelligence; Early Childhood; Kindergarten.*

Introduction

Project-Based Learning (PjBL) is a methodology that focuses on learning through actively exploring and resolving real-world problems. This method enhances students' problem-solving skills and increases creativity, critical thinking, and interpersonal skills— a key competency in the 21st century(Pratami et al, 2023). By engaging in projects that reflect actual challenges, students are encouraged to think deeply and critically about problems, collaborate with peers, and apply their knowledge in practice (Dole, Bloom, and Doss 2017). PjBL also work to enhance the student motivation and academic performance (Requies et al. 2018).

One of the significant advantages of PjBL is its capacity to support inclusive education. This method accommodates diverse learning styles and abilities, ensuring every student can learn effectively. By allowing students to work on projects that interest them and align with their strengths, PjBL creates a more engaging and personalized learning experience(Requies et al. 2018). This inclusivity helps address students' varied needs and promotes a sense of belonging and equity within the classroom.

Moreover, PjBL is closely linked with the theory of Multiple Intelligences (MI), proposed by Howard Gardner in 1983. Gardner's theory describes intelligence as not a single intelligence but a combination of various intelligence(Benazira et al, 2021). These intelligences include linguistic, logical-mathematical, spatial, musical, bodily-kinaesthetic, interpersonal, intrapersonal, and naturalistic intelligences (Хижняк et al. 2021). By providing a range of project options that draw on different types of intelligence, PjBL allows students to develop and showcase their unique strengths. This holistic approach to education enriches the learning experience and prepares students to thrive in the real world. The types of intelligence include:

Verbal-Linguistic Intelligence: This ability is associated with language skilfully, both in writing and speaking. Students with high verbal-linguistic intelligence excel in reading, writing, storytelling, and memorizing words.

Logical-Mathematical Intelligence: This ability involves the capacity for logical reasoning, problem-solving, and grasping complex concepts. Students with this intelligence often excel in mathematics, scientific reasoning, and rational thinking. They like to make things in sequence, play puzzles, and know how to order or rank, and classify something.

Visual-Spatial Intelligence: This visual ability involves manipulating and visualizing objects in space. Students with vital visual-spatial intelligence are often gifted in drawing, designing, and understanding maps and diagrams.

Bodily-Kinaesthetic Intelligence: This ability to use one's body effectively to express ideas or solve problems. Students with this intelligence are often observed in athletes, dancers, and individuals who excel in physical activities.

Musical Intelligence involves understanding, creating, and appreciating music. Students with high musical intelligence are often excellent at singing, playing instruments, and recognizing musical patterns.

Interpersonal Intelligence: This ability to understand and interact effectively with others. students with vital interpersonal intelligence excel in communication, empathy, and building relationships.

Intrapersonal Intelligence: This is the ability to understand oneself, including emotions, motivations, and goals. People with high intrapersonal intelligence tend to be reflective and self-aware.

Naturalistic Intelligence: This ability involves recognizing and categorizing plants, animals, and other elements of the natural world.

Gardner's theory encourages teachers to align their teaching method and strategy to diverse learning styles and cognitive abilities. It represents that each person has a unique combination of these intelligences, influencing their learning preferences and strengths. MI encourages students to develop various intelligences and promotes an equal learning method. It is beneficial for students to prepare for a range of future careers. MI also promotes all intelligence is respected equally, which can foster students' motivation and self-confidence. A study shows the importance of incorporating the MI into teaching delivery and strategies. In addition, the paper also noted that teachers should facilitate the various types of student learning by adopting MI into their teaching plan. Incorporating MI into the teaching framework will enhance the quality of the teaching and learning process. A further study recorded that studies that put MI into their teaching strategies performed better academically than those that did not include MI in their teaching methods. MI also enhances student engagement because of the study from which math students obtain much better results. Hence, a teaching method that suits MI as the basis of learning is preferred in a dynamic environment. This project tries to apply the MI aspect to project-based learning methodology. The eco print project was selected to nurture the MI in kindergarten students. The project is not a full project-based learning where the students are working in a group. It is a semi-individual project where one student must complete the task in a given time following the instruction. This is also a stepping stone for real projects where collaboration with their peers is necessary.

Project Objectives

This project aims to enhance multiple intelligence skills such as verbal-linguistic intelligence, Logical-Mathematical Intelligence, Visual-Spatial Intelligence, bodily-kinaesthetic intelligence, music, Naturalistic Intelligence, and Interpersonal Intelligence. However, there are also the following objectives:

i. To introduce sustainable craft and environmental consideration

ii. To enhance the confidence among students

iii. To foster inclusive education.

NALI approach implemented in the research

Novelty

Multiple intelligence and project-based learning have been introduced over many decades. A teacher who can apply projects considering the multiple intelligence aspect is still growing. Besides, the preschooler's learning material must be concise since it can affect their learning experience. Hence, integrating the PjBL and MI using the Eco print project will elevate teaching delivery, particularly for young people.

Creativity

Magic Bag project uses the eco print technique and natural coloring available in their environment. Leaves and flowers are utilized to produce attractive colors. Children are encouraged to arrange the flowers and leaves, which can enhance their creativity and art skills in a plain canvas bag. The bag will be used to collect their mother's favorite snacks, and they are encouraged to surprise the mother as their final project.

Innovativeness

Using Eco print projects to enhance MI is aligned with Howard Gardner's Theory. Several potential innovations may be obtained by the students, including:

Multidiscipline learning. Eco-print projects can utilize multiple art, science, and mathematics knowledge. For instance, students can learn about the anatomy of plants and the chemical reactions of how the color of leaves can be transferred into a fabric. They can also learn about math, like the total number of leaves and flowers used for coloring the bag and the shape of leaves. In addition, they can also learn about the techniques used for making patterns or coloring fabric, which uses a straightforward method. Students may also learn about sustainability issues and reusable crafts, which can increase environmental intelligence.

Physical Activities. Students at such a young age need to develop their gross motor skills. This activity may allow them to improve their motor skills through kinesthetic and art activities.

Interpersonal skills. A student may improve their interpersonal skills by considering their mother's preferences. Students also learn to appreciate the art and traditional techniques that consider sustainable issues.

Inclusive education. Following Howard Garner's theory will help teachers provide the learning materials to accommodate inclusive education. Eco print will allow students to use their kinesthetic or movement skills best. Visual and unique intelligence is also nurtured by observing the material needed to decorate the bag. They can experiment with the pattern using natural ingredients. This is good for students who have good visual skills.

Applicability

Magic Bag eco print projects are versatile and can be used for any age, particularly for your age, in which your intelligence is still developing. This project aligned with sustainability issues and inclusive learning, allowing comprehensive learning. As for the teacher, this project can enhance the MI of their students using single projects, which is beneficial for the learning experience.

Research Methodology

The method used for implementing Magic Bag Eco print qualitative research method such as a case study in one kindergarten in Bandung, Indonesia. This project uses a project-based learning scheme. It consists of several stages: initiating, planning, execution, monitoring and controlling, and closing. The project will be given to one class of kindergarten students comprised of 15 students in 2022. Most of them will enrol in primary school in the following year. Four teachers participated in the project. They were instructed to give the students information about the project. They need to collect some leaves and flowers near their house. The teacher was also informed to prepare the plain bag made of canvas for Eco print. This activity can be substituted by bringing any unused clothes into students' homes and trying to decorate the clothes in class. The project duration took 1,5 months. The summary of the procedure is presented in Table 1:

Table 1: Ecoprint Project Steps

Stage	Resources	Remark	Student's MI aspects
Initiating (Duration: 1 week)			
selecting observable skills	curriculum, teaching plan	Choose the skills that will be evaluated, such as motor skills, hand grip, art, basic math, color,	-
selecting learning outcome	curriculum, teaching plan	Match the LO	-
inform the parents about the project	inform using a formal letter or personal messaging application	Inform the project earlier since it requires collaboration with the parent. Tell them the benefit of the project.	-
Planning (duration: 1 week)			
develop assessment for an eco print project	assessment form	Make an assessment form for each observable skill	-
prepare for eco-print material	wood hammer, plastic (the size should be broader and larger than the canvas bag), canvas	Wood hammers are preferable with a flat surface; canvas fabric is washed first or soaked in hot water to eliminate the wax in the fabric. Let it cool until dry in sunlight.	-
make a timeline for the project	word	The timeline should be adjusted with the teaching plan	-
instruct the students about the project, such as: bringing flowers or leaves near their house, bringing unused clothes	flowers, leaves	The teacher may inform the parents and students of the preferable leaves and flowers such as casava leaf, butterfly pea flower, or small leaves.	-
Execution (duration: 2 week)			
the teacher informs the student about the magic bag, the purpose of the project, the eco print technique, the environmental issue	PowerPoint, projector	The teacher uses the bag to describe its function, the decoration of the bag, and how it will be given to their mom as a gift.	Naturalistic Intelligence, Visual-Spatial Intelligence
teacher performed the example of the Eco print technique and informed the students to do as they did	flowers, leaves, hammer, canvas bag, plastic	Teachers can do some demos in front of the class. They can deliver the demonstration using music and dance to engage the students.	Naturalistic Intelligence, Visual-Spatial Intelligence, musical intelligence
instruct the student to place the canvas bag on the floor	canvas bag	The teacher should ensure enough space to perform the eco print technique.	Visual-Spatial Intelligence

Stage	Resources	Remark	Student's MI aspects
instruct the student to decorate the canvas bag using flowers and leaves and make some arrangement	flowers, leaves, hammer, canvas bag, plastic	The teacher can assist the student in arranging the flower	Naturalistic Intelligence, Visual-Spatial Intelligence
instruct the student to put the layer over the flower and leaves arrangement using a plastic	flowers, leaves, hammer, canvas bag, plastic	The teacher can assist the student in putting the layer on and ensure it covers the leaves and flowers perfectly.	Bodily-Kinaesthetic Intelligence, Visual-Spatial Intelligence
the student smashed the leaves and flowers using a hammer	hammer	Teachers must be careful about this stage; some students may be distracted by smashing too slowly or too fast. Make sure it doesn't damage the arrangement.	Bodily-Kinaesthetic Intelligence, Visual-Spatial Intelligence, Intrapersonal Intelligence
the student open gently the plastic layer and flower/leaves	hand	Pay attention for those who has sensory issue	Intrapersonal Intelligence
dry the canvas bag using direct sunlight and let it dry for 1 day	Sunlight	The leaves and flowers may leave wet surface so it should be dry before it will use	Naturalistic Intelligence
inform the student to buy what their mother favourite snack in the supermarket using magic bag	snack or can be replaced by letter, art made by students	Bring the magic bag to the supermarket and Ask the parent to leave amount of money and let the children buy some favorites snack in the supermarket.	Logical-Mathematical Intelligence, Intrapersonal Intelligence
Monitoring and controlling (duration: 1 week)			
the teacher corrected the student's position when smashing the leaves and flower	assessment form	The children may do squat to smash the leaves on the floor. Floor will be best base for ecoprint since it would not damage the table	Bodily-Kinaesthetic Intelligence, Visual-Spatial Intelligence
the teacher assisted the student in arranging the flower and leaves	flower and leaves	Challenge the children to explore the arrangement with different shapes and colors	Visual-Spatial Intelligence
The teacher assisted the student in purchasing the snack with limited money	money	Teacher form the student into several group and monitor their purchase	Logical-Mathematical Intelligence
Closing (Duration 1 day)			
Student gives the magic bag to the parents and presents the magic bag in front of the class	magic bag	Ask the parent to record the process of children giving the gift and ask how they feel about it. Send the video to the teacher using the messenger application.	Interpersonal Intelligence, Verbal-Linguistic Intelligence, Visual-Spatial Intelligence
teacher completes the assessment form	assessment form	Complete all the MI checklist observations obtained by the project.	-
teacher makes a reflective evaluation of the project	PowerPoint, projector	The teacher can make an exhibition about the student's project and invite the parents to evaluate the bag. The teacher may ask the students about the process that they have been through in making the project. Ask them how they feel about their accomplishment.	Intrapersonal Intelligence, Verbal-Linguistic Intelligence

To investigate the method's effectiveness, the MI test evaluation was conducted two times, before and after the implementation. The MI aspects are carried out using a simple checklist. If the post-test implementation has increased against the pre-test, then the method is successful.

Discussion and Findings

The Magic Bag eco print project resulted in several significant findings that enhance student's MI. We observed that the student's MI was increased after the PjbL was completed. We assessed the students by three categories: firstly, "A" poses excellent student ability, "B" means slightly good ability, and C represents the students who need exceptional guidance. As shown in Figure 1, all the MI aspects increased after the project ended. Looking at visual spacial intelligence, the students have the same evaluation, meaning that before the project, they had better abilities in this area. In addition, the number of students who still need further guidance is also reduced by the treatment. However, beyond the MI observation, some students encountered difficulty in smashing the leaves during the eco-print process. This observation suggests these students may have weaker muscle strength, potentially impacting their fine motor skills and affecting their writing abilities in future academic endeavors. Strengthening these muscles through targeted activities could be beneficial.

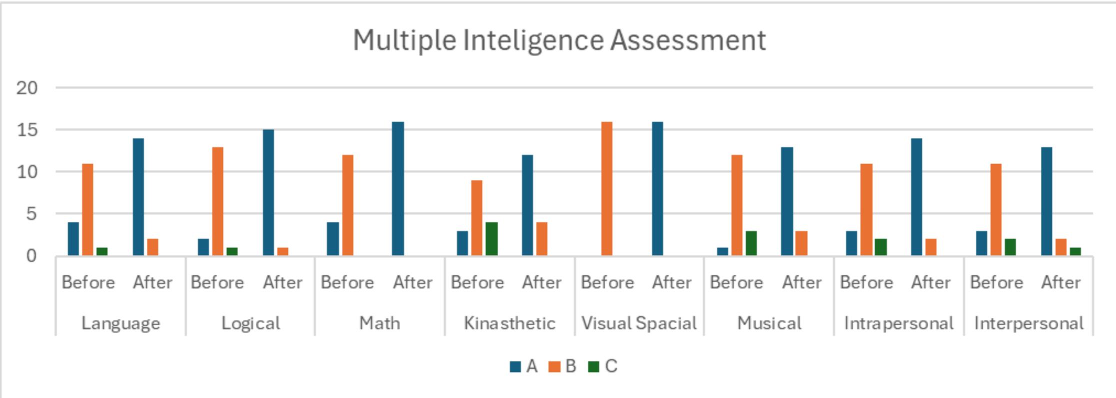

Figure 1: Pre and Post-Multiple Intelligence Evaluation

Secondly, it was observed that some students tended to replicate the teacher's example rather than create their unique arrangements of flowers and leaves. This behavior indicates a need to develop students' creativity and flexibility in design. Encouraging students to experiment with different patterns and combinations can foster their artistic expression and enhance their confidence in their creative abilities.

Additionally, the eco print project introduced basic mathematical concepts to students. Through sorting and arranging big leaves and small flowers, students engaged with ideas of size, shape, and color, laying the groundwork for more complex mathematical thinking. This hands-on approach to learning math concepts can be both engaging and educational.


Figure 2: Magic Bag Eco Print Project

Lastly, teaching delivery that engages with the MI aspect can benefit students with different types of intelligence. Focusing only on one intelligence will minimize the other intelligence that may be important to them to develop. All intelligences require effective intervention and guidance to help all individuals achieve optimal development. The recommendation for future work calls for international researchers to reproduce the procedure and investigate the project's effect on MI using more enhanced statistical methods and larger samples. Some exciting research could be the investigation of the effectiveness of MI projects for special needs children in kindergarten.

Award

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ii. Winner of Teaching Digital Innovation, E-learning of Project Management Course Indonesian, Ministry of Research and Education 2020

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ID 61: Revolutionizing Undergraduate Career Readiness Through the Career Profile Interview Project (CPIP)

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Highlights: The Career Profile Interview Project (CPIP) is an innovative approach to career education for second-year psychology students. It pairs students to interview experienced professionals, bridging academic theories with real-world career trajectories. Students create reports, reflections, and presentations, fostering collaborative learning and peer knowledge sharing. CPIP develops 21st-century skills like collaboration, communication, critical thinking, and creativity. Rooted in Education 4.0 principles, it provides a realistic preview of professional landscapes and emphasizes the interplay between individual initiative and organizational support in career management. The project's novelty lies in combining practical experience, peer learning, and reflection, preparing students for future careers while building professional networks.

Keywords: *Career readiness; career profile; interview; undergraduate*

Introduction

The Career Profile Interview Project (CPIP) introduces an innovative and experiential approach to career education for second-year psychology students enrolled in the Career Development course (SHMR2083). By pairing students and having them interview experienced professionals, CPIP provides a direct link between academic theories of career development and real-world professional trajectories. The project culminates in the creation of detailed reports and personal reflections, as well as class presentations that foster collaborative learning and peer-to-peer knowledge sharing. This approach ensures that students gain insights into long-term career progression and develop essential 21st-century skills, such as collaboration, communication, critical thinking, and creativity (Siddiq, Olofsson, Lindberg & Tomczyk, 2024). CPIP is rooted in the principles of Education 4.0, emphasizing integrating real-world learning into the curriculum (Vonitsanos, Moustaka, Doukakis & Mylonas, 2024). By engaging directly with working professionals, students obtain a realistic preview of their future career landscape and develop an exquisite understanding of how personal initiative and organizational support interact in career management. The project's novelty lies in its practical experience, peer learning, and personal reflection. It offers a holistic approach to career education that prepares students for the complexities of the modern workplace.

Furthermore, CPIP has the potential to bridge the gap between academic learning and practical application by creating opportunities for students to establish professional networks. This enhances their career readiness and contributes to their overall personal and professional development. Through CPIP, students emerge with a deeper understanding of career planning, the significance of aligning personal and professional goals, and the critical role of passion and interest in shaping a fulfilling career path.

Innovation Objectives

Most undergraduate students have little to no significant work experience, making it challenging to understand career concepts and theories and how they can be applied in preparing for their future careers. Furthermore, they have limited exposure to job hunting and the workplace environment. This inexperience makes it harder for students to fully contextualize the knowledge taught in a career development course (Arjanggi, 2017). During the ice-breaking session, the instructor observed that many students held misconceptions about career management. They believe that organizations are accountable for managing their careers. They are unaware of the individual role in career management and the importance of aligning personal goals with organizational expectations. Students rarely engage in conversations about career or career progression, even with close family members. As a result, they fail to understand how careers evolve and, more importantly, how profoundly one's job can influence personal identity. In other words, students view jobs as an occupation rather than a significant part of a person's identity and life journey. To solve this problem, the Career Profile Interview Project (CPIP) was introduced in this course to achieve the following objectives:

i. To provide students with realistic insights into the diverse career paths of working adults

ii. To bridge the gap between theoretical career concepts and practical application through in-depth interviews

iii. To develop skills in interviewing, report writing, and presentation

iv. To foster self-reflection and critical thinking about personal career aspirations

v. To initiate students' professional networking skills by connecting them with experienced professionals in a structured, educational context
vi. To highlight the impact of career choices on life satisfaction
vii. To create a collaborative learning environment where students can share insights and learn from others.

NALI Approach

Novelty, Creativity and Innovativeness

The Career Profile Interview Project (CPIP) introduces an innovative method of career education by incorporating actual work experiences into the academic curriculum for second-year psychology students. CPIP distinguishes itself from traditional assignments by enabling direct and meaningful interaction between students and experienced professionals, going beyond academic exploration. This distinctive connection provides students with exceptional insights into the intricacies of job advancement, including the difficulties, prospects, and decision-making procedures that professionals face along their journey. The uniqueness of CPIP resides in its multifaceted design, which integrates practical experience with academic learning to produce a whole educational experience. The project goes beyond the limits of a typical classroom by mandating that students collaborate in pairs to discover and interview individuals who possess significant professional experience. This allows students to directly engage with the practical aspects of the job market (Enstroem & Schmaltz, 2024). This experience allows students to understand and apply career development theories and gives them a realistic glimpse into their future job prospects (Grantham & Iachizzi, 2024).

CPIP promotes a collaborative learning environment by sharing peer-to-peer knowledge through class presentations. This project component promotes the exchange of varied perspectives among students, enhancing the entire class's educational experience. The project's collaborative aspect improves comprehension and fosters vital skills such as communication, teamwork, and critical thinking, which are crucial in today's professional environment (Taxirovna, 2024). Moreover, CPIP fills a crucial void in conventional career education by highlighting the significance of personal motivation in career management. By engaging in personal introspection and examining the data collected from their interviews, students understand how their personal interests, values, and passions significantly influence their career satisfaction. The emphasis on reflection is valuable as it motivates students to engage in analytical thinking regarding their career goals and to harmonize their goals with their values and passions.

Besides that, CPIP can establish professional connections between students and their interviewees, which will benefit future networking. Through this networking, students develop the necessary skills and connections to navigate their future jobs efficiently. Overall, the Career Profile Interview Project (CPIP) is an innovative educational tool that connects academic learning with real-world experience and develops crucial skills and professional networks. The innovative approach to career education, which involves direct participation, collaborative learning, and personal reflection, establishes a new benchmark for equipping students with the necessary skills to thrive in their future professions.

Applicability and Impact

The Career Profile Interview Project (CPIP) effectively incorporates essential components of Education 4.0 and the 21st Century 4C's Skills—Collaboration, Communication, Critical Thinking, and Creativity—into its structure and implementation. These components are crucial for providing students with the skills necessary to succeed in the job market.

1. Cooperation

Throughout this project, students are obligated to work in pairs. This arrangement promotes collaboration and collaborative learning, enabling students to leverage their skills and distribute responsibilities to accomplish the task. Collaborating closely with a partner enables students to cultivate essential interpersonal skills, including conflict resolution, empathy, and mutual support, which are vital for successful collaboration in professional environments (Namaziandost, Homayouni & Rahmani, 2020). Moreover, the ultimate class presentation is a collaborative endeavour to disseminate knowledge, during which students share their discoveries with their classmates.

2. Interpersonal exchange of information and ideas.

This project requires students to participate in diverse kinds of professional communication actively. For example, conducting interviews with experienced professionals allows students to enhance their verbal communication abilities, including questioning, listening, and responding skills (Nardon, Hari & Aarma, 2021). The necessity to produce a written report also strengthens their capacity to analyse and synthesize information. In addition, the class presentation component allows students to polish their public speaking and presentation abilities, which are crucial for effective communication in any professional environment (Farabi, Hassanvand & Gorjian, 2017).

3. Analytical Reasoning

The CPIP places a significant focus on critical thinking since students must examine and synthesise the information from their interviews. This includes analysing individuals' career trajectories and individual and organisational support and connecting these findings with career theories and concepts learnt in class. Through this project, students enhance their ability to engage in critical thinking and apply theoretical knowledge to practical scenarios. Including the critical thinking component in CPIP improves students' academic achievements and equips them with problem-solving skills (Changwong, Sukkamart & Sisan, 2018).

4. Innovation

In the CPIP, students are specifically encouraged to demonstrate creativity, especially regarding their approach to the interview process and the presentation of their findings. Although the project offers fundamental instructions for conducting interviews, students are urged to think innovatively to enhance their comprehension of career growth. This level of autonomy enables students to customise their interviews according to their interests, leading to a more personalised and significant learning experience. Moreover, the written report allows students to exhibit their discoveries in a conventional report structure or a magazine-style publication. Students can express their thoughts uniquely, showcasing their capacity to think creatively (Karunarathne & Calma, 2024).

Methodology

The Career Profile Interview Project (CPIP) addresses CLO2 and CLO3 of the career development course:

- CLO2: Produce reports on the application of suitable organizational career systems and individual career in handling career problems
- CLO3: Ability to be receptive to new ideas towards self-directed or autonomous learning

This project requires students to collaborate in pairs. Their task is to identify and interview an individual with over ten years of work experience whom multiple companies have employed throughout their career. Retirees are also acceptable candidates for the interview. The interview should focus on the subject's career history, exploring factors that influenced their decisions to leave or remain with each employer and the types of organizational support they received. Students are encouraged to explore beyond these basic guidelines to enrich their learning experience. Following the interview, students must compile a report consisting of five main sections: Introduction, Interviewee Profile, Interview Findings, Interview Analysis, Students' Reflection, and References. As a final step, each pair will present their project findings to the class, sharing insights from their interview experience.

In this project, students use various technology tools. For example, digital interview tools, such as video conferencing software (e.g., Zoom, Google Meet), can be used for remote interviews. For face-to-face meetings, students use smartphone audio recording apps to record the interview sessions. Besides that, they use collaborative writing platforms such as Google Docs to write reports and presentation software, such as Canva, to share their findings with the class and online research tools, such as Google Scholar, to find relevant career literature to support their analysis.

Findings and Outcomes of the Career Profile Interview Project (CPIP)

Students' Reflections

The Career Profile Interview Project (CPIP) notably influenced students, as seen by their individual responses. The students' reflections demonstrate the various ways in which the project impacted their learning and personal growth. The following are examples of selected students' reflections:

"Throughout the journey of completing this project, many things have surprised me. I envisioned my career journey as a joyful, stable, and fulfilling journey. However, it turns out that this is not the case, as admitted by the interviewee in my project. My interviewee and many interviewees from other groups recognize the hardships, challenges, and instabilities in the working world. This project made me realize the importance of being brave, prepared and courageous in facing the reality of the working realm. Altogether, I understand that the most crucial aspect in choosing a career and company is that it aligns with one's desires, goals, and values. This project has also indirectly highlighted the issue of job hopping, as shown by my interviewee and other interviewees from other groups. Before this, I thought job hopping was a negative thing as the company would see you as a person who is not loyal. However, things have changed. Nowadays, younger generations, including Gen Z, no longer prioritize what the company says about you, but how you feel about the company. Thus, I believe job hopping is not necessarily a negative thing. Instead, it is an effort to find job satisfaction, work-life balance and personal fulfilment." (Maryam Sofea Binti Farizal)

"I am glad that I got to do this assignment, as not only does it enhance my communication skills and expand my network, but it also provides me with early exposure to how career development works in an individual's life. Through this assignment, I can see how one's career development can be influenced by various factors, like personal values, interests, organisational support, and even family influence. I believe that the information and knowledge I gained from this project are essential for my future as I can be readily available to grab any opportunities to enhance my skills and experiences but also be prepared for any obstacles that may challenge my career journey. This project relates to me because I also have an ambitious spirit where even now, as a student, I am okay to study far from my family in order for me to work on myself; like Mr. Megat, I also love to try on various things and grab any opportunities that lie upon me, as it will help with my character development. This project is also eye-opening as it shows me how one's career development is not static; it has an ever-changing nature, and sometimes the changes can be beyond your expectations, where you not only may change companies but you can also change industries." (Nur Izyan Azyan Binti Izzudin)

"Throughout the project, I felt confusion and dilemma. I thought going through the traditional career path would guarantee my career and life satisfaction. However, this project made me realize that satisfaction through a career can go beyond the traditional path, just like Ms. Nora, who didn't follow the traditional path yet achieved her career and life satisfaction. I figured out my interviewee was enjoying her daily life through her jobs. This made me think about what exactly I look for in a job. What kind of career can make me satisfied financially and psychologically? While considering what makes me enjoy my job, I learnt that everyone has different career needs and expectations. My interviewee, for instance, does not expect much from her career as long as she gets to enjoy her job and gain sufficient money to travel around the world. In contrast, I expect my career to define me. I want my career achievements to tell people what kind of person or employee I am. I want my career to give me financial stability. I believe this is because my personality seeks satisfaction and security via achievements. Thus, I enjoy doing work encouraging me to achieve awards or rewards." (Mirshali a/p Ravichantar)

"In completing this assignment, I learned about career development. Conducting an analysis based on the findings from Mr. Shaifuddin helped me realise the importance of individual interests and passion in selecting our career journey. Mr. Shaifuddin often emphasised and advised us to follow our hearts rather than other people's wishes, such as our parents and peer pressure. It gave me an insight that we can decide where we want to pursue our careers and how our careers will guide us throughout our lives. I believe that, with the knowledge I have gained, I can decide carefully on my career path. My career planning will also be critically important as I want to become a clinical psychologist; even though my parents want me to become a chemical engineer, I will have to prove to them that I can be that." (Putera Muhammad Syaraf Bin Sarianto)

"Throughout the experience of completing the assignment, I managed to learn more about career development through Mr. Zulhilmi's career journey. Also, the interview gave me insight into how the real workforce is going to be, and not all companies will be supportive of providing a proper career development plan to the employee. In addition, while completing the analysis findings part, the assignment helped me better understand the concept and theory learned in the class and relate the information with the findings we gathered, which will be truly beneficial for me since I may need to apply the theory on the real-life situation in the future. Moreover, I had first-hand experience conducting interviews with experienced individuals, although my interview skills were still lacking. However, the experiences helped me develop the skill to professionally communicate with Mr. Zulhilmi and improve my interviewing skills for academic purposes." (Nur Asyiqin Binti Nurijan)

These reflections emphasize a change in students' perspectives on career paths and career management. Through CPIP, students develop an understanding of the dynamics of career challenges, including employment uncertainty and frequent job changes. This knowledge helped students to realize the significance of aligning personal values with career decisions. Interacting with experienced professionals also offered students valuable perspectives on how personal values and organizational support can shape career development. Besides, students learnt from their interviews that job fulfilment might be attained by pursuing unconventional routes. The reflections also highlight students' realization of matching job decisions with individual interests and passions. In sum, CPIP significantly influenced student learning by offering practical knowledge and experiences related to career development, challenging existing beliefs, and improving practical abilities. Students acquired a more profound comprehension of career realities, enhanced their communication skills, and clarified their career objectives. The project fostered a significant link between theory and practice, equipping students with the necessary skills for their future professions.

Past studies can support the positive reflections from the students. For example, a study by Cheung and Arnold (2014) suggests that career exploration may result in positive career development outcomes among university students. Their study, which involved 271 Hong Kong Chinese University students, revealed that teachers are critical in providing career support. Besides gaining valuable information through the interviews, students accumulate more knowledge from peer learning through class presentations, which Boud et al. (2014) define as a two-way, reciprocal learning activity. They claim that students learn more by explaining their ideas and participating in peer-learning activities.

Moreover, peer learning that is introduced in a planned manner can help students learn effectively. According to Mann et al. (2016), exposing students to career development activities such as internship programs, worksite visits, job fairs, and career counselling may influence students' attitudes towards learning. They argue that participation in career development activities will likely prepare students for their future working lives. This is because students can associate their education with how it can influence their future lives, resulting in improved learning motivation. Zhang et al. (2023) conducted a recent study that defined career readiness as finding employment and succeeding in one's chosen career. They argued that students are neither career-ready nor prepared. This undermines the transition from university to work. Therefore, career planning education is paramount to equipping students with the mindset and skills for determining their future career trajectory.

Students' Evaluation on Teaching and Learning

The Career Profile Interview Project (CPIP) significantly influenced student learning, specifically performance, engagement, and empowerment. Students evaluated the instructor's teaching and learning via the e-PPP platform. The evaluation includes the course's design and organization, feedback and assessment mechanism, facilitation/implementation of the course, social presence, and lecturer professionalism.

Design & Organisation (mean: 5.91/6.00): The high rating in this category suggests that students perceived the course as well-structured and well-organised. The CPIP enabled students to actively participate in the course learning actively, indirectly improving their understanding of the course.

Feedback & Assessment (Mean: 5.88/6.00): This score indicates the high level of efficacy of the feedback mechanisms integrated into the course. Students received regular feedback throughout the CPIP, which enabled them to improve, resulting in improved learning results.

Facilitation/Implementation (mean: 5.90/6.00): This score suggests students felt well-supported throughout the course. The lecturer played an active role in mentoring the students, providing resources, and defining expectations, which contributed to students' satisfaction with the course.

Social Presence (Mean: 5.79/6.00): This score emphasises the development of a strong sense of teamwork within the course. The CPIP requires students to collaborate in pairs and participate in classroom presentations, fostering peer learning and social engagement.

Lecture Professionalism (mean: 5.90/6.00): The lecturer's exceptional professionalism score indicates that students are satisfied with the level of knowledge exhibited by the lecturer, resulting in an improved learning experience.

Student Satisfaction (S3: Very Satisfied): The high level of satisfaction suggests that students considered the course outstanding, with the CPIP playing a crucial role. Complemented with proficient facilitation, the course's congruence of learning objectives, teaching material, and assessments led to a learning experience that satisfied the students.

Students' Academic Performance and Achievement of Learning Outcomes

The average score for the final examination result is 84%, which suggests that students excelled in the course, potentially due to the effective implementation of CPIP, which has improved students' understanding of the course. The project allowed students to learn about career development principles in a practical setting, thereby enhancing their overall academic achievement. The average grades for CLO2 and CLO3 are 91% and 90% respectively. These results indicate the students' proficiency in meeting the course's specific learning objectives, particularly in their ability to comprehend and apply career theories and models and embrace new concepts for self-directed learning. The CPIP specifically targeted these results by requiring students to analyse the career profiles of experienced professionals through interviews and participate in self-directed learning while conducting their research.

Potential for Commercialisation

The ideas and data obtained from the Career Profile Interview Project (CPIP) have significant commercial potential for creating a Career Readiness Training Module (CRTM) specifically designed for undergraduate students. The CRTM uses real-life case studies from interviews to offer a practical and context-specific learning experience. These case studies provide genuine illustrations demonstrating various career paths, challenges, and practical approaches for achieving career success, making the training module an invaluable resource for students preparing to enter the job market. The CRTM could be designed as a holistic program encompassing interactive seminars and personalised career coaching sessions. Incorporating real-life scenarios from CPIP interviews would enhance the training program. This strategy improves the learning experience and makes the module more attractive to educational institutions looking to expand their career services.

Conclusion

The CPIP significantly improved student engagement, performance, and empowerment by bridging academic theories and real-world experiences. The favourable teaching ratings and students' reflections demonstrate that the project has successfully facilitated student learning. The CPIP provided students with theoretical knowledge, practical abilities, and valuable transferable skills, effectively equipping them for their future jobs.

Acknowledgement

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ID 62: Development of SReP e-marks Application for Design and Clothing Courses Towards Teacher Student's Continuous Assessment and Examination Management

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Highlights: The problem that lecturers often face during practical tests is that the marks that are done conventionally are often lost, important comments that need attention are forgotten, the time is very short, and the number of students is large (Khairudin & Wan Ahmad Jaafar, 2020). Therefore, researchers have carried out an inovations systems on the student marking process by developing the SReP e-marks application for 123 Design and Technology course students at the Temenggong Ibrahim Campus Teacher Education Institute, Johor (IPGMKTI). This application was developed using the Rapid Application Development (RAD) Model and it is hoped that the development of this application will help most lecturers to implement continuous assessment management and final exams for all students. Therefore, stakeholders are expected to support digital development among lecturers by providing opportunities and financial support and the latest equipment.

Keywords: *SReP emarks application; RAD models; Continuous Assessment (PB); Digital technology*

Introduction

To face a future full of challenges and high technology, the field of education needs to be ready to change towards digitization for all things including in the field of assessment. Assessment is a systematic process carried out to obtain information about learning and building student knowledge. Assessment at IPGM Campus is aimed at measuring and determining student performance and achievement for the purpose of awarding certificates/diplomas/and degrees (IPGM, 2023).

In Malaysia, the Malaysian Teacher Education Institute (IPGM) is an institution that responsible for providing teacher education training to prospective teachers for primary school education. IPG is a higher education institution that provides training for courses related to education in primary schools such as Design and Technology, Science, Mathematics, Counselling, English, Malay and Early Childhood Education. Students will follow the course theoretically and practically and will need to undergo an assessment process to measure the understanding and performance of each student.

Assessment at IPG is carried out for courses involving theory and practice. There are two levels of assessment namely continuous assessment and final assessment to measure student's ability. For the implementation of continuous assessment at IPG, practical courses are implemented to see the student's potential in mastering the course while the final assessment stage involves a written examination (IPGM, 2023).

Application development towards more efficiency nowadays is very necessary. An efficient system helps lecturers perform tasks better. The development of this application is a combination that includes people, hardware, software, networking and data that are responsible for creating, collecting, exchanging and distributing information in an organization. It is a process of collecting information from various forms, processing and exchanging information, collecting the information obtained in the desired form and then distributing the information to certain parties for action. In parallel with the development of the country's digital policy which is given attention by the Ministry of Education and Culture, the development of applications that facilitate is a must nowadays (Ministry of Education Malaysia, 2023).

Thus, realizing the importance of having an application that can be accessed anywhere by using existing equipment and that does not involve high expenses and is useful nowadays, the sewing mark application was developed. The development of this application is at an early stage to see the response from lecturers and authorities in performing tasks more efficiently and saving time.

Reflections on the Clothing Design Course (RBTS 3103)

Clothing Design Course (RBTS 3103) that has been followed by Design and Technology students for the June 2021/2025 intake at IPG is a course that gives students the opportunity to master sewing techniques through theoretical and practical learning. This course is offered so that students can master the knowledge and skills of Clothing Design and is a learning process that shapes students' creativity in planning, managing and creating the art of clothing design.

The implementation of the practical test is after the student has mastered all the theory and practice provided in the course followed, which for students at IPG is carried out within a period of three to four months for each course. When carrying out practical tests, lecturers need to carry out direct, continuous observation methods and require notes to be able to give authentic comments when looking at the work steps being carried out. This puts a bit of pressure on the lecturer because the lecturer must always write down the student's name on the paper. Lecturers need to see 10-

15 students at each practical test session. This situation will cause some notes to be forgotten because the lecturer must observe each assignment in a limited time which is three hours for each practical test session. This coincides with the study of Khairudin & Wan Ahmad Jaafar, 2020) which states that the problem often faced by lecturers during practical tests is that notes made conventionally are often lost, important comments that need attention are forgotten, a very short time, the number of students which are many and many paper records are used.

During the practical test, lecturers also need to help students who face problems related to tools such as the use of sewing machines and edge sewing machines as well as the lack of materials such as fabric and thread. Although the time given is long, for students who have no sewing background, this test puts a bit of pressure on them because they lack practical skills. The lecturer must also always observe that each student is comfortable and not stressed, so documentation is needed so that the practical test scoring can be seen again when the lecturer is in a comfortable state and is not managing the practical test.

Therefore, to ensure that the lecturer's assignments are more practical and efficient, the researcher developed the SReP e-marks application. This application was developed using the Rapid Application Development (RAD) Methodology which covers four phases namely requirements planning, instructional design, development and implementation (Mudassar & Khan, 2023). Figure 1 below shows the implementation process of the RAD Model application.

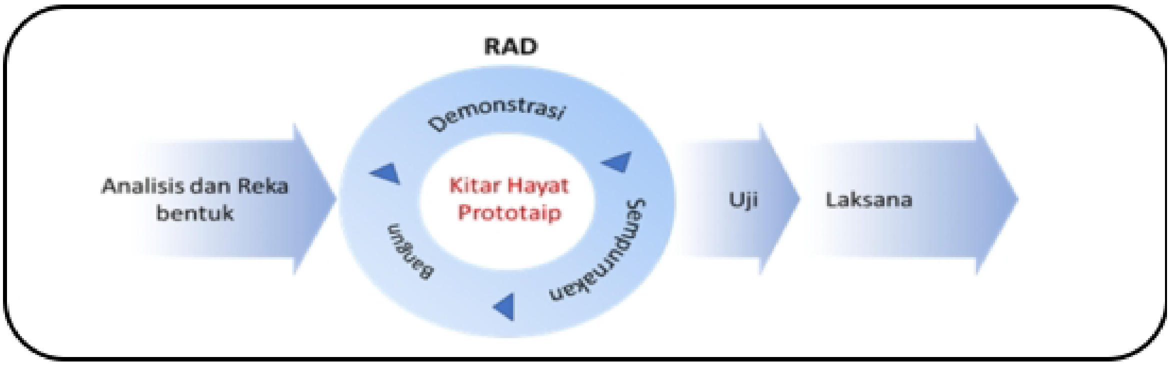

Figure 1: RAD application model, (Ali Khan, 2023)

The development methodology of a system is a work procedure implemented to structure, plan and control the development process of each application used. The techniques and tools used are the main factors in the success of RAD. The main goal of this methodology is to produce a high-quality system quickly by emphasizing user needs.

Literature Review

In this context, theory is knowledge in the form of non-fixed experiences, values, contextual information and expert views that combine old and new information and experiences. Whereas, practical refers to the technical skills that students need to master based on the theory that has been learned. These practical skills give students the opportunity to learn each skill step by step from easy to the most difficult according to the assessment stage that has been planned as stated in Bloom's Taxonomy cognitive skills theory (Wilson, 2016). By mastering these practical skills, it will shape students' understanding and create creative ideas that can be used for education and daily life.

According to a study (Wilcox & Lewandowski, 2016), the implementation of practical skills for a course that is based on a guidebook or manual only does not encourage students to engage authentically because it is very structured. This is because the step-by-step procedure provided prevents students from using other knowledge and skills in the practical test. The situation should not happen because students need to get information in a scientific way to connect the acquired skills with the existing experience. So practical tests need to be carried out in conditions that give students the opportunity to unearth ideas and high creativity.

The implementation of the Digital Education Policy is a government effort to empower the digital economy. This policy is a step taken by the government to provide a digitally literate generation that can boost the quality of the country's education to become one of the best education providers in the world. Among the main objectives of the Digital Education Policy developed are: i) providing a digitally literate generation, ii) improving the competence and professional development of stakeholders, iii) bridging the digital divide (KPM, Digital Education Policy, 2023). The Ministry hopes that the development of digital education will change the phenomenon of education in this country from conventional learning to E-Learning (Electronic Learning) and then M-Learning (Mobile Learning) (Nordin M., 2023).

SReP e-marks Application Development

In this study, one of the main objectives of the development of this application is to overcome the problem of conventional marking to a digital marking system (e-marks).

In phase 1 at the requirement planning stage, the researcher examined several issues related to the use of manual forms as well as conventional scoring methods. After examining the problems found in the marking form as well as the feedback given among the lecturers who teach, the researcher designed the assessment content for the development of an appropriate application to overcome the issue of manual marking. Among the requirements that are given attention is that the application must be user-friendly, useful, accessible anywhere and have a low cost of expenditure.

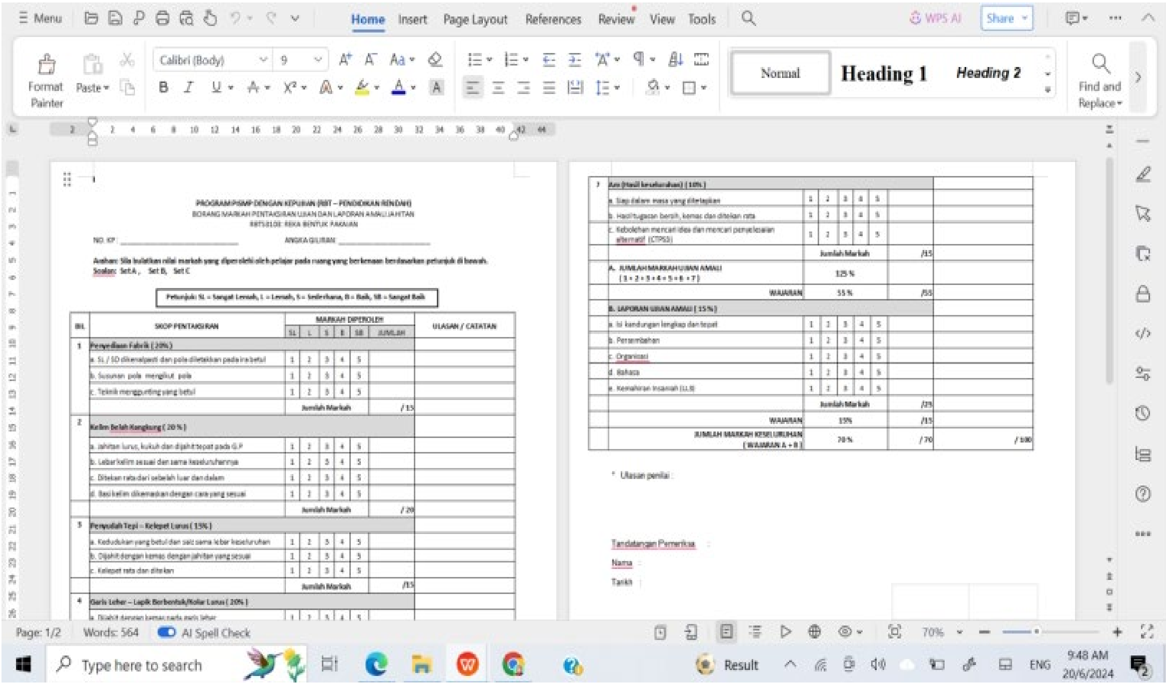

Figure 2: An example of a manual form

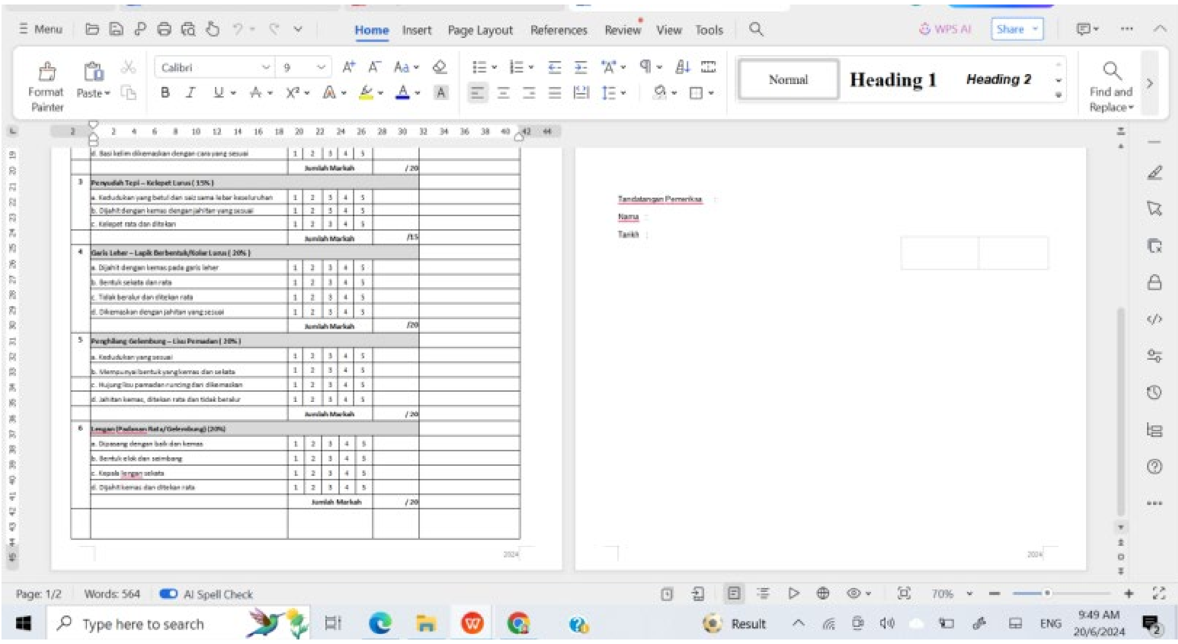

Figure 3: Example extension of manual form

Next, in phase 2, at the application development stage, the researcher gathers all the necessary information by using the "Microsoft Excel" application notes such as figure 2 to figure 4. The information entered is as found in the manual form. Some additional information such as percentages, grades and notes are included in the application. In this phase, the researcher did an initial demonstration to the fellow lecturers involved. After that, improvements are made to the comments given.

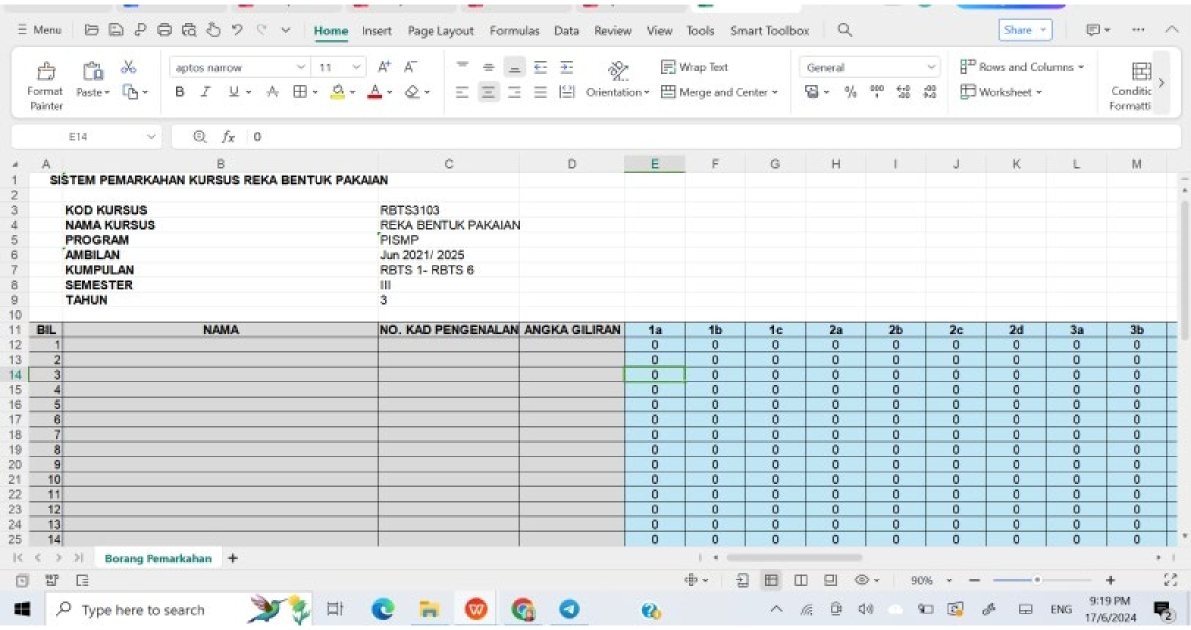

Figure 4: Part 1

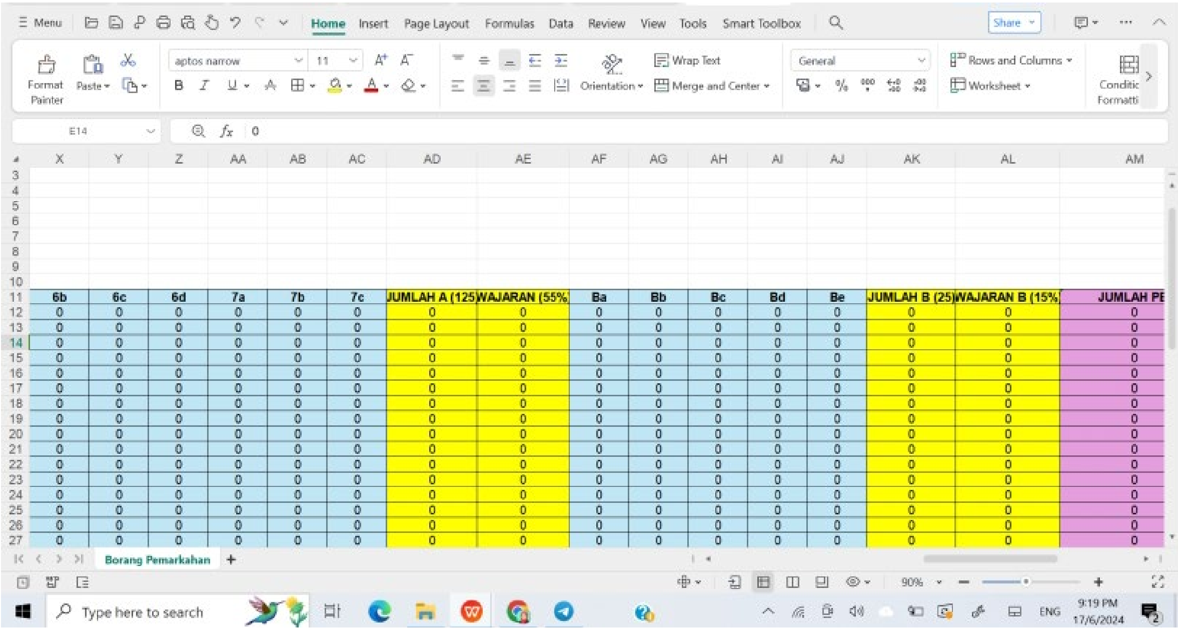

Figure 5: Part 2

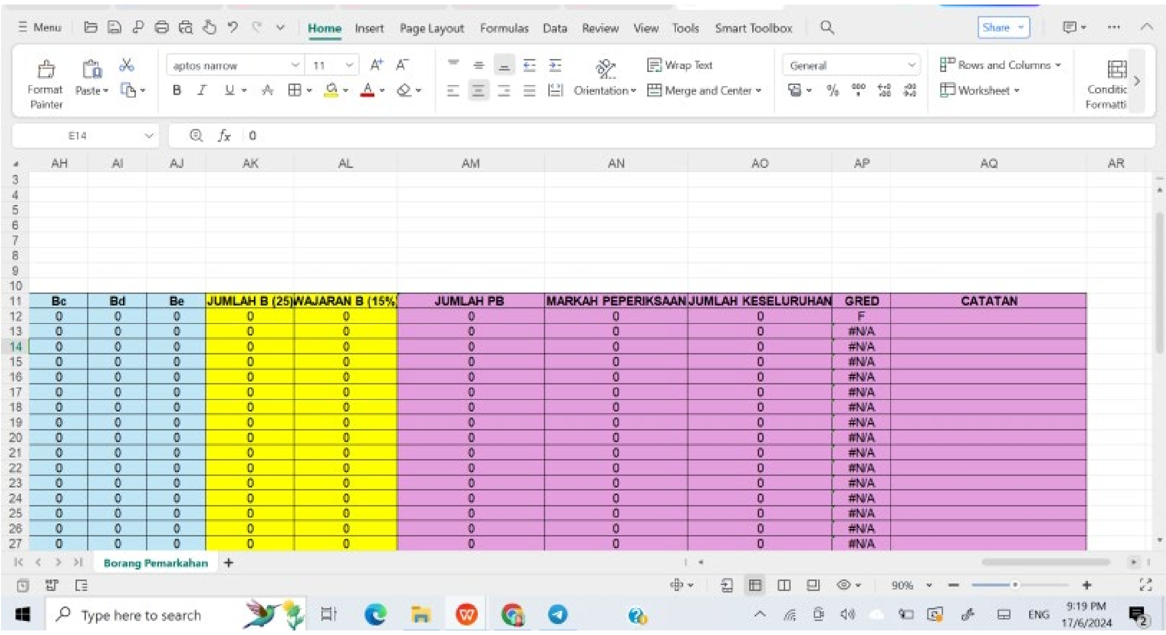

Figure 6: Section 3

In phase 3, the review is done, and all the documents are placed in one file, then the development of the appropriate application is produced to allow it to be accessed virtually using tools that are used regularly, which are mobile phones. All the requirements found in the form are developed and the researcher ensures that nothing is left out. Demonstrations were done several times and then actions were taken to ensure the successful implementation of e-marks.

In phase 4, after the research was carried out and the preliminary tests were carried out for the lecturers involved, then finally once again improvements were made until the SReP e-marks were finally implemented for all the lecturers teaching the Clothing Design Course.So the result is the logo of the SReP e-marks application can be used on the relevant lecturer's mobile phone as Figure 7 below:

Figure 7: The Apparel Design System E-Marks (SReP e-marks) Application Menu is generated

This SReP e-marks application can be used by all lecturers. Lecturers need to download by sharing the link that will be given by the researcher. Testing so far has been done among lecturers and they have given good feedback.

Content found in the SReP e-marks application

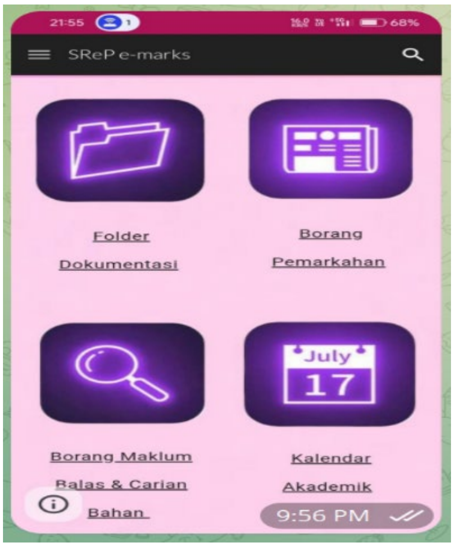

Figure 8: SReP e-marks content

Among the contents found in SReP e-marks as shown in Figure 8 above are several folders that can be accessed by lecturers, including documentation folders, digital marking forms, feedback forms & material searches as well as the Campus IPG academic calendar. All contents may be improved from time to time. Lecturers can see the progress of students over time through video recordings in the documentation folder or through the display of pictures taken.

However, this is an early stage for the development of the SReP e-marks application. For lecturers who carry out practical tests, it depends on their discretion and wisdom to match the practice carried out. Thus, the concept of continuous assessment will be achieved in an unlimited period and sufficient time. This is to ensure that lecturers can monitor the progress of students and that students are given the opportunity to improve every skill needed to increase their potential for them to face the world of digital education in the future.

Overall, there are several advantages in the development of the SReP e-marks application namely; (i) Enable lecturers to fill in accurate and appropriate marks within an unlimited period of time, (ii) have documentation that can help lecturers recall the implementation of practical tests carried out, (iii) can receive feedback from various parties related to the course carried out , (iv) can be uploaded and implemented anywhere using the internet, (iv) this application is confidential and special only for lecturers who teach and the exam section, (v) the marks given can be copied directly to the system.

Discussion of the Study

The development of the SReP e-marks application is very relevant because it can support and equip lecturers with the development of digital technology at the present time. This coincides with the goal of the Ministry of Education which has become the main driver in the development of the country's progress (Ayob. N, Hamzah, I.S, & Aziz, M. A, 2021). Now Mastery in digital skills is becoming increasingly important because the use of the internet in teaching and learning is an aspect that is emphasized. The Digital Education Policy itself emphasizes four main objectives, which are supported by six cores as well as 18 strategies and 41 initiatives in detail (Ministry of Education Malaysia, 2023) The implementation of this policy can be optimally utilized by students, educators, education leaders and all interested parties to bridge the digital divide further enables digital education to be implemented successfully (Ministry of Education Malaysia, 2023)).

In addition, the development of this application is a support for the group of lecturers who carry out practical tests. Coincides with the wishes of the Malaysian Ministry of Education (KPM), which states that practical assignments can encourage the active involvement of students in trying to learn something more clearly (Majlis Peperiksaan Malaysia, 2012). The practical test task involves two domains, namely the cognitive domain and the psychomotor domain, that need to be mastered in performing practical work. Therefore, the implementation of practical tests is very important to be implemented and at the same time the assessment also needs to be carried out to see the potential of the students to be in line with the courses offered.

Davis, (2014) also stated that lecturers need support through training, material assistance and positive experiences with students. This also coincides with the statement by Chala, (2019) that the practical test will not be successfully implemented if the lecturer is not skilled in planning the practical implementation well and efficiently. Furthermore, the lecturer's competence towards the low use of the workshop will have an impact on the management of the workshop during the practical work carried out (Mahanani et.al., 2020). According to Ahmad K, & Wan Yahya, W.A, (2021) assessment is a process of looking at individual potential, so accurate and good assessment requires continuous observation, focus and evaluation that is appropriate to the current phenomenon. If this matter can be continued then, the quality of education can be improved and support the improvement of the National Digital Education Policy.

In addition, the development of this application is also seen as appropriate to be implemented for all courses that have the implementation of practical tests. For the next researcher, it is suggested to produce a variety of applications that facilitate the lecturers and are compatible with the course implemented in practice. This will help to reduce the burden of performing other tasks. The skill of mastering lifelong learning for other fields apart from the existing field is very helpful for each lecturer to relate the needs of each knowledge. This coincides with the study of Ayob, N. H., Hamzah, I. S., & Aziz, M. A. (2021), which states that success in ensuring the reduction of the digital gap is important to increase the digital fluency rate and at the same time foster the innovation process in society. The emphasis on this aspect of digital education is also seen to be in line with the 4th sustainable development goal which is to gain access to quality education and the 10th goal which is to reduce inequality.

Importance of SReP e-marks application development

The development of this application is rationally focused on using it to record marks and comments for each section related to the sewing course. The development of this application can manage student marking more easily, grade marks and can be copied to the IPG examination system. This can simultaneously help reduce the burden on lecturers who have more and more side tasks in terms of clerical work at IPG.

This application is easier because it can be accessed anywhere, and a documentation report is provided to look again if the lecturer is less confident with the original marking. This application also contains an academic calendar that can be accessed by lecturers to focus on important dates to carry out daily tasks. Each data entered into this application can always be updated from time to time depending on the changes that occur according to the requirements of the exam and IPG academic management.

This application will only be used by lecturers who teach according to the courses offered. So, a security system is provided to prevent students from accessing the information contained in this application. Ethics for this use are also given attention and lecturers who use this application will also be given information related to confidentiality. In addition, this application does not involve any financial expenses that may burden the lecturer.

Therefore, the development of this application supports the implementation of the Education Digital Policy as expected by the Ministry of Education itself. The goal is to reduce the workload of lecturers, time and quality of work which is expected to be successful with the development of this application. Dynamic application development allows a person to understand its use faster and subsequently store information and data in the long term.

Conclusion

Overall, the development of this SReP e-marks application is complete, good and appropriate by applying the RAD Model which covers four phases which are user needs analysis, teaching design, implementation of application development and application implementation. This is because the development of the SReP e-marks application is very much in line with the needs of lecturers today who are on the wave of digital development. It is hoped that this study will be the basis for application development studies that help facilitate lecturers in the future.

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ID 63: Project Oriented Cooperative Based Learning (PoCoBL) for Invention Project

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Highlights: This research aimed to identify the significance of Project Oriented Cooperative Based Learning (PoCoBL) and to assess the impact of generic skills within PoCoBL for producing invention project. The key skills focused by researcher were team working, problem solving and communication. This study involved 30 final year students from Bachelor of Technology with Education (Mechanical Engineering) with Honours-SHPJH, Bachelor of Technology with Education (Electric and Electronics) with Honours-SHPRH and Bachelor of Technology with Education (Building Construction) with Honours-SHPQH in UTM. A quantitative observation method utilizing using 5 Likert scale to gather the data. Statistical for Social Science (SPPS) version 26 software was used to get the frequency, percentage and min score values. The result indicate that most respondents agree on the important of PoCoBL and its positive impact on developing generic skills for producing their project.

Keywords: *PoCoBL; technical and engineering; knowledge; skills*

Introduction

Technical and engineering students should have several technical knowledge and skills that contribute to enhance and improve their role in business and society and also enable students to perform their work with professionalism and success. Students should have the knowledge and abilities for example; teamwork, communicating skills, solving problems and critical thinking where all these outcomes are present in the PoCoBL. Project Oriented Cooperative Based Learning (PoCoBL) for an Invention Project combines the advantages of Project based learning (PjBL) with collaborative learning (CL) to enhance students' skills and knowledge acquisition (Eswaran,2024). According to Amish and Jihan (2023), collaborative online project-based learning model is important to enhance learning in engineering. According to Crawley et al., 2014, where the new and global challenges that exist nowadays have proven that those skills are essential in order to improve and enhance an engineer's masterpiece. According to De Miranda et al. (2008), the big problem in this is what preparation and training should the teachers get for them to teach engineering design skills, particularly by the in-service teacher professional development program. Thus, this research was investigated the PoCoBL approach in knowledge and skills that implemented in invention project together with the NALI to provide the undergraduate students with the appropriate skills in line with industry and technology development.

Objectives

The following are the objectives of this study:

i. To enhance students' interest and attitudes towards PoCoBL in an invention project
ii. To increase students' knowledge and skills
iii. To produce invention project towards PoCoBL related to industry and community need

Novelty

The invention project that offers for technical and engineering students did not highlight the proper procedure to completing the project with appropriated teaching and learning method previously. Thus, the PoCoBL step was applying in invention project resulted snowball of POCOBL knowledge and skills. The students must follow the PoCoBL step properly during competing the invention project. The knowledge and skills were improved and enhance such as interpersonal personal, technical and also generics skills.

Creativity

PoCoBL approach varies types of learning such as: Active Learning, Co-operative Learning, Problem Based Learning, Project Based Learning, industrial Based Learning. The lists of PoCoBL project during completing the invention project as follows:

Electro fun technology, Vibration machine for Perna Viridis, and Smart Aroma Oven for Roasting Goats. Furthermore, the PoCoBL also can be applied to all project such as for engineering student, TVET students, primary and secondary school and also for teacher or lecturer that teaching project subject or course.

Innovativeness

With this PoCoBL approach various generic skills for students can be improved and enhance such as; Creative Thinking, Design Thinking, Critics Thinking, Problem solving, Communication skills and Team working. Furthermore, previously when doing the invention project, no highlight on the NALI teaching and learning properly. Thus, with integrated this approach was increased students' knowledge and skills and also engage students with community.

Applicability

Apply teaching and learning during NALI such as: Active Learning, Problem Based Learning, Project Based Learning, Industrial Based Learning and Community Based Learning.

Impact on learning and teaching - Performance, Engagement and Empowerment

The effectiveness of learning and teaching are more interactive and active learning has been applied which has been approved from results of the survey by using questionnaire. Furthermore, by applying PoCoBL has been increased students' knowledge and skills, motivate students to learn effectively during complete the invention project and also guided students doing the project properly refer to PoCoBL step. Student also need to engage with industry and community to identify the customer need. Referring to Education 4.0 /21st Century 4C's Skills this PoCoBL in invention project students can improve the skills of problem solving, team-working, communication, critical thinking and also creativity thinking skills.

Research Methodology (Design and Development)

For the purpose of this study, a non-experimental approach was used to identify the importance and the impact of PoCoBL approach in terms of skills and knowledge for an invention project. A quantitative data survey of 5 Likert scale questionnaire was used to collect the numeric data among the students. The online survey of the same 5 Likert scale questionnaire using Google form was used.

These researches focused on of 30 final year students were 11 students from SHPRH, 11 students from SHPJH and 8 students from 4SHPQH. These students had the experience of conducting the invention project using the PoCoBL approaches.

A pilot test was firstly conducted where 5 students was chosen randomly from technical and engineering department to answer the questionnaire. These students are those who also had the experience in conducting the PoCoBL approach. The Cronbach's Alpha for the reliability was then calculated. The results obtained by SPSS software recorded the Cronbach's Alpha of 0.91, reflecting that the instrument has a high degree of reliability.

Findings/Outcome

The quantitative method survey with 5 Likert scales was used in this study. Table 1 displays the standard deviation, and mean which were calculated using SPSS 26.0 to find which item the students agree and do not agree with the most. The results and finding of this study are elaborated in sub-section as follows;

Items the Importance of PoCoBL in invention Project

Table 1 listed the Items used to assess the importance of PoCoBL in an invention project.

Table 1: Item for the importance of PoCoBL in an invention project

No. Item		Mean	Std.
1	PoCoBL strengthens the capabilities and skills of the students.	4.12	0.80
2	PoCoBL approach, teacher must act as facilitator and not a lecturer.	4.13	0.78
3	PoCoBL motivate students to be independent.	4.17	0.70
4	PoCoBL help students measure their own performance.	4.13	0.63
5	PoCoBL promote the responsiveness of the faculties' activities towards the enhancement of students' academic performance.	4.00	0.69
6	PoCoBL develop the study habits of the students.	4.07	0.83
7	PoCoBL challenge students to become more competitive.	4.13	7.39
8	PoCoBL practice collaboration rather than competition	3.97	0.89
9	PoCoBL creates a mind-set towards a clear direction of learning	3.87	0.82

The mean value for Item 1 until 9 recorded that the students mostly "agree" with the statement.

Items for PoCoBL Skills

Table 2 listed the Items for students' survey of the PoCoBL skills in an invention project.

Table 2: Items for PoCoBL Skills

No. Item		Mean	Std.
10	Improved student team-working skills. (Teamwork skill)	4.23	0.90
11	Improved student problem solving skills. (Problem solving)	4.10	0.76
12	Enjoyable and improve the social skills than formal lectures (Communication skill)	4.03	1.03

No. Item		Mean	Std.
13	Sessions enable student to fully participate as a team member. (Teamwork skill)	3.93	0.87
14	Develop student responsibility, tolerance, ethics, friendship, and punctuality (Communication skill).	4.00	0.59
15	Student can design, implement and innovate their product in capstone project. (Problem solving)	4.07	0.78
16	Student can produce a final product or system in given time. (Problem solving).	4.23	0.77
17	Student can improve their communication skills. (Communication skill)	3.73	1.26
18	Students in group can cooperate well and helpfulness each other. (Teamwork skill)	4.00	0.75

Table 2 shows the statement about the PoCoBL approach that related to the skill for the mean value of item 10 until 18. From the items, most of the students strongly agreed with those statements. The item 13 shows that the students agree that fully participate as a team member with mean 3.93 however the improvements also need to be done in term of responsibility each other to the task given. With reference to item no 17, with this PoCoBL approach students need to further improve this communication skills to achieve the goal of the invention project at the end of the semester with mean value 3.73.

Potential for Commercialization

The IP such as copy write has been registered to protect the research. Furthermore, the collaboration with stakeholders such as: Politeknik Malaysia, School and MTUN also can be done. Short series course for technical and vocational institution and engineering department can be given.

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ID 64: Dari Kelas ke Realiti: Memperkasa Penguasaan Pemikiran Kritis dan Kreatif Menggunakan Pendekatan Pembelajaran PROACTIV

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Sorotan: Dalam projek ini, program pemikiran kritis dan kreatif yang dinamakan sebagai *Critical and Creative Camp 3.0 (3C Camp 3.0)* telah dianjurkan. Program ini mempunyai dua tujuan iaitu memperkasa pemikiran kritis dan kreatif mahasiswa UTM bagi kursus UHMS 2022 menerusi pendekatan pembelajaran PROACTIV dan khidmat komuniti (*Corporate Social Responsibility*); dan mengasah minda kreatif dan inovatif pelajar sekolah menerusi pertandingan rekacipta produk inovasi berasaskan bahan kitar semula. Oleh itu, program *3C Camp 3.0* ini menerapkan aspek kemahiran intelek yang inovatif. Proses merancang dan menganjurkan program *3C Camp 3.0* oleh mahasiswa UTM, serta proses merekacipta produk inovasi oleh peserta program menguji kecerdasan berfikir secara kritis dan imaginatif sebelum pembuatan keputusan. Secara spesifik, proses pemikiran kritis dan kreatif pelajar bermula dengan menganalisis masalah, menilai masalah, menjana idea, membuat pilihan dan perancangan bagi menyelesaikan masalah. Program ini melibatkan enam orang pensyarah dan 144 orang mahasiswa UTM, yang berperanan sebagai penceramah dan fasilitator, serta 242 orang pelajar dari Sekolah Kebangsaan Taman Bukit Dahlia (SKTBD), Pasir Gudang, sebagai peserta. Keberkesanan program *3C Camp 3.0* ini diukur berdasarkan kualiti produk rekacipta inovasi yang dihasilkan peserta program, dapatan soal selidik serta maklumbalas dan pemerhatian guru. Secara keseluruhan, dapatan kajian menunjukkan peningkatan dari aspek kesedaran dan minat terhadap aktiviti kreatif dan inovatif dalam kalangan peserta program.

Kata kunci: *Pemikiran kritis; pemikiran kreatif; inovasi; rekacipta; interaktif*

Pengenalan

Program *Critical and Creative Thinking Camp (3C Camp 3.0)*, yang telah dijalankan ini mengandungi dua sasaran utama. Pertama, program ini bertujuan untuk mencapai hasil pembelajaran kursus (CLO 4) melalui aktiviti interaktif yang lebih menyeronokkan kepada mahasiswa UTM. Berdasarkan pemerhatian, mahasiswa UTM yang mengambil kursus UHMS 2022 ini mampu mengemukakan pelbagai idea kreatif dan telah dipamerkan sebelum, semasa dan selepas penganjuran program *3C Camp 3.0* di sekolah. Sewaktu di dalam kelas, para mahasiswa telah didedahkan dengan pengetahuan berkaitan konsep berfikir, persepsi, pemikiran kritis, rekacipta dan inovasi, pemenang hadiah Nobel dan teknik pemikiran kreatif aras tinggi menggunakan model CoRT (*Cognitive Research Trust*) 1 serta CoRT 4. Keberkesanan pembelajaran mahasiswa dinilai berdasarkan dua kerja kursus utama iaitu menyediakan kertas cadangan program yang mengandungi pameran interaktif dan permainan kreatif, serta laporan program. Secara spesifik, kualiti kertas cadangan dan laporan dinilai berdasarkan beberapa kriteria seperti; nama projek inovasi, objektif dan matlamat projek inovasi, pernyataan masalah, penjanaan idea, draf idea, penyelesaian masalah, kos pembangunan produk, kesimpulan, lampiran, *Gantt Chart* projek, senarai ahli dan kepakaran serta minit mesyuarat. Manakala kualiti poster dinilai berdasarkan; analisis masalah, mengenalpasti fakta, penjanaan idea, penyelesaian masalah dan anggaran kos yang terlibat.

Kedua, program ini juga bertujuan untuk memberi pendedahan kepada pelajar sekolah terpilih mempamerkan bakat merekacipta produk inovasi yang diaturkan dalam program *3C Camp 3.0*. Keberkesanan program *3C Camp 3.0* ini ke atas pelajar sekolah diukur berdasarkan kualiti produk rekacipta inovasi yang mereka hasilkan, dapatan soal selidik, serta pemerhatian guru-guru selepas program. Berdasarkan dapatan soal selidik, program ini telah mendapat maklumbalas yang memberangsangkan daripada peserta program. Kesimpulannya, program ini telah berjaya mencapai objektif dan matlamat yang digariskan, serta mendatangkan manfaat bukan sahaja kepada mahasiswa UTM, bahkan pelajar sekolah terlibat.

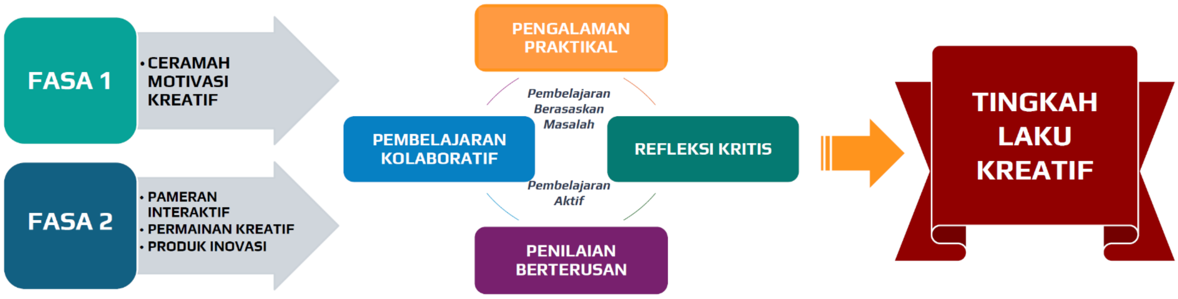
Kandungan

Objektif Projek

1. Memperkasa pemikiran kreatif dan kritis mahasiswa UTM dan peserta program menerusi pameran interaktif dan permainan kreatif.
2. Mengasah minda kreatif dan inovatif peserta program menerusi pertandingan rekacipta produk inovasi.
3. Menerapkan nilai teras UTM iaitu integrity, synergy, excellence & sustainability (ISES) dalam diri mahasiswa.

Pelaksanaan Pendekatan NALI dalam Projek

Projek ini mengintegrasikan tiga pendekatan pembelajaran iaitu pembelajaran aktif, pembelajaran kolaboratif dan pembelajaran berasaskan masalah yang berpotensi meningkatkan kecerdasan analitikal dan imaginatif pelajar. Kombinasi ini diadaptasi dari Teori Pembelajaran Berasaskan Pengalaman atau *Experiential Learning Theory* (Kolb, 1984), yang menekankan pendekatan pembelajaran melalui pengalaman nyata dan situasi sebenar. Menurut Kolb (1984) proses pembelajaran akan lebih efektif dan bermakna apabila pelajar belajar dengan melakukan dan mempraktikkan apa yang dipelajari, bukannya sekadar mendengar kuliah atau membaca nota. Tambahan lagi, pelajar akan lebih mudah memahami dan mengingati konsep yang dipelajari kerana mereka mengalami sendiri pengalaman tersebut. Hasilnya, pelajar akan lebih bertanggungjawab ke atas pembelajaran mereka sendiri, rasa percaya diri dan keyakinan meningkat. Ilustrasi perlaksanaan projek *3C Camp 3.0* menggunakan pendekatan pembelajaran PROACTIV berasaskan teori pembelajaran yang disarankan oleh Kolb (1984) ditunjukkan dalam Rajah 1.



Rajah 1**:** Kerangka pembelajaran PROACTIV

Program *3C Camp 3.0* dilaksanakan dalam dua fasa. Seperti yang ditunjukkan dalam Rajah 1, program ini bermula dengan ceramah motivasi kreatif oleh pensyarah kepada 242 orang pelajar sekolah. Ceramah ini bertujuan membuka minda dan minat pelajar sekolah terhadap aktiviti rekacipta dan inovasi produk. Ceramah ini juga memberi kesedaran kepada pelajar untuk memanfaatkan bahan kitar semula dan memelihara persekitaran. Dalam Fasa 1 juga, mahasiswa UTM menghasilkan kertas cadangan program *3C Camp 3.0* yang mengandungi objektif program, aktiviti kreatif, tentatif program dan anggaran perbelanjaan. Proses ini memberi peluang kepada mereka untuk mengaplikasikan konsep pemikiran kritis dan kreatif yang dipelajari di dalam kelas ke dalam konteks realiti. Proses ini mendedahkan mahasiswa kepada **pengalaman praktikal** seperti disarankan oleh Kolb (1984). Kertas cadangan tersebut akan disemak oleh pensyarah kursus dan setiap kumpulan membuat pembetulan berdasarkan maklumbalas pensyarah. **Refleksi kritis** berlaku pada peringkat ini. **Pembelajaran kolaboratif** juga berlaku dalam fasa ini, di mana dalam kumpulan kecil mahasiswa UTM bekerjasama dan berkongsi idea bagi menjayakan pameran interaktif dan permainan kreatif di sekolah. Bagi pelajar sekolah pula, fasa ini memberi pendedahan kepada mereka membina kemahiran komunikasi dan kerjasama menerusi pembinaan produk inovasi menggunakan bahan kitar semula. Pameran interaktif dan permainan kreatif dilaksanakan di sekolah dalam Fasa 2. Selain dari terlibat dengan pameran dan permainan, pelajar sekolah juga mempertaruhkan produk inovasi masing-masing menerusi pertandingan yang dianjurkan. **Penilaian berterusan** berlaku pada peringkat ini apabila peserta menerima maklum balas secara langsung daripada juri.

Keaslian, Kreativiti dan Inovasi

Keaslian projek ini terletak pada gabungan tiga pengalaman pembelajaran yang berbeza, iaitu pembelajaran aktif, pembelajaran kolaboratif, dan pembelajaran berasaskan masalah. Perlaksanaan projek ini pula diadun menggunakan teori pembelajaran berasaskan pengalaman Kolb (1984). Secara keseluruhan pelajar mendapat pengalaman yang boleh menajamkan lagi daya pemikiran kritis dan kreatif mereka.

Elemen kreativiti pula terletak pada pameran interaktif, permainan kreatif dan produk inovasi, masing-masing dihasilkan oleh mahasiswa UTM dan pelajar sekolah. Dengan bimbingan pensyarah, pelajar berjaya melaksanakan proses berikut:

- Mengenalpasti keperluan pelajar sekolah. Dalam konteks ini pembinaan daya pemikiran kritis dan kreatif adalah satu keperluan bagi pelajar.
- Menetapkan objektif dan skop program dengan jelas.
- Mereka bentuk program termasuk membangunkan kandungan program.
- Merancang tentatif program, anggaran kos, tempat latihan, dan peralatan yang diperlukan bagi menjayakan program.
- Melaksanakan program mengikut perancangan.
- Menilai keberkesanan program menerusi kaedah yang sesuai (cth. soal selidik).
- Menyediakan laporan akhir.

Elemen inovasi dalam projek ini terletak pada kolaborasi antara pihak UTM dan pihak sekolah dalam memberikan pengalaman dan pembelajaran yang bermakna kepada mahasiswa UTM dan pelajar sekolah. Selain itu, elemen inovasi juga wujud daripada gabungan kerjasama antara pensyarah dan mahasiswa UTM dalam menjayakan program *3C Camp 3.0* ini. Tambahan pula, keberkesanan projek ini dinilai menggunakan kedua-dua kaedah kuantitatif dan kualitatif, di mana data kajian diperolehi menerusi temubual bersama pelajar sekolah selepas program, borang soal selidik kepada pelajar sekolah, serta maklum balas guru. Soal selidik pula diedarkan sebelum dan selepas program selesai.

Program *3C Camp 3.0* berjaya mencapai matlamat utamanya iaitu untuk mengembangkan keaslian, kreativiti dan inovasi dalam kalangan pelajar melalui aktiviti interaktif yang menyeronokkan. Sepanjang program, pelajar telah menunjukkan pelbagai idea kreatif yang bukan sahaja dipamerkan semasa program di sekolah, tetapi juga dalam tugas akademik mereka.

Kebolehgunaan dan Impak dalam Program

Program *3C Camp 3.0* ini menunjukkan kebolehgunaan dan impak yang signifikan terhadap peserta. Gabungan tiga kaedah pembelajaran (cth. pembelajaran aktif; pembelajaran kolaboratif; pembelajaran berasaskan masalah) dan adaptasi teori pembelajaran berasaskan pengalaman (Kolb, 1984) adalah praktikal dan efektif serta sesuai diaplikasikan dalam semua peringkat pelajar dan konteks pembelajaran.

Impak program ini diperlihatkan melalui maklum balas positif dari pelajar komuniti terlibat, termasuk pentadbir sekolah, guru-guru, pelajar sekolah dan mahasiswa UTM. Semua pihak melihat program ini sebagai usaha yang berkesan untuk membudayakan pemikiran kritis dan kreatif serta mencadangkan agar ia diteruskan pada masa akan datang. Melalui pelaksanaan siri program ini, jelas bahawa objektif untuk menggabungkan teori dengan praktik dalam konteks pendidikan berjaya dicapai, menjadikannya satu model kebolehgunaan yang boleh dicontohi dalam program-program lain.

Metodologi Projek

Untuk siri pertama, pensyarah memberi ceramah berkaitan pemikiran kritis dan kreatif kepada pelajar sekolah. Ia berhasil menyampaikan pengetahuan serta kemahiran berkaitan pemikiran kritis dan kreatif kepada pelajar sekolah. Sementara itu, siri kedua, pelajar sekolah dan pelajar UTM yang dijemput terlibat sebagai peserta dalam aktiviti seperti pameran interaktif dan permainan. Ia berhasil menjadi medium praktik untuk pelajar sekolah dan mahasiswa UTM dengan keterlibatan mereka sebagai peserta dalam aktiviti seperti pameran interaktif dan permainan.

Siri pertama pada 20 November 2023, yang memberi fokus kepada ceramah mengenai pemikiran kritis dan kreatif, berjaya memberikan pemahaman asas kepada pelajar sekolah. Siri kedua pada 4 Disember 2023 pula melibatkan pelajar sekolah dan pelajar UTM dalam aktiviti seperti pameran interaktif dan permainan, yang memungkinkan mereka untuk mengaplikasikan konsep-konsep yang dipelajari.

Inisiatif ini melibatkan dua pensyarah kanan UTM, Prof. Madya Dr. Mohd. Azhar Abd Hamid dan Dr. Salwa Abd Patah, yang masing-masing menyumbang dalam menyampaikan ilmu serta menggerakkan sesi wacana dengan guru-guru. Program ini menjadi medium proaktif untuk memupuk minda pelajar dengan pengetahuan kritis dan kreatif, yang diterjemahkan melalui aktiviti *hands-on* dan pameran interaktif.

Dapatan dan Perbincangan

Dapatan Soal Selidik: Dapatan kajian ini diperolehi daripada kaedah soalselidik dan temubual. Borang soal selidik diedarkan kepada pelajar sekolah sebelum dan selepas program tamat.

FASA 1: Kadar pulangan soal selidik adalah sebanyak 86% peratus iaitu mewakili 209 pelajar sekolah. Seperti yang ditunjukkan dalam Jadual 1, terdapat peningkatan yang signifikan dalam skor sebelum (M=3.49) dan selepas program (M=4.24). Ini menunjukkan tahap kesedaran dan minat pelajar sekolah terhadap aktiviti kreatif dan inovasi telah meningkat daripada sederhana kepada tahap tinggi selepas mengikuti program.

FASA 2: Dapatan t-test menunjukkan peningkatan skor min dari 3.54 (Ujian Pra) kepada 4.34 (Ujian Pos) selepas pelaksanaan Pameran Interaktif dan Permainan Kreatif dalam Fasa 2. Peningkatan ini mencadangkan bahawa pameran dan permainan kreatif memberi kesan positif terhadap pelajar yang terlibat, seperti peningkatan pengetahuan, pemahaman dan keterlibatan.

Jadual 1: Dapatan Soal Selidik Ujian Pra dan Ujian Pos Mengikut Fasa

Item	Fasa 1 : Ceramah Motivasi Kreatif		Fasa 2 : Pameran Interaktif, Permainan Kreatif dan Produk Inovasi	
	Skor Min		Skor Min	
	Ujian Pra	Ujian Pos	Ujian Pra	Ujian Pos
Saya yakin saya seorang yang kritis dan kreatif.	3.33	4.21	3.47	4.36
Pemikiran kritis dan kreatif penting dalam kehidupan seharian saya.	3.70	4.29	3.69	4.33
Berfikir kritis dan kreatif dapat membantu saya menyelesaikan masalah dalam kehidupan seharian.	3.72	4.27	3.69	4.37
Merekacipta sesuatu produk baru dapat meningkatkan pemikiran kritis dan kreatif saya.	3.35	4.00	3.51	4.24
Program 3C Camp memberi kesan yang positif kepada saya.	3.36	4.23	3.48	4.31
Program 3C Camp dapat meningkatkan bakat dan daya berfikir secara kritis saya.	3.39	4.18	3.43	4.30
Program 3C Camp menaikkan minat saya untuk merekacipta produk kreatif.	3.25	4.14	3.39	4.31
	3.76	4.35	3.72	4.43

Item	Fasa 1 : Ceramah Motivasi Kreatif		Fasa 2 : Pameran Interaktif, Permainan Kreatif dan Produk Inovasi	
	Skor Min		Skor Min	
	Ujian Pra	Ujian Pos	Ujian Pra	Ujian Pos
Saya setuju program 3C Camp dijalankan di sekolah pada masa akan datang.				
Skor keseluruhan	3.49	4.24	3.54	4.34

Secara keseluruhan, penemuan kajian menunjukkan peningkatan positif dari aspek kesedaran dan minat terhadap aktiviti kreatif dan inovatif dalam kalangan pelajar sekolah. Program 3C Camp 3.0 ini menunjukkan kesedaran dan minat terhadap aktiviti kreatif dan inovatif boleh dipupuk menerusi kaedah pendidikan yang sesuai, seperti program dan kempen kesedaran. Kajian ini membuktikan adalah penting pihak universiti dan sekolah mengambil inisiatif mempelbagaikan teknik pembelajaran bagi membina pengalaman pembelajaran yang lebih bermakna sekaligus berkesan dalam meningkatkan pemikiran kritis dan kreatif dalam kalangan pelajar. Kajian ini juga membuktikan kesedaran dan minat terhadap kreativiti dan inovasi boleh dipupuk menerusi ceramah motivasi kreatif, pertandingan kreatif dan inovatif, pameran interaktif dan permainan kreatif.

Maklumbalas dari Komuniti: Program ini telah menerima maklum balas yang sangat positif daripada pelbagai pihak dalam komuniti, termasuk pentadbir sekolah, guru-guru, pelajar sekolah serta mahasiswa UTM. Mereka melihat program ini sebagai satu inisiatif yang berkesan dalam membina serta merangsang pemikiran kritis dan kreatif. Kejayaan program ini memberi keyakinan kepada semua pihak bahawa ia wajar diteruskan pada masa akan datang. Berikut adalah maklumbalas pelajar selepas program:

Pelajar X: "Program ini memang membantu saya berfikir di luar kotak. Saya berharap program ini dapat diteruskan lagi pada masa akan datang."

Pelajar Y: "Saya harap program *3C Camp* ini dapat disambung lagi dan marilah kita mengamalkan apa yang dipelajari daripada program ini."

Pelajar Z: "Program *3C Camp* amat membantu. Ia dapat meningkatkan keyakinan diri saya dan memberi motivasi kepada saya berkaitan pemikiran kritis dan kreatif. Saya berharap program ini dapat diteruskan lagi pada masa akan datang."

Berdasarkan kepada semua dapatan kualitatif, adalah dapat disimpulkan bahawa program ini telah mendapat maklum balas yang sangat positif daripada komuniti, termasuk pentadbir sekolah, guru, pelajar sekolah, dan mahasiswa UTM. Mereka menganggap program ini sebagai inisiatif yang berkesan dalam membina dan merangsang pemikiran kritis dan kreatif. Kejayaan program ini telah meningkatkan keyakinan komuniti terhadap keberkesanannya, dan terdapat kesepakatan bahawa program ini wajar diteruskan pada masa akan datang. Pelajar-pelajar yang terlibat juga memberikan ulasan yang positif, menunjukkan bahawa program ini membantu mereka berfikir di luar kotak, meningkatkan keyakinan diri, serta memberikan motivasi berkaitan pemikiran kritis dan kreatif.

Hasil Projek: Dalam siri pertama yang diadakan pada 20 November 2023, program ini berjaya menyampaikan ilmu mengenai pemikiran kritis dan kreatif kepada pelajar sekolah. Siri kedua pula, yang diadakan pada 4 Disember 2023, memberikan peluang kepada pelajar sekolah dan pelajar UTM untuk mengaplikasikan ilmu yang dipelajari melalui aktiviti-aktiviti praktikal seperti pameran interaktif dan permainan. Ini menunjukkan bahawa program tersebut bukan sahaja menyediakan pembelajaran teori tetapi juga memberi ruang untuk amalan praktikal. ini turut dipamerkan dalam pautan berita *Newshub* UTM di pautan:

https://news.utm.my/ms/2024/02/program-3c-camp-2023-sharps-fssh-bugarkan-minda-pelajar/

Justifikasi Pelaksanaan Program ini direka untuk memenuhi hasil pembelajaran kursus dengan pendekatan yang interaktif dan menyeronokkan. Berdasarkan maklumat kursus UHMS 2022 Pemikiran Kritis dan Kreatif, program ini turut merangkumi CLO 4 yang memerlukan pelajar untuk menjalankan projek berkumpulan berdasarkan teknik pemikiran kreatif, yang menyumbang 40% daripada markah keseluruhan. Aktiviti-aktiviti dalam program ini memberi peluang kepada pelajar untuk menunjukkan kreativiti mereka melalui kertas cadangan/laporan dan poster.

Hasil Pembelajaran dan Analisis Mahasiswa UTM telah menunjukkan pelbagai idea kreatif yang dipamerkan semasa program di sekolah. Dalam kelas, pelajar didedahkan kepada konsep-konsep asas seperti proses berfikir, persepsi, dan pemikiran kritis serta kreatif. Mereka kemudian mengaplikasikan pengetahuan ini dalam kerja kursus utama yang melibatkan penyediaan kertas cadangan, pameran interaktif, permainan kreatif dan laporan.

Penambahbaikan Beberapa penambahbaikan telah dikenalpasti untuk masa akan datang, termasuk memastikan aktiviti interaktif yang membolehkan murid-murid berinteraksi secara lebih mendalam dengan produk yang dipamerkan, memperbesar saiz poster untuk penyampaian maklumat yang lebih jelas, memperkenalkan inovasi daripada bahan kitar semula, dan mengintegrasikan teknologi digital dalam pameran.

Kesimpulan

Program ini telah berjaya mencapai objektif dan matlamat yang ditetapkan. Maklum balas yang diterima daripada peserta program sangat positif, menunjukkan bahawa program ini memberi manfaat yang besar bukan sahaja kepada pelajar UTM, tetapi juga kepada murid-murid sekolah. Diharapkan program sebegini dapat diteruskan dan diperkembangkan lagi pada masa akan datang.

Penghargaan

Sekalung penghargaan buat Tuan Mohd Senin bin Khamis selaku Guru Besar, para pentadbir sekolah yang terdiri daripada Guru-guru Penolong Kanan, Puan Norhawanom Abid selaku Guru Kaunseling, guru-guru dan murid-murid Sekolah Kebangsaan Taman Bukit Dahlia (SKTBD), Pasir Gudang, Johor.

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ID 65: Integrating Design and Construction in the Design Studio Through an Innovative Collaborative Project Approach

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Highlights: This teaching innovation merges individual and collaborative studio tasks, beginning with students designing furniture that emphasizes functionality, anthropomorphism, and contextual placement. The project then transitions into a group phase where students construct furniture at a 1:1 scale. A unique challenge requires students to build a design created by their peers, rather than their own, fostering a deep understanding of the distinct roles of designer and builder. Designers must provide clear instructions and respond to construction feedback, simulating real-world client-builder interactions. The project culminated in the successful creation and public exhibition of 19 full-scale furniture pieces.

Keywords: *Design studio; collaborative design; peer-learning; design & build*

Introduction

In architectural education, the relationship between design and construction is often taught as separate entities, leading to a gap in students' understanding of how these roles interact in practice. To address this, we introduced an innovative studio project that bridges this gap by integrating both design and construction phases into a single learning experience.

Students begin by individually designing a piece of furniture, focusing on functionality, anthropomorphism, and visual appeal. They produced illustrations and scaled models of their ideas. The challenge then expands in the following stage, as students, grouped into teams, are tasked with constructing the designs developed by their peers rather than their own.

This unique approach compels students to engage with the complexities of translating design intentions into built forms, promoting a deeper understanding of the dynamic between designers and builders. By taking on roles as both designers and builders, students gain invaluable insights into the collaborative nature of architectural practice. The project culminated in the successful construction and public exhibition of 19 full-scale furniture pieces, demonstrating the practical application of the theoretical knowledge acquired.

Background

The current architectural education system practiced in Malaysia, while highly effective in fostering creativity and honing the technical skills of aspiring designers, has inadvertently become too inward-looking. Over the years, the curriculum of the design studio has evolved to emphasize the development of individual creativity and design thinking. This focus has been crucial in nurturing students' abilities to think critically and produce innovative designs. However, this approach has resulted in graduates who while excelling at creating standalone designs, they do struggle to collaborate effectively with professionals outside the design fraternity, such as engineers, quantity surveyors, and builders.

This inward focus was not a deliberate choice but rather the outcome of gradual changes in the educational syllabus. As architectural programs increasingly prioritized the internal development of creativity and design development, less emphasis was placed on the practical aspects of working within a multidisciplinary team. This shift has inadvertently created a generation of designers who, while technically proficient, often lack the necessary skills to navigate the complexities of real-world projects where collaboration and communication with non-designers are critical.

The consequences of this educational focus have become increasingly apparent. Fresh graduates tend to struggle with the realities of professional practice, where the ability to work alongside engineers, contractors, and clients is critical. The struggle is no longer circumstantial; they have become a common issue, highlighting a significant gap in the current educational framework.

A change is necessary to address these shortcomings. Architectural education must evolve to better prepare students for the collaborative nature of professional practice. This means incorporating more opportunities for students to engage with the construction process and to experience the challenges of translating design into reality while working with a team. By doing so, we can ensure that future architects are not only skilled designers but also effective collaborators who can thrive in the multifaceted environment of the construction industry. And this has to happen as early as possible!

The Idea

To address this problem, the 1st year Studio Masters of the B.Sc. Architecture with Honours programme in UTM developed a radical approach of switching roles in the development of a design project. Instead of making students construct their designs, the brief now requires them to form into groups of builders, where they will be assigned to construct designs by their peers.

Objectives

i. To enhance students' understanding of the interrelationship between design and construction phases through practical, hands-on experience;

ii. To cultivate teamwork and communication skills by requiring students to construct designs developed by their peers;

iii. To simulate real-world architectural practice by assuming both designer and builder roles, fostering a holistic view of the design-build process.

The Innovation

This approach immerses students in the full spectrum of architectural practice by integrating design and construction phases into a cohesive learning experience. The project cultivates essential teamwork and communication skills by requiring students to build designs created by their peers while also providing hands-on, real-world experience that bridges the gap between theory and practice. This method enhances their understanding of the design-build relationship and prepares them to navigate the complexities of professional collaboration in the architectural field.

This innovative approach offers unique exposure to architecture students that was only taught at theoretical level before. Especially when implemented at a very early stage, this exposes the young designers to different roles related to their subsequent roles in the industry. It prepares them for the collaborative demands of the architectural profession, making it a valuable addition to the curriculum.

Methodology

A structured and iterative methodology was implemented to achieve the selected objectives, focusing on individual and group activities. The methodology is divided into three key phases: Design, Construction, and Reflection.

Design Phase

Each student was assigned to design a piece of furniture with specific guidelines emphasizing functionality, anthropomorphism, and aesthetic values. The design process involved multiple stages of ideation, sketching, and scaled modelling, supported by feedback sessions by the lecturers. This phase aimed to broaden students' understanding of design principles while encouraging creativity and critical thinking.

Upon completion, students submitted their final designs for review. The assessment panel consisting of studio lecturers evaluated the designs based on the given criteria. Through a democratic selection process, the students voted for 19 of their favourite designs to be constructed in the next phase.

Design Phase

Students formed groups of three or four students. These are called the builder groups. Then, each group was randomly assigned with a particular design. Importantly, students were not assigned to build their designs, but rather those developed by their peers. This required them to interpret and execute another designer's vision, mirroring the real-world dynamic between architects and builders.

During construction, students alternated between the builder and the client/designer roles. Builders were responsible for understanding and executing the design, while the original designers provided guidance, responded to challenges, and made decisions to adapt the design based on practical constraints. This simulated the iterative communication process between designers and builders in professional practice.

The construction process was conducted at a 1:1 scale, allowing students to experience real materials, tools, and construction techniques. This hands-on experience was crucial for understanding the practical implications of design decisions and the challenges of translating a concept into a tangible product.

Reflection Phase:

At this phase, students participated in reflective sessions where they analyzed the challenges of the project. Students produced reports detailing the construction process, costs, challenges, changes made to address the challenges and what they learned from the project as well as insights gained from working in a team.

Outcome

A total of 58 students were divided into 19 groups, each tasked with constructing a selected furniture design. The development process was overseen by 5 lecturers, ensuring continuous supervision and guidance. Over 3 weeks, all 19 pieces of furniture were successfully constructed, with costs ranging from RM0 (using entirely recycled materials) to RM365.

Figure 1: Furniture Exhibition conducted as a conclusion of the collaborative project at Faculty of Built Environment & Surveying, UTM.

Each group maintained a detailed report documenting their progress, observations, and reflections. While most groups worked effectively together, two groups encountered difficulties in collaboration, and one group reported that a member withdrew from participating in the work. Notably, 18 out of the 19 groups made some adjustments to the original designs during construction, with one group implementing a major change due to unsuitable materials.

Portfolio Review Feedback

At the end of the semester, the Portfolio Review was conducted to conclude the semesterly progress of the Design Studio. The members of the School scrutinized the activities, development, and assessment of the studio programme, and provide feedback to the teaching team in order to provide continuous quality improvements.

The Portfolio Review Panel acknowledged the potential of the collaborative aspect of the Project. The students seemed encouraged when working together even for a short project. The student gave generally positive feedback, but informed the Panel that they did struggle trying to meet the expectation of the designers (who were their peers). The main reason was that the designers themselves were not well versed in the construction and materiality, hence there's a large degree of uncertainty that slows down their progress.

The Portfolio Panel agreed with this and informed the teaching team of this project to improve and provide a more structured system in running the project throughout the semester.

Discussion

This innovative design-build studio project has demonstrated significant potential to enhance architectural education by bridging the gap between design and construction. Through the integration of hands-on construction tasks with individual design work, students were able to gain a holistic understanding of the architectural process, from conceptualization to execution. The project not only fostered creativity and problem-solving but also cultivated essential teamwork and communication skills that are crucial for professional practice.

The challenges faced during the construction phase, particularly the need to work with peer designs and make real-time adjustments, provided students with invaluable insights into the complexities of translating ideas into tangible outcomes. Despite the hurdles encountered, such as collaboration difficulties within some groups and the necessity for design modifications, the successful completion and public exhibition of 19 full-scale furniture pieces underscored the effectiveness of this educational approach.

In meeting the NALI criteria of novelty, creativity, innovativeness, applicability, and impact, this project has set a new standard for experiential learning in architectural education. It prepares students not only to be skilled designers but also to be adaptive, collaborative professionals capable of navigating the multifaceted challenges of the architecture industry. As we look to the future, the insights gained from this project will serve as a foundation for further innovations in teaching and learning, ultimately contributing to the development of well-rounded architects who are equipped to lead in a rapidly evolving field.

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ID 66: Innovative Pedagogical Strategies in Health and Fitness Courses: Implementing the Sri Pulai Sihat dan Cergas Program

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Highlights: The **Sri Pulai Sihat dan Cergas** exercise program, conducted over four weeks among Taman Sri Pulai Community, represents an innovative approach in Health and Fitness Course in Sports Science degree. A theme-based exercise program delves into the innovative pedagogical strategies employed to guide sports science students in designing and executing a community-focused fitness program. The initiative offers a comprehensive model that integrates theoretical learning with practical application, fostering enhanced educational practices and heightened student engagement in the field of health and fitness.

Keywords: *Experiential Learning; Student Empowerment; Community Health Program; Health and Fitness Courses*

Introduction

The implementation of innovative pedagogical strategies within sports science courses is essential for fostering a comprehensive and practical understanding of health and fitness principles. As educational paradigms shift towards more experiential and applied learning, it becomes imperative to incorporate programs that bridge the gap between theoretical knowledge and real-world application (Qadhi, 2023) The primary objective of the Sri Pulai Sihat dan Cergas Exercise Program was to establish an innovative pedagogical strategy within sports science courses, directly linking academic learning with community health outcomes. This objective is consistent with the IDEAS approach, which emphasizes the integration of experiential learning, community engagement, and student-led initiatives (Guàrdia et al., 2021).

The Sri Pulai Sihat dan Cergas program, with its specific focus on women, addresses the unique health and fitness challenges faced by this demographic. By incorporating active learning principles, the program empowers students to assume responsibility for their educational experience, leading the design and execution of the fitness program. Central to this approach is problem-based learning (PBL), which enables students to apply their theoretical knowledge to address practical health challenges within the community. Furthermore, the program highlights the importance of peer learning, fostering collaboration and mutual support among students. Through these combined elements, the program not only promotes physical well-being but also enhances mental and emotional health among women participants.

The incorporation of this program within sports science curricula exemplifies a shift towards more holistic and inclusive educational practices. By focusing on women's health, the program contributes to broader societal goals of reducing health disparities and promoting wellness across different populations (Rudnicka et al., 2020). This paper explores the innovative pedagogical strategies employed in the Sri Pulai Sihat dan Cergas Exercise Program and examines its impact on both student learning outcomes and community health.

Research Methodology

This study aims to evaluate the implementation of the Sri Pulai Sihat dan Cergas Exercise Program within Health and Fitness course, focusing on its role in enhancing student learning outcomes and promoting community health, particularly among women. The program's primary objective is to establish an innovative pedagogical strategy that connects academic learning with practical applications, aligning with the New Academia Learning Innovation (NALI) framework. This approach integrates experiential learning, community engagement, and student-led initiatives to improve academic performance and contribute to the broader societal goal of enhancing health and wellness.

The study began with a needs assessment to identify the health challenges faced by women in the community, leading to the formulation of targeted program objectives. The program was designed to incorporate active learning strategies, with students taking the lead in developing and executing fitness activities. Problem-based learning (PBL) was a core element, allowing students to apply theoretical knowledge to address real-world health challenges, thereby fostering critical thinking and problem-solving skills. Community engagement was facilitated through partnerships with local health organizations (KEMAS Iskandar Puteri) and industry (Trio Diva Fitness), ensuring the program's relevance and impact. Additionally, peer learning was emphasized to foster collaboration and mutual support among students.

Figure 1: Sri Pulai Sihat dan Cergas Program Development Phases

Data collection involved pre- and post-program fitness assessments, and reflective journals, which were analyzed to measure the impact on student learning outcomes and community health. This comprehensive methodology enabled the study to capture the multifaceted benefits of the Sri Pulai Sihat dan Cergas Exercise Program, highlighting its potential as a model for innovative pedagogy in sports science education.

Findings and Discussion

The Sri Pulai Sihat dan Cergas program demonstrated significant advancements in both student learning outcomes and community health. This initiative, involving first-year students with limited experience in community programs, achieved remarkable success due to comprehensive guidance from their lecturers. The program's hands-on approach played a crucial role in developing critical thinking, leadership, and communication skills, which are essential for future professional roles. Students displayed a deepened understanding of health and fitness principles and gained increased confidence in applying these concepts in practical settings.

Promotion efforts for the program were strategically executed through the development of a study poster, which enhanced visibility and engagement. Additionally, a database was created to allow participants to access their data, aligning with the program's educational and community-oriented objectives. The success of the program was further supported by funding from the Centre of Community Industry and Network (CCIN) and Yayasan Penyayang Iskandar Puteri, which provided crucial financial backing for the implementation of effective strategies that maximized the impact on both student learning and community health outcomes.

Students proficiently conducted physical activities based on essential fitness components such as strength, endurance, flexibility, and cardiovascular health. They designed and implemented fitness programs tailored to the needs of the community, achieving an attainment level exceeding 80%. This achievement reflects their competence in meeting Program Learning Outcome 3 (Practice the knowledge and skills to address authentic problems) and Program Learning Outcome 8 (Adapt to changes pragmatically in dealing with socio-cultural changes).

Table 1: Course Learning Outcomes Achievement

Course Learning Outcomes	Average Score	Attainment Level	
		Over 65%	Over 50%
Proficiently demonstrate physical fitness activities and physical fitness test battery based on physical fitness components.	89.2%	97%	100%
Conduct a physical fitness activities/testing and wellness program within groups and the community.	80.9%	97%	97%

The success of the project was significantly attributed to the iterative feedback process, which allowed for continuous improvements and ensured the program's relevance and responsiveness to the needs of both students and community participants. Community members reported increased physical activity levels and greater health awareness, underscoring the program's effectiveness in addressing local health needs. The dynamic feedback loop enabled students to adapt their strategies and interventions, reinforcing their ability to manage real-world challenges effectively and contribute positively to community health (Cunningham et al., 2021).

Conclusion

The Sri Pulai Sihat and Cergas exercise program represents a novel integration of health and fitness course with real-world community health challenges. This approach introduces a paradigm shift in educational practice, where theoretical knowledge is directly applied to address specific local health issues. Unlike traditional models that often separate academic learning from practical application, this program seamlessly merges these elements, offering students a unique opportunity to tackle real-world problems through their academic training (Cunningham et al., 2021)

The program's design exemplifies creativity through its incorporation of interactive learning modules, customized exercise plans, and comprehensive evaluation methods. Interactive modules facilitated active learning and engagement, while customized exercise plans were tailored to meet the diverse needs of the community, enhancing both participant involvement and program effectiveness. The use of multifaceted evaluation methods ensured a thorough assessment of both student performance and program impact, fostering continuous improvement (Cunningham et al., 2021)

Innovativeness is a key feature of the Sri Pulai Sihat and Cergas program, evident in its holistic approach that combines theoretical knowledge with practical, community-based learning. Students were involved in every stage of the program, from initial conceptualization to execution and subsequent evaluation. This comprehensive involvement provided a robust learning experience, allowing students to apply their academic knowledge in a practical setting and develop essential skills in program management and community engagement (Ali et al., 2021).

The program aligns closely with the New Academia Learning Innovation (NALI) framework, which emphasizes innovative teaching practices and practical applications of academic principles. It serves as a scalable model, demonstrating the effectiveness of integrating academic theory with real-world challenges. This alignment underscores the program's relevance across various educational settings and its potential to influence broader educational practices (Corbin, 2021).

The impact on students has been profound. Active participation in the program not only heightened motivation but also deepened their understanding of theoretical concepts. The hands-on experience enhanced students' confidence and prepared them for professional challenges by bridging the gap between theory and practice. This practical engagement has been instrumental in equipping students with critical skills necessary for impactful careers and community health(Cunningham et al., 2021).

The Sri Pulai Sihat and Cergas exercise program exemplifies a forward-thinking approach to sports science education, characterized by its novelty, creativity, and innovativeness. By integrating real-world challenges with educational theory, the program offers a robust model for enhancing student learning and engagement. It highlights the transformative potential of experiential learning in preparing future-oriented, quality graduates who are adept at addressing community health and fitness challenges effectively as in Corbin, (2021), Cunningham et al., (2021) and Qadhi, (2023).

In conclusion, the Sri Pulai Sihat and Cergas exercise program represents a forward-thinking model for sports science education. It illustrates the power of experiential learning to prepare students for impactful careers and address real-world challenges in community health and fitness. This initiative not only enhances educational practices but also contributes meaningfully to the well-being of the community, setting a benchmark for future innovations in sports science education.

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ID 67: Produk 'The Dreamers' Sebagai Alat Bimbingan Kerjaya Bagi Murid Sekolah Rendah Daerah Pasir Gudang

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Sorotan: Penggunaan produk 'The Dreamers' bertujuan bagi memudahkan penyampaian bimbingan kerjaya dalam kalangan murid sekolah rendah. Murid *Student Leaders Board (SLB)* serta guru bimbingan dan kaunseling berperanan sebagai fasilitator mudah mengendalikan sesi bimbingan kelompok kerjaya Produk ini mengandungi elemen AI iaitu, penggunaan kaedah robotik berserta aktiviti meneroka bidang kerjaya dengan penggunaan Myer-Briggs Type Indicator (MBTI). Myer-Briggs Type Indicator (MBTI) telah diterjemahkan dalam bahasa melayu mengikut standard pemahaman murid sekolah rendah oleh pakar bahasa seperti dilampirkan. Kaedah yang digunakan bagi menggerakkan robort adalah dengan menggunakan sistem '*coding*.' Kaedah robotik yang digunakan adalah sebagai elemen menarik minat murid sekolah rendah dengan berkonsepkan bermain sambil belajar. Tambahan pula, murid akan memahami personaliti kendiri dengan bidang kerjaya yang boleh diceburi pada masa akan datang. Akhir sekali, projek ini meningkatkan kefahaman hala tuju kerjaya murid sejajar dengan tema 'Eksplorasi Maksima Dunia Kerjaya STEM.'

Kata kunci: *Student Leaders Board (SLB); fasilitator; kaedah robotik; Myer-Briggs Type Indicator; personaliti*

Pengenalan

Menurut McCrindle (2019), generasi Alpha dikenali sebagai generasi milenial yang lahir setelah tahun 2010. Mereka merupakan generasi yang paling akrab dengan internet sepanjang masa. Generasi yang paling akrab dengan teknologi digital dan generasi yang dikatakan paling cerdas dengan penggunaan internet dibanding generasi-generasi sebelumnya. Bagi hasil produk 'The Dreamers,' bersasarkan murid sekolah rendah yang terdiri daripada tahap dua iaitu, tahun empat, lima dan enam. Produk ini dibina berdasarkan model Addie dan penggunaan model 5P ketika menguji produk ini bersama kumpulan sasaran. Sebelum menguji produk ini, maklum balas guru bimbingan dan kaunseling telah dibuat bagi melihat pendapat mereka mengenai produk ini. Berdasarkan pandangan mereka, terdapat beberapa pengubahsuaian dan penambahbaikan produk agar dapat melihat produktivitinya kelak.

Objektif Produk 'The Dreamers'

Objektif projek ini secara umum adalah untuk memperkenalkan produk 'The Dreamers,' kepada para Guru Bimbingan dan Kaunseling serta murid sekolah rendah supaya mereka dapat mengendalikan sesi bimbingan kelompok dengan lebih berkesan.

Objektif produk 'The Dreamers,' adalah seperti berikut:

i. Mengenal pasti jenis personaliti murid sekolah rendah dengan tepat.
ii. Menyediakan satu garis panduan bimbingan kerjaya kepada Guru Bimbingan dan Kaunseling.
iii. Meningkatkan keyakinan diri murid dari aspek jasmani, emosi, rohani, intelek dan juga sosial.
iv. Memupuk minat murid dalam pelbagai bidang yang diceburi (kerjaya).
v. Membantu Guru Bimbingan dan Kaunseling dalam membina aktiviti pengajaran dan pembelajaran yang mampu menarik perhatian murid dan lebih berfokus.
vi. Mencungkil bakat murid yang intrinsik dan ekstrinsik.
vii. Membina semangat koperatif dan kolaboratif.
viii. Menggalakkan murid berfikir secara kritis, kreatif dan inovatif serta merangsang kemahiran berfikir aras tinggi dengan menghubungkaitkan dengan situasi-situasi persekitaran dan semasa.
ix. Menjadi garis panduan guru dengan murid dan boleh diubah suai mengikut kreativiti dan keselesaan masing-masing kerana produk ini bersifat fleksibel.
x. Meluaskan penggunaan modul tanpa mengira sosio budaya serta mampu meluahkan perasaan masing-masing tanpa batasan (kaunseling silang budaya).

Penggunaan elemen NALI 2024 dalam produk 'The Dreamers'

Permasalahan yang dihadapi sehingga mencetus idea bagi membina produk 'The Dreamers' ini adalah disebabkan keperluan bahan ketika pelaksanaan bimbingan kerjaya di sekolah rendah. Dengan penggunaan bahan, barulah murid sekolah rendah akan lebih tertumpu kepada penyampaian maklumat yang diberi berbanding hanya melalui kaedah lisan. Edisi pertama NALI telah dianjurkan pada tahun 2018. Ia terdiri daripada falsafah yang berpusatkan warga pendidik dengan penggunaan pelbagai jenis bahan pembelajaran ke arah mencapai akademik keusahawanan. Produk yang dihasilkan membantu warga pendidik dalam meningkatkan usaha mengajar dan membimbing dari askpek kemahiran menyelesaikan sesuatu permasalahan, pemikiran positif, kemahiran sosial dan mengekalkan emosi yang stabil serta kuat dalam menangani situasi yang mencabar. Dengan adanya produk ini guru bimbingan dan kaunseling berserta murid sekolah rendah dapat meningkatkan usaha penyampaian maklumat berkaitan dengan personaliti seiring dengan bidang kerjaya yang boleh diceburi dengan mudah dan berkesan. Aspirasi Rancangan Malaysia Kedua Belas (RMKe-12) yang menetapkan visi untuk menjadikan Malaysia sebuah negara keusahawanan yang unggul menjelang 2030. Kanak-kanak dapat meningkatkan kemahiran pendigitalan seiring dengan memahami kepentingan keusahawanan dalam diri mereka sekiranya dibimbing bermula dari sekolah rendah. Mereka akan lebih menerapkan ciri keusahawanan seperti mempunyai keyakinan diri, kreatif dan inovatif, akauntabiliti, berani mengambil risiko, kreatif dan inovatif, berupaya bekerja secara berpasukan, berkebolehan untuk menyelesaikan masalah dan mengambil keputusan segera dalam membentuk minda keusahawanan yang mantap (Nurazmaliza, 2020).

Spesifikasi Produk 'The Dreamers'

Model Inovasi (Model ADDIE: Analisis, Reka bentuk, Pembangunan, Pelaksanaan dan Penilaian)

Produk 'The Dreamers' telah direkabentuk dengan adanya liputan fasa model pengajaran ADDIE. Sebagai fasa pertama, analisis dibuat berdasarkan beberapa persoalan sejurus dengan keperluan sasaran produk, iklim pengajaran dan pembelajaran serta matlamat bimbingan yang ingin diberikan kepada murid sekolah rendah. Produk 'The Dreamers' menjadi panduan kepada guru bimbingan dan kaunseling (GBK) dan juga membuka ruang kepada murid dalam pembelajaran praktikal menjadi seorang fasilitator bermula dari sekolah rendah. Produk ini direka bentuk atas dasar kepentingan pendedahan bidang kerjaya di Malaysia. Sejurus dengan perkara ini, penggunaan kaedah robotik digunakan agar murid sekolah rendah dapat didedahkan dengan penggunaan kecerdasan buatan *(artificial intelligence)*. Tempoh projek ini adalah selama tiga bulan. Hasil cipta robot menarik minat murid sekolah rendah dalam mengeksplorasikan pergerakkanya dengan mempelajari sistem *'coding.'*

Model Pedagogi (Model 5P: Penglibatan, Penerokaan, Penerangan, Pengolahan dan Penilaian)

Model 5P didasarkan pada teori konstruktivis untuk belajar, yang menunjukkan bahawa individu membina pengetahuan yang makna dari pengalaman. Dengan memahami dan merenungkan aktiviti, murid dapat menggabungkan pengetahuan baru dengan idea sebelumnya. Murid membina pemahaman asas menerusi aktiviti (Garderen, Decker, Juergensen & Abdelnaby, 2020). Model ini membantu guru bimbingan dan kaunseling serta murid *Student Leaders Board (SLB)* yang dilantik sebagai fasilitator bagi memberi pengenalan mengenai dunia kerjaya secara umum sehingga terperinci kepada kumpulan sasaran. Mereka juga akan berkongsi kandungan produk 'The Dreamers' yang meliputi penggunaan kaedah robotik. Tuntasnya, guru dapat menilai murid SLB yang menjadi pemimpin produk ini sejurus dengan pemahaman murid yang terlibat bersama sepanjang sesi bimbingan kerjaya berlangsung.

Deskripsi Produk *'The Dreamers'* dari Segi Kandungan dan Strategik pelaksanaan

Pembentukan produk berasaskan kepada:

i. Myer-Briggs Type Indicator (MBTI) yang telah diubah suai (alih bahasa) untuk mengukur personaliti murid.

ii. Permainan robot berdasarkan jenis personaliti murid.

iii. situasi-situasi yang disediakan dalam bentuk soalan rangsangan untuk setiap kategori personaliti dan ditulis atas kad kad kecil bagi mendapatkan respons murid.

iv. Soalan-soalan rangsangan yang disediakan mengambil kira kriteria Kemahiran Berfikir Aras Tinggi (KBAT) tahap kefahaman dan aplikasi.

Langkah Pelaksanaan Modul

Satu inventori personaliti telah diubahsuai (alih bahasa) dengan mengekalkan konstruk asal instrumen untuk mengukur personaliti klien kanak-kanak di sekolah kebangsaan. Inventori ini telah diubahsuai berdasarkan Keirsey Temperament sorter oleh June E. Millet (310) 277-7518. Skor daripada ujian ini akan menentukan jenis personaliti kanak-kanak mengikut Myer-Briggs Type Indicator (MBTI). Skor yang diperolehi daripada alat ujian ini akan dikira secara manual. Kemudian jenis-jenis personaliti akan ditentukan. Petunjuk yang digunakan dalam menentukan ciri-ciri perbezaan norma personaliti individu seperti dalam jadual 1.

Jadual 1: Petunjuk Jenis Personaliti MBTI

<table>
<tr><th>FUNGSI DOMINAN</th><th>FUNGSI AUXILIARY</th><th>JENIS MBTI</th><th>PETUNJUK</th></tr>
<tr><td>Introvert Merasa</td><td>Bersama Ekstrovert memikir</td><td>ISTJ</td><td rowspan="4">Extroversion (E);
Introversion (I);
Sensing (S);
Intuition (N);
Thinking (T);
Feeling (F);</td></tr>
<tr><td>Introvert Merasa</td><td>Bersama Ekstrovert emosi</td><td>ISFJ</td></tr>
<tr><td>Ekstrovert Merasa</td><td>Bersama Introvert memikir</td><td>ESTI</td></tr>
<tr><td>Ekstrovert Merasa</td><td>Bersama introvert emosi</td><td>ESFP</td></tr>
</table>

Introvert Intuisi	Bersama Ekstrovert memikir	INTJ	judging (J); perceiving (P).
Introvert Intuisi	Bersama Ekstrovert emosi	INFJ	
Ekstrovert Intuisi	Bersama Introvert memikir	ENTI	
Ekstrovert Intuisi	Bersama introvert emosi	ENFP	
Introvert Memikir	Bersama Ekstrovert merasa	ISTP	
Introvert Memikir	Bersama Ekstrovert intuisi	INTP	
Ekstrovert Memikir	Bersama Introvert merasa	ESTJ	
Ekstrovert Memikir	Bersama introvert intuisi	ENTJ	
Introvert Emosi	Bersama Ekstrovert merasa	ISFP	
Introvert Emosi	Bersama Ekstrovert intuisi	INFP	
Ekstrovert Emosi	Bersama Introvert merasa	ESFJ	
Ekstrovert Emosi	Bersama introvert intuisi	ENFJ	

Murid-murid yang telah dikelompokkan akan menjalani sesi bimbingan dalam kumpulan yang mempunyai jenis personaliti yang dominan. Guru Bimbingan dan Kaunseling serta murid SLB yang dilantik sebagai fasilitator akan menggunakan satu permainan yang dinamakan 'The Dreamers' yang dicipta berasaskan kepada jenis-jenis personaliti klien. Permainan dicipta khusus untuk jenis personaliti berikut; ekstrovert/introvert, merasa/intuisi, mengadil/memerhati dan memikir/beremosi.

Kelebihan Produk *'The Dreamers'*

Produk ini menyediakan panduan untuk Guru Bimbingan dan Kaunseling serta memudahkan urusan menyusun aktiviti. Modul ini bersifat fleksibel yang mana Guru Bimbingan dan Kaunseling serta murid SLB (fasilitator) boleh menggunakan kreativitinya untuk mengubah suai bentuk papan (board) permainan ini mengikut keselesaannya berdasarkan panduan, kad-kad situasi dan motif yang disediakan. Guru Bimbingan dan Kaunseling serta murid SLB dapat mengenal pasti dan mempelajari jenis personaliti dengan lebih tepat. Kekuatan modul ini bergantung kepada soalan dan situasi yang disediakan. Kad-kad situasi yang disediakan adalah mengambil kira minat dan kecenderungan yang berbeza bagi setiap jenis personaliti murid. Situasi-situasi yang disediakan dalam setiap kategori permainan ini berupaya mencungkil bakat murid yang intrinsik dan ekstrinsik, membina semangat koperatif dan kolaboratif dan menggalakkan murid berfikir secara kritis, kreatif dan inovatif serta merangsang kemahiran berfikir aras tinggi dengan menghubungkaitkan dengan situasi-situasi persekitaran dan semasa. Aktiviti permainan dalam modul ini berupaya meningkatkan keyakinan diri murid dari aspek jasmani, emosi, rohani, intelek dan juga sosial. Di samping itu, dapat memupuk minat murid dalam pelbagai bidang yang diceburi (kerjaya).

Keberkesanan Produk 'The Dreamers' dalam Sesi Penerokaan Bimbingan Kelompok Murid Tahap Dua Melalui Pemerhatian Guru

Melalui pemerhatian, didapati murid-murid melaksanakan permainan ini dengan perasaan yang amat gembira dan seronok. Setiap murid amat responsif, koperatif dan ceria ketika bermain (100%). Dapatan daripada pemerhatian terhadap kemahiran dalam memberikan pendapat dan tingkah laku bersemangat ialah (81.3%). Dengan ini, *rappo* bersama murid dan Guru Bimbingan dan Kaunseling akan berterusan dan berkekalan selepas pelaksanaan modul kerana selepas modul ini terlaksana, terdapat hubungan yang memudahkan guru bimbingan dan kaunseling untuk memperkembangkan bakat dan personaliti seseorang murid. Namun begitu, dapatan ini menunjukan terdapat murid yang kurang proaktif (75%). Hal ini memberi isyarat bahawa kebanyakan murid memerlukan bimbingan terarah daripada Guru Bimbingan dan Kaunseling. Melalui dapatan temu bual bersama Guru Besar, Guru Bimbingan dan Kaunseling dan juga murid iaitu merangsang pemikiran, mengenal diri, pemikiran rasional dan tindak balas positif telah dikendalikan.

Jadual 2: Analisis Tingkah laku Murid Melalui Pemerhatian Guru Bimbingan dan Kaunseling

Murid	Responsif	Koperatif	Memberi Cadangan	Proaktif	Bersemangat	Ceria	Fokus
1	√	√	√		√	√	√
2	√	√	√	√	√	√	√
3	√	√	√	√	√	√	√
4	√	√	√	√		√	√
5	√	√	√		√	√	√
6	√	√		√	√	√	
7	√	√	√		√	√	√
8	√	√	√	√		√	√
9	√	√		√	√	√	√
10	√	√	√		√	√	√
11	√	√	√	√	√	√	
12	√	√		√	√	√	√
13	√	√	√	√		√	√
14	√	√	√	√	√	√	√

Murid	Responsif	Koperatif	Memberi Cadangan	Proaktif	Bersemangat	Ceria	Fokus
15	√	√	√	√	√	√	√
16	√	√	√	√	√	√	√
Peratus	**100%**	**100%**	**81.3%**	**75%**	**81.3%**	**100%**	**87.5%**

Tambahan pula, temu bual dibuat bagi melihat pandangan guru besar, guru bimbingan dan kaunseling serta murid sekolah yang disasarkan. Pandangan Guru Besar terhadap produk ini adalah, produk ini berkesan kerana dapat meningkatkan keyakinan diri Guru Bimbingan dan Kaunseling di samping aktiviti dalam modul ini memberi tindak balas yang amat positif. Beliau berpendapat, permainan ini perlu melibatkan setiap murid di sekolah, agar mereka benar-benar dapat mengenal diri. Hal ini demikian kerana, dengan mengenali diri, mereka mampu mengubah masa hadapan mereka. Beliau berpendapat, murid Tahap Dua ini, memerlukan pendedahan bagi mengenali diri lebih awal, kerana dengan mengenal diri, mampu membangkitkan semangat diri mereka untuk bersedia bagi pentaksiran dalaman sekolah yang terakhir di sekolah rendah sebelum menjejak kaki di sekolah menengah. Tuntasnya, persepsi ketiga-tiga pihak memiliki persamaan seperti diringkaskan dalam jadual di bawah.

Jadual 3: Ringkasan Analisis Persepsi Guru Besar, Guru Bimbingan & Kaunseling dan Murid Terhadap Produk 'The Dreamers'

Peserta	Tema			
	MerangsangPemikiran	**Mengenal Diri**	**Pemikiran Rasional**	**Tindakbalas Positif**
Guru Besar	√	√	√	√
Guru Bimbingan dan Kaunseling	√	√	√	√
Murid	√	√	√	√

Potensi Pengkomersialan

Sebanyak 608 buah sekolah rendah yang terdapat di negeri Johor. Sasaran perkomersilan produk ini adalah guru bimbingan dan kaunseling sekolah rendah. Produk 'The Dreamers' ini dicadangkan supaya boleh dijual berdasarkan model-model yang digunakan dalam produk ini. Strategik pengkomersilan pula, produk ini akan dibentangkan kepada pihak PPD dan JPN agar dapat membuat pertimbangan tentang penggunaan produk ini. Justeru itu, pegawai berkenaan akan menilai dan dengan ada banuan dari sektor psikologi dan kaunseling, dapat menerima galakkan daripada guru bimbingan dan kaunseling sekolah rendah. Ianya akan memudahkan bagi pengkomersialan pada peringkat negeri.

Kesimpulan dan Cadangan

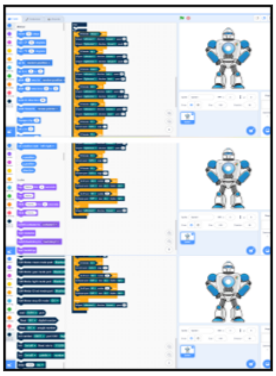
Secara keseluruhan, produk 'The Dreamers' akan menyokong untuk mencapai matlamat ketiga dari 'Sustainable Development Goals'. 'Sustainable Development Goals' adalah rangka tindakan untuk mencapai masa depan yang lebih baik dan lestari untuk semua. 'Sustainable Development Goals' mengatasi tentangan global yang kita hadapi, termasuk kemiskinan, ketidaksamaan, perubahan iklim, kerusakan alam sekitar, perdamaian dan keadilan. Matlamat ketiga 'Sustainable Development Goals' adalah kualiti pendidikan. Ia memastikan penyampaian kandungan pembelajaran yang berkualiti seiring dengan keperluan global serta menjamin kehidupan yang bercirikan minda yang sihat dan mempromosikan pengetahuan bidang kerjaya adalah penting untuk membina kesejahteraan hidup. Produk ini dapat membantu generasi Alpha bagi meningkatkan ilmu pengetahuan mengenai penggunaan kaedah robotik dalam meneroka personaliti yang seiring dengan bidang kerjaya. Cadangan penambahbaikannya pula, produk ini perlu dipelbagaikan lagi aktiviti dan bentuk hasilnya. Guru bimbingan dan kaunseling perlu digalakkan bagi melaksanakan Program Kerjaya di Sekolah Rendah (terutamanya, bagi murid tahap 2 yang terdiri daripada tahun 4, 5 dan 6). Berdasarkan dapatan pendapat dapat disimpulkan bahawa, produk ini sangat menarik, releven, mudah difahami, mudah diakses dan juga produk ini mampu memberikan impak yang positif kepada murid sekolah rendah. Sebagai kesimpulan, produk 'The Dreamers' dapat memastikan pemahaman "Eksplorasi Maksima Dunia Kerjaya STEM".

Gambar-gambar Yang berkaitan

Bahan-bahan yang digunakan bagi menghasilkan produk inovasi ini adalah seperti berikut:

- **Robot:** dihasilkan dengan rupa bentuk kereta mainan
- **Papan:** Direka bentuk seperti jalan raya
- ***Remote Control*:** bagi memudahkan pergerakkan robot mengikut arah yang ditentukan.
- **Kad Situasi: berkonsepkan empat domain utama personaliti Myer Briggs iaitu *Rationals* (warna Hijau) Ekstrovert dan introvert; *Idealist* (warna Biru) Merasa dan intuisi; *Artisan* (warna Jingga) Mengadil dan memerhati; *Guardian* (warna Kuning) Memikir dan Emosi.**

Sebelum dan selepas penambahbaikan produk 'The Dreamers'

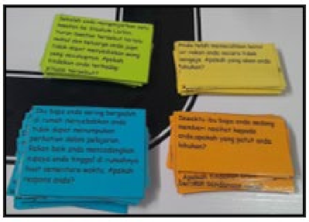


Sistem ***Coding***

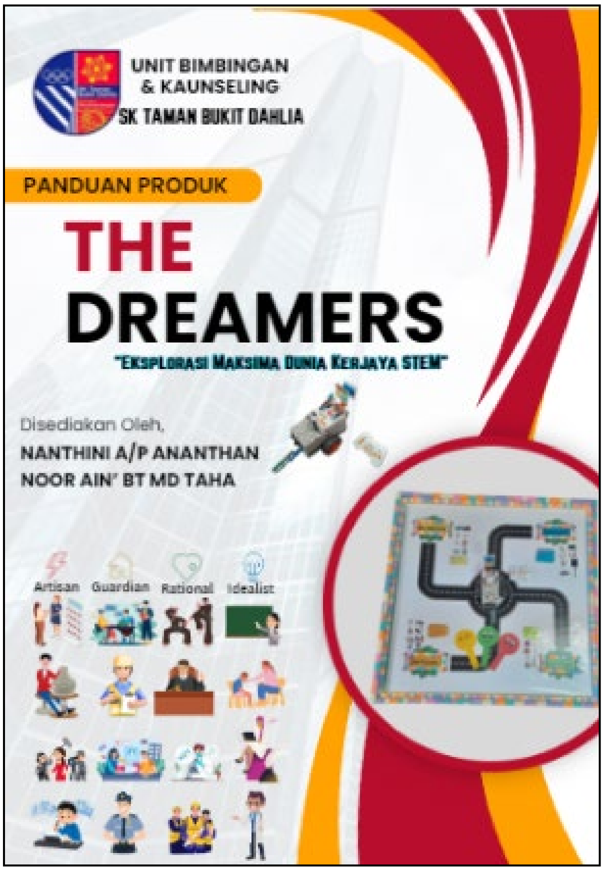
- Bagi memudahkan pelaksanaan bimbingan kelompok kerjaya, fasilitator telah menggunakan sistem 'Coding'
- Sistem Coding ini dibuat dengan menggunakan aplikasi *My Robot Time (MRT Friends)*
- Ianya memudahkan aktiviti bimbingan kelompok berserta murid akan mempelajari cara menggerakkan robot dengan betul.

Coding permainan robot yang disediakan

ARTISAN	GUARDIAN	RATIONAL	IDEALIST
Promoter (ESTP)	**Supervisor** (ESTJ)	**Fieldmarshal** (ENTJ)	**Teacher** (ENFJ)
Crafter (ISTP)	**Inspector** (ISTJ)	**Mastermind** (INTJ)	**Counselor** (INFJ)
Performer (ESFP)	**Provider** (ESFJ)	**Inventor** (ENTP)	**Champion** (ENFP)
Composer (ISFP)	**Protector** (ISFJ)	**Architect** (INTP)	**Healer** (INFP)



Kod situasi yang disediakan bagi memudahkan interkasi dua hala dalam bimbingan kelompok kerjaya



Buku panduan produk 'The Dreamers'

Rujukan

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ID 68: Collaborative Learning in Mathematics: Evaluating the Impact of Scavenger Hunt on Student Performance

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Highlights: The decreasing interest in STEM is a concerning issue. To address this issue, Mathematics enrichment program for SPM candidates was implemented, featuring engaging scavenger hunt activities to enhance learning. The collaboration between the government, university, and community fosters shared goals and responsibilities, creating a unified environment for effective implementation. This initiative significantly boosted student interest and confidence in Additional Mathematics, as reflected in pre- and post-survey results. The program integrates cognitive, practical, interpersonal, communication, and leadership skills among students and facilitators. Meanwhile, lecturers strengthened community relationships, demonstrating UTM's commitment to educational excellence and community engagement.

Keywords: *STEM education; Mathematics enrichment; High school; Student engagement*

Introduction

Interest in STEM fields is declining with only 40.95% of Malaysian students, which means only 152, 568 students were involved in STEM (MOE, 2022; Idris et al., 2023). This is concerning as most high-demand jobs by 2025 will be in STEM areas such as data analysis, robotics, and artificial intelligence. By 2025, the percentage of positions that are considered to be obsolete will decrease from 15.4% to 9 % of the total workforce while the unveiling professions will rise from 7.8% to 13.5%. Hence, about 85 million jobs could be shifted due to changes between humans and machines whereby approximately 97 million new roles are expected which would be more appropriate for the changing dynamics between people, machines and algorithms (World Economic Forum, 2020). Misconceptions that mathematics is difficult, and science is only for the "smart" students exacerbate this issue. Studies reveal that such beliefs discourage students from pursuing STEM careers, further diminishing the already low interest (Idris et al., 2023).

STEM education is crucial because it equips individuals with skills essential for today's job market and helps address global challenges. It integrates science, technology, engineering, and mathematics into a cohesive system that fosters critical thinking, problem-solving, and innovation. Science provides insights into our world, technology prepares students for high-tech environments, engineering enhances practical skills, and mathematics aids in decision-making and error analysis (Razali et al., 2020). A well-rounded STEM education ensures that professionals can contribute to economic and social progress while promoting environmental sustainability. Thus, addressing the decline in STEM interest is vital for developing a skilled workforce capable of driving future innovations and solutions.

Content

To address this issue, the MJIIT Mathematics Unit has taken proactive measures through innovative educational initiatives. One such initiative is the Mathematics Enrichment Program for future SPM candidates, designed to enhance mathematics learning through engaging activities. This program, aimed at high school students, fosters collaboration among students, teachers, and lecturers. Its uniqueness lies in the integration of advanced mathematical concepts into the standard curriculum, offering a fresh approach to tackling the declining interest in STEM fields.

The program's creative design ensures comprehensive coverage of the SPM syllabus while incorporating interactive elements that engage students. It stands out for its improvements over traditional teaching methods, providing a robust platform for higher-level mathematics understanding. Student feedback has been instrumental in iterating and enhancing the program. Aligned with various innovative learning models, the program applies experiential learning, service learning, and collaborative learning methods. This makes it highly relevant to modern educational practices and scalable for broader application (Li et al., 2020).

The objectives of this program include enhancing participants' learning by focusing on certain additional mathematics topics. By incorporating experiential and collaborative learning methods, it ensures a deep understanding of these selected areas and provides a strong foundation for navigating complex mathematical challenges. Another objective emphasises developing analytical thinking and problem-solving skills through engagement with challenging mathematical problems and real-world applications related to the topics. Final objective is to prepare students for the SPM examinations, which focuses on providing an in-depth understanding of the selected mathematical topics and their application in various contexts (Johari and Sulaiman, 2024).

NALI Approach

The diagram of university-government-community involvement in this Mathematics program highlights the synergy between government, university and community: Jabatan Pendidikan Wilayah Persekutuan Putrajaya (JPWPP), Universiti Teknologi Malaysia (UTM), and SMK Agama Putrajaya (SMAPUTRA), respectively (Figure 1). This collaboration plays a vital role in driving the success of the program and creating a robust framework for educational growth. UTM brings in academic expertise, leadership development opportunities for its students to be facilitators, and structured learning methodologies. JPWPP supports the initiative by providing policy backing, and necessary resources among stakeholders. SMAPUTRA serves as the ground for practical implementation, where students and teachers benefit from the expertise and support provided by both the university and the government. The involvement of these three organisations improves these key aspects: collaboration, communication, leadership, and critical thinking.

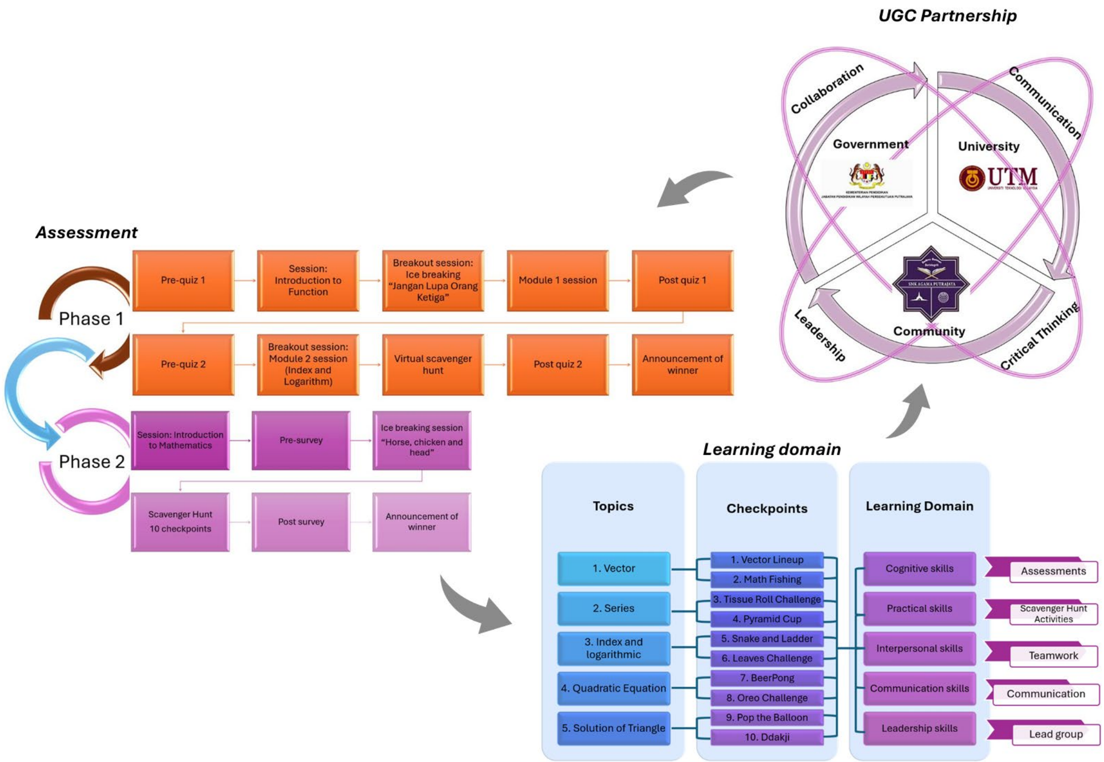

Figure 1: UGC partnership and program activity assessment align with learning domains

Collaboration in terms of joint effort across university, government, and community promotes shared goals and responsibilities, creating a cohesive environment for effective program execution. In addition, interaction and feedback among the organisations ensure the program runs smoothly, with active exchange of information helping in problem-solving and decision-making processes. Besides, instillation of leadership among UTM students in organising and managing activities, which fosters personal growth, team-building skills, and project management capabilities. Finally, this program encourages participants, particularly university students and SMAPUTRA students, to solve complex mathematical problems through engaging and interactive activities, enhancing their problem-solving and critical thinking skills (Moi and Basari, 2024).

Methodology

This Mathematics program consists of two phases. The first phase was conducted online in 2022, and due to positive feedback from both students and teachers, the second phase was implemented physically in December 2023. Phase 2 remained the same structure as Phase 1, with the main activity being a scavenger hunt involving 10 checkpoints. At each checkpoint, students engage in games and answer questions related to five topics in additional mathematics: vectors, series, index and logarithmic, quadratic equation, and solution of triangle. Facilitators provide clear instructions, making it essential for teams to listen and follow directions. After completing the assigned games, students solve questions before moving to the next checkpoint. Students and facilitators develop various skills across these learning domains:

Cognitive skills: As students solve additional mathematics problems at each checkpoint, they engage in higher-order thinking skills such as analysis, evaluation, and problem-solving, reflecting the cognitive domain. They apply mathematical concepts, analyse problems, and evaluate solutions, enhancing their critical thinking and knowledge understanding.

Practical skills: Through the physical activities at each checkpoint and the application of mathematical principles, students also develop practical skills. These hands-on tasks require students to synthesize theoretical knowledge with real-world applications, which helps in bridging the gap between classroom learning and practical experience.

Interpersonal skills: The scavenger hunt fosters teamwork and collaboration, as students work in teams to complete each challenge. This collaborative approach cultivates interpersonal skills, helping students to support and cooperate with each other.

Communication skills: Both students and facilitators enhance their communication skills. Students must communicate clearly within their teams to solve problems effectively, while facilitators practise giving clear, concise instructions and constructive feedback, essential for promoting understanding and engagement.

Leadership skills: Facilitators gain leadership experience by guiding groups of students, organising activities, and providing evaluations. Students also have opportunities to develop leadership within their teams by taking initiative, managing time, and helping peers during tasks, which reflects the higher levels of the affective domain in Bloom's taxonomy.

Finding and discussion

This section presents the findings of this program based on SMAPUTRA students and UTM facilitators. Table 1 shows a significant improvement in both interest and level of confidence in Mathematics among SMAPUTRA students.

Table 1: Responses from survey

Criteria	Students responses	Before program	After program
SMAPUTRA	Level of interest in Additional Mathematics	5 (Very high) : 9 (14.1%) 4 (High) : 27 (42.2%) 3 (Neutral) : 20 (31.3%) 2 (Low) : 5 (7.8%) 1 (Very low) : 3 (4.7%)	5 (Very high) : 15 (25.0%) 4 (High) : 33 (55.0%) 3 (Neutral) : 10 (16.7%) 2 (Low) : 2 (3.3%) 1 (Very low) : 0 (0.0%)
	Level of confidence when answering Mathematics questions	5 (Very high) : 1 (1.6%) 4 (High) : 28 (43.8%) 3 (Neutral) : 28 (43.8%) 2 (Low) : 7 (10.9%) 1 (Very low) : 0 (0.0%)	5 (Very high) : 8 (13.3%) 4 (High) : 27 (45.0%) 3 (Neutral) : 21 (31.3%) 2 (Low) : 3 (5.0%) 1 (Very low) : 1 (1.7%)
Program	Method of learning suitable for students	5 (Very agree) : 28 4 (Agree) : 24 3 (Neutral) : 7 2 (Disagree) : 1 1 (Very disagree) : 0	
	This program gives good impact to me	5 (Very agree) : 31 4 (Agree) : 22 3 (Neutral) : 7 2 (Disagree) : 0 1 (Very disagree) : 0	
	I understand Mathematics in deep after joining this program	5 (Very agree) : 19 4 (Agree) : 27 3 (Neutral) : 12 2 (Disagree) : 1 1 (Very disagree) : 0	
	I will recommend this program to others	5 (Very agree) : 26 4 (Agree) : 27 3 (Neutral) : 6 2 (Disagree) : 1 1 (Very disagree) : 0	

Initially, 4.7% of students were very not interested in Additional Mathematics, while 14.1% were very interested. After the activity, there were no students with very low interest, and interest levels rose to 55% and very high interest to 29%. This indicates that the program effectively increased students' enthusiasm for Mathematics. Similarly, confidence in solving Mathematics problems also shows a notable rise. Before the activity, only 1% of students were very confident, and none were not very confident. After participating, 13.3% of students reported being very confident, and only 1.7% felt very unsure. Based on the interview, the student recognized that there are still some mathematical concepts they have not fully mastered. These changes reflect a positive development in students' understanding and self-awareness regarding their Mathematics skills, highlighting the program's success in enhancing their performance.

The survey results also indicate strong positive feedback regarding the program's effectiveness. A majority of students felt that the facilitators were highly knowledgeable in Mathematics, with 27 strongly agreeing and 26 agreeing on their expertise. The presentation style of the facilitators was deemed effective by 24 students who strongly agreed and 21 who agreed. Most students (28 strongly agreed and 24 agreed) found the learning activities suitable for their learning. The program was seen as having a positive impact by 31 students who strongly agreed and 22 who agreed. Additionally, 19 students strongly agreed and 27 agreed that their understanding of Mathematics deepened after participating in the program. Finally, 26 students strongly agreed and 27 agreed that they would recommend the program to other students.

The UTM facilitators provided positive feedback and constructive suggestions based on the post-program survey. They appreciated the program for its effectiveness in benefiting both SMKA Putrajaya students and themselves, noting that it helped them step out of their comfort zones and gain new experiences. The program was described as engaging, enjoyable, and beneficial.

Conclusion

The education system is a key pillar of any nation. The declining interest in STEM, particularly among the younger generation, is a concerning issue. The mathematics enhancement program featuring scavenger hunt activity conducted at SMKA Putrajaya was designed to help student deepen their understanding of mathematical concepts and applications, while striving for excellence in STEM fields. This program has successfully met its primary objectives, as shown by the pre- and post-survey analysis. Additionally, facilitators enhanced their teamwork and program management skills early in their academic journey. Furthermore, the program provided UTM lecturers with opportunities to strengthen their engagement with the external community through such collaborations. It is hoped that this program will benefit all participants, both directly and indirectly.

Video Presentation

https://youtu.be/-UpDcum696g?si=GOcdyyhbGfc8sMJs

Acknowledgement

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ID 69: Integrating Software Engineering Education with Real-World Impact: A Multi-Course Service-Learning Project at MJIIT for Klang Valley Schools

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Highlights: The Multi-Course Service-Learning Project at Malaysia-Japan International Institute Technology (MJIIT), Universiti Teknologi Malaysia, integrates four core software engineering courses — System Analysis and Design (SECD2613), Database (SECD2523), Human-Computer Interaction (SECV2113), and Applications Development (SECJ3104) — to address the challenges of rising student enrolment and limited academic faculty. Utilizing the New Academia Learning Innovation (NALI) framework, the third-year students collaborated with the second-year students to develop software applications for Klang Valley schools. Inter-department lecturers coordinate between students and schools, ensuring project alignment with real-world needs. Within a semester, six third-year students' groups, supported by the juniors, successfully delivered software applications, enhancing students' technical skills, teamwork, and community engagement, preparing them for future challenges in software engineering.

Keywords: *Service Learning; Interdisciplinary Collaboration; Software Engineering Education; Community Engagement; NALI*

Introduction to Multi-Course Service-Learning Project

The Multi-Course Service-Learning Project at the Malaysia-Japan International Institute of Technology (MJIIT), Universiti Teknologi Malaysia, represents a forward-thinking initiative to enhance software engineering education. As student enrollment continues to rise and academic faculty resources become increasingly stretched, there is a pressing need for innovative educational methods that maintain quality and rigor. This project integrates four core software engineering courses— System Analysis and Design (SECD2613), Database (SECD2523), Human-Computer Interaction (SECV2113), and Applications Development (SECJ3104)—into a single, cohesive learning experience. This approach not only addresses logistical challenges but also enriches the educational experience by encouraging interdisciplinary collaboration and practical application of knowledge through the adoption of the New Academia Learning Innovation (NALI) framework (Ariffin & Ghazali, 2017).

The primary objective of this project is to foster teamwork and interdisciplinary collaboration among students. By integrating multiple software engineering courses, the project enables students to work effectively in diverse teams, applying their combined knowledge to solve real-world problems. The hands-on experience gained through developing software applications for schools in the Klang Valley allows students to bridge the gap between theory and practice, thereby strengthening their technical and problem-solving skills. Additionally, the project aims to cultivate a sense of social responsibility and community engagement by involving students in service-learning projects that directly benefit local schools, enhancing their communication, project management, and client interaction skills.

One of the novel aspects of this project is its approach to combining multiple courses under a single, shared project (see Figure 1). This structure encourages students to see how different aspects of software engineering—ranging from system analysis to application development—work together to solve real-life problems. The project breaks new ground by integrating the local community into the learning process, positioning students as active problem-solvers. The involvement of lecturers from various departments as coordinators further enhances the project's novelty, ensuring that it remains aligned with both academic standards and community needs.

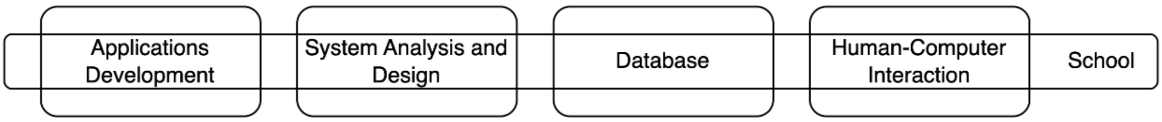

Figure 1: Multi-courses Service-Learning Project

The project's design encourages students to draw connections between various aspects of software engineering, such as system analysis, database management, user interface design and user experience, and application development, to develop comprehensive solutions. This integrated approach not only fosters creativity but also challenges students to think critically about how to integrate different components into a functioning application. The requirement for students to develop applications for real schools rather than hypothetical projects adds another layer of creativity, as they must design solutions that are technically sound, user-friendly, and tailored to the specific needs of the schools.

The project is closely aligned with NALI framework (Ariffin & Ghazali, 2017), which emphasizes active, student-centered learning and real-world engagement. By combining service learning with a multi-course approach, the project fosters holistic and integrated learning experiences that prepare students for future challenges in the software engineering field. Through their involvement in this project, students are empowered to take ownership of their education, engage deeply with the material, and apply their knowledge in meaningful ways that have a tangible impact on the community. This approach not only enhances their learning experience but also prepares them to be proactive and confident professionals in their future careers.

Project Objectives

The objectives of the Multi-Course Service-Learning Project are as follows.

i. To foster teamwork and interdisciplinary collaboration among students by integrating the knowledge and skills from multiple software engineering courses, enabling them to work effectively in diverse groups to solve real-world problems.

ii. To provide students with hands-on experience in applying theoretical concepts to practical scenarios by developing software applications that address the specific needs of schools in the Klang Valley, thereby strengthening their problem-solving and technical skills.

iii. To cultivate a sense of social responsibility and community engagement among students by involving them in service-learning projects that directly benefit local schools, while also enhancing their communication, project management, and client interaction skills through collaborative efforts with lecturers and external stakeholders.

NALI Approach in the Multi-Course Service-Learning Project

The NALI approach has been used in the Multi-Course Service-Learning Project to promote an active, student-centered approach to education, with an emphasis on creativity, innovation, and real-world applicability. The discussion of the NALI approach adopted is as follows.

Novelty of the Project

The Multi-Course Service-Learning Project introduces a novel approach to software engineering education by integrating four distinct courses into a single, cohesive learning experience. This approach aligns with the principles outlined in the "Service-Learning in Engineering: A Resource Guidebook", which emphasizes the importance of multidisciplinary teamwork in service-learning projects (Oakes, 2004). By combining MJIIT Software Engineering courses such as System Analysis and Design (SECD2613), Database (SECD2523), Human-Computer Interaction (SECV2113), and Applications Development (SECJ3104), into a unified framework, the project encourages students to apply knowledge from each discipline in a real-world context, fostering skills in problem identification, formulation, and solution development.

The project breaks new ground by directly involving the local community—in this case, schools in the Klang Valley—in the learning process. This approach positions students as active problem-solvers rather than passive learners, providing them with opportunities to engage in meaningful projects that have tangible outcomes. As highlighted by Liu (2005), incorporating service-learning into software engineering education can significantly enrich the educational experience by allowing students to tackle substantial problems collaboratively. By engaging with real-world problems, students navigate the complexities of software development, including client interactions, requirement gathering, and iterative design, which are often underemphasized in traditional software engineering curricula (Oakes, 2004).

The idea of utilizing lecturers from other departments as coordinators to facilitate communication between students and external stakeholders further enhances the novelty of the project. This approach ensures that the project is academically rigorous and closely aligned with the community's practical needs. Studies have shown that project-based service-learning can enhance students' understanding of engineering's societal impacts and improve their professional development outcomes (Benning et al., 2022). By merging engineering education with service-learning (Brown & Bauer, 2019), the Multi-Course Service-Learning Project bridges the gap between theory and practice.

Creativity of the Project

The creativity of the Multi-Course Service-Learning Project is evident in the way the courses are linked to create a seamless learning experience. The project's design encourages students to draw connections between various aspects of software engineering, such as system analysis, database management, user interface design, and application development, to develop comprehensive solutions. This integrated approach fosters collaboration among students with diverse skill sets, ensuring that each team benefits from a balanced representation of expertise across all four courses. Such structuring not only promotes creativity but also challenges students to think critically about how to integrate different components into a functioning application (Liu, 2005).

Moreover, requiring students to develop applications for real schools rather than hypothetical or classroom-based projects adds a layer of creativity to the learning process. Students must be innovative in designing solutions that are technically sound, user-friendly, and tailored to the specific needs of the schools. This real-world application requires students to extend beyond textbook knowledge and think creatively about addressing practical challenges, such as working within resource constraints, meeting deadlines, and ensuring that their solutions are sustainable and easy to maintain (Brown & Bauer, 2019; Jacoby & Howard, 2014).

Innovativeness of the Project

The Multi-Course Service-Learning Project represents a significant improvement over traditional teaching methods by integrating multiple courses into a single, project-based learning experience. This innovative approach not only streamlines the curriculum but also provides a more holistic view of software engineering, allowing students to see how different aspects of the discipline interconnect and complement each other. By doing so, it addresses a common issue in education where students often struggle to understand how separate courses relate to the broader field of study (Brown & Bauer, 2019). This project improves conventional methods by encouraging students to apply their knowledge comprehensively, enhancing their learning experience and preparedness for the workforce (National Academies of Sciences and Medicine, 2018).

Another innovative aspect of the project is the involvement of lecturers from other departments as coordinators. This cross-departmental collaboration represents a shift from the traditional faculty-centric model of course delivery to a more collaborative approach that leverages the expertise of various faculty members. This change not only provides students with diverse perspectives but also ensures that the projects remain aligned with the real needs of the community, thereby improving the relevance and impact of the learning experience.

Applicability and Impact of the Project

The project is highly applicable to the NALI framework (Ariffin & Ghazali, 2017), which emphasizes active, student-centered learning and real-world engagement. By combining service learning with a multi-course approach, the project aligns perfectly with NALI's goals of fostering holistic and integrated learning experiences. The service-learning component, where students develop applications for local schools, is a direct application of NALI's focus on connecting academic learning with community service, ensuring that students not only gain technical skills but also understand the social impact of their work.

Furthermore, the project embodies the NALI principle of promoting interdisciplinary collaboration and critical thinking. By working on projects that require knowledge from multiple courses, students are encouraged to think beyond disciplinary boundaries and develop solutions that are both innovative and practical. This approach ensures that the learning experience is not only academically rigorous but also relevant to real-world challenges, preparing students to be more adaptable and resourceful in their future careers.

Research Methodology

This project adopts the service-learning methodology by (Musa et al., 2017) that contains of 3 phases. The discussion of each phase is as follows.

Phase 1: Service-Learning Planning, Analysis and Design
This phase consists of several steps. Step 1 was forming the dedicated and committed committee, which the roles among others are as liaison to the community, lecturer, program coordinator, that the involvement of each one the key to the success of the project. Step 2 was conducting feasibility study where this involved identifying the courses and ensuring the integration across the courses would work between the students. This study adopts a *senpai-kohai* (mentor-mentee) approach where each school was teamed by 1 senior team (Application Development) with 2 junior teams (Database, System Analysis and Design, Database). In addition, recognizing the type of service-learning projects to be conducted, where we went for direct services. Operational, Financial, and Technical, are also part of Step 2, where resources, funding resources, and IT equipment are planned and considered.

Phase 2: Service-Learning Delivery
This phase established community engagement with the selected six schools around Kuala Lumpur and Selangor. Letter of Intent (LoI) was prepared for all schools and signed as the symbol of commitment between the parties. This project diligently followed four iterations of the agile development approach, where throughout the 15-week-long semester, a series of physical visits, and virtual meetings in between, are conducted.

Phase 3: Evaluation, Reflection and Monitoring
As four iterations were carried out, there were four evaluation rounds that took place with one final evaluation at the end of the semester. The formative evaluation gathered feedback to improve the next iteration, while the summative evaluation summed up the responds by the community. The students performed reflection at the end of the project about their experiences engaging with the community. The monitoring began once the developed applications are installed at the respective schools.

Results and Discussion

Within a semester, six groups successfully delivered six software applications, which five have been successfully installed in the respective schools in the Klang Valley. The developed software applications have all been registered for copyright. The details of the software applications are summarized in Table 1.

Table 1: A summary of the software applications developed during the Multi-Course Service-Learning Project

Developed Software Application	Description of the Software Application	School Name and Location
Co-curricular Tracking System	A web-based and mobile-based curriculum tracking system	Sekolah Menengah Islam ABIM, Sungai Ramal, Kajang
Sungai Pusu Attendance System (SPAS)	A web-based attendance management system with barcode scanner	Sekolah Menengah Kebangsaan Sungai Pusu, Kuala Lumpur

Student Portal	A web-based student management system	Sekolah Kebangsaan Saujana Utama, Sungai Buloh
SMART Management Portal	A web-based student management system and academic resource tracker	Sekolah Menengah Agama Riyadhatul A'mal, Kuala Lumpur
Turquoise	A web-based/mobile-based character development evaluation system	Sekolah Rendah Islam Al-Amin Wilayah Persekutuan, Kuala Lumpur
EduBabble (not installed)	A web-based comprehensive textbook management system	Sekolah Menengah Kebangsaan Orkid Desa, Kuala Lumpur

Through this project, students can enhance their technical skills, teamwork, and community engagement, preparing them for future challenges in software engineering. The project also has a profound impact on student learning by deeply engaging them in the educational process and empowering them to take ownership of their initiatives. By working on real-world applications for local schools, students become more invested in their work, knowing that their efforts will have a tangible impact on the community. This level of engagement fosters a sense of responsibility and motivation that is often missing in traditional classroom settings, where projects are typically hypothetical and disconnected from real-world needs (Jacoby & Howard, 2014). Research indicates that service-learning enhances student engagement, leading to improved learning outcomes and a deeper understanding of course material (Carini et al., 2006; Ewell, 2009).

Moreover, the project empowers students by placing them in roles where they must make critical decisions, solve complex problems, and interact with external stakeholders, such as school representatives and project coordinators. This empowerment goes beyond technical skills, instilling in students the confidence to take initiative, lead teams, and manage projects effectively (Brown & Bauer, 2019). The experience of seeing their work implemented in real settings further reinforces their learning, providing a sense of accomplishment and validation that significantly enhances their educational journey. This empowerment prepares students not only to excel in their academic pursuits but also to be proactive and confident professionals in their future careers (Kuh et al., 2007).

From the perspective of educators, the Multi-Course Service-Learning Project enhances teaching effectiveness by integrating real-world applications into the curriculum, making theoretical concepts more relatable for students. This approach bridges the gap between academic knowledge and practical experience, enriching the learning process and improving overall teaching methods. The project also fosters interdisciplinary collaboration among faculty members, encouraging innovative teaching strategies and a more cohesive educational experience. This teamwork not only enriches educators' professional skills but also opens opportunities for connecting with the community and industry partners, broadening their professional networks.

Additionally, the project drives curriculum innovation by promoting active learning, collaboration, and real-world problem-solving. This focus on dynamic, relevant teaching methods helps educators better prepare students for future challenges while contributing to their holistic development. The success of the project reflects positively on educators and the institution, highlighting their role in shaping competent professionals. Finally, by contributing to the holistic development of their students, educators play a crucial role in building the technical, teamwork, and problem-solving skills essential for student success. The positive impact on student outcomes reflects the effectiveness of the educators' efforts and enhances the institution's reputation. Through this project, educators can take pride in their role in shaping well-rounded, competent professionals who are prepared to excel in their future careers.

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We extend our sincere gratitude to the management at MJIIT for their unwavering support, the dedicated teachers from the participating schools for their invaluable and continuous feedback, and the students whose hard work and commitment were instrumental in the success of this project. Additionally, we would like to thank the rest of the project team members for their collaboration, dedication, and valuable contributions throughout the project.

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ID 70: Sustainable Business Start-up Day: Building Social Entrepreneurs with the How People Learn Framework

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Highlights: Sustainable Business Start-up Day is an activity organised for the Small Business Management module in June 2024. This activity focuses on choosing the best business ideas with relevant Sustainable Development Goals (SDGs) as prize winners. With the adoption of How People Learn Framework (HPL), participants went through several learning approaches and workshops to develop a detailed business plan and present it in both poster and PowerPoint slides. The winners were selected based on the most feasible business ideas with a focus on social entrepreneurship for the activity.

Keywords: *Business idea; SDGs; Social entrepreneurship; How People Learn Framework (HPL)*

Introduction

Muhammad Yunus and Grameen Bank were awarded the Nobel Peace Prize in 2006 for their work to "create economic and social development from below". Grameen Bank is a typical example of social entrepreneurship that grants poor people, especially housewives with small loans on easy terms to start small businesses (The Nobel Prize, 2006). According to the research from World Economic Forum (2024), more than 8 million social enterprises from over 80 countries have contributed 200 million jobs worldwide in delivering the Sustainable Development Goals (SDGs). Social entrepreneur is someone who starts or runs an enterprise that aims to make money to serve a useful social purpose (Cambridge dictionary, 2024).

The Sustainable Development Goals (SDGs) were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet and ensure that by 2030 all people enjoy peace and prosperity (United Nations General Assembly, 2015). By embedding the education on SDGs, participants can demonstrate their understanding of the SDGs and utilise the relevant skills to complete the assessment (Ravana et al., 2023).

The objectives for this Sustainable Business Start-up Day are to incorporate Sustainable Development Goals (SDGs) in the syllabus of Small Business Management and to enable students to develop business plan through sustainable practices. In addition, this activity considers the How People Learn Framework (HPL) in building a career as a social entrepreneur.

Research Methodology

The participants for this activity were 66 students from Diploma in Business Administration, intake of August 2023, who enrolled for BENT 1013 Small Business Management module offered from March to July 2024 semester in Sunway College Johor Bahru. There are a total of twelve groups with each group consisting of 5 to 6 members. They were required to attend three workshops: a Sustainable Development Goals (SDGs) workshop in week 2, workshop on Pecha Kucha Presentation in week 4 and a Canva workshop in week 8. Surveys were conducted before and after the SDGs workshop to gauge the awareness level of SDGs among participants. After the first two workshops, participants discussed their proposal with the subject lecturer. In week 7, participants pitched their proposals using Pecha Kucha presentation style. A winning group that best demonstrates the Pecha Kucha technique was selected. Canva workshop was conducted by external industry guest speakers who was also appointed as one of the activity judges. Students submitted business plan in week 11 and poster submission in week 12. Lastly, a Sustainable Business Start-up Day, a half-day competition, was created to display the posters and to present the business plans. Marking rubrics for poster, proposal presentation and business plan presentation were prepared to determine the best performing group. A survey was also conducted at the end of the activity to gauge the involvement level of participants.

NALI Implementation Approach

How People Learn Framework (HPL)

This activity incorporated How People Learn Framework (Brandsford et al., 2004) and scenario-based learning to design the learning environments and encourage real-world application. For HPL framework, there are four overlapping lenses including knowledge centred, learner centred, assessment centred and community centred.

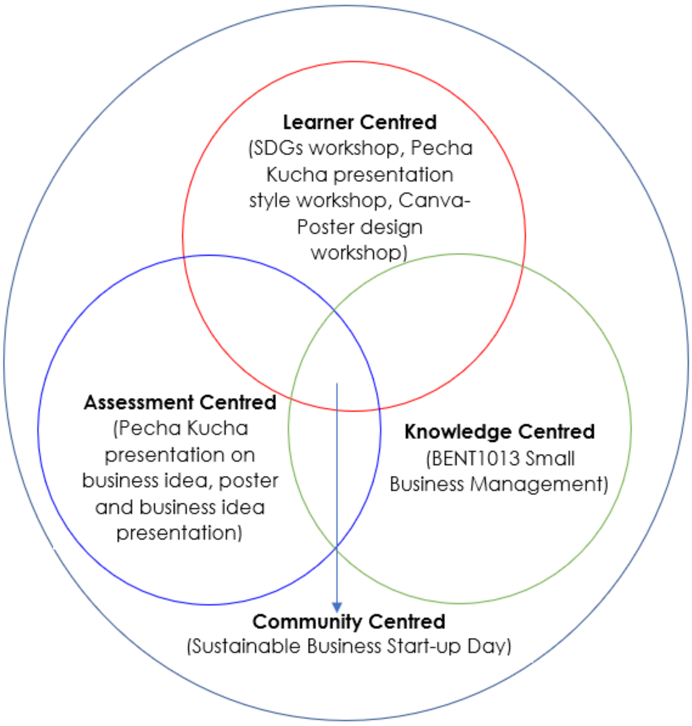

Figure 1: Adapted How People Learn Framework (HPL) for Small Business Management Module

Knowledge centred
Knowledge centred refers to the learning environment that integrates with facts, ideas, concepts, and principles in an allocated timing (The IRIS Center, 2005). BENT 1013 Small Business Management module requires participants to develop a proper business planning in 14 weeks lesson. According to Hisrich (2024), a formal business plan should include marketing, human resource, operation and financial plan to show future investors of potential business ideas to be commercialised into big businesses. During the 14 weeks lesson, participants will have lecture and tutorial sessions to understand basic knowledge for each topic. At the same time, videos, case-studies and consultation hours help to enhance the validity of the business idea. This allows participants to develop metacognitive skills that encourage them to learn and research more about the social entrepreneurship of the business. Metacognitive skills refer to the skills of self-awareness on the resources available and how to select the relevant resources from their learning process and use them to achieve goals for all areas of life or for continuous improvement (Cimatti, 2016).

Learner centred
Learner centred highlights that every participant learns with their different pre-conceptions intact. With the differences in social and cultural traditions, experiences, thoughts and beliefs, they build upon their knowledge and extend to what they can do (The IRIS Center, 2005). For participants to develop business plans through SDGs practices, academicians need to consider their exposure to SDGs and equip them with a SDGs workshop to guide them in mapping the social problems with the relevant goals. Acknowledging the participants' background and prior knowledge are crucial in guiding them to make connections between the knowledge gained in the classroom and the real world (Brandsford et al., 2004). Pecha Kucha presentation style workshop is arranged to support students with the Japanese format of presentations in which students use 20 slides and 20 seconds auto-advancing to display on the screen. In view of participants who are in their third semester or first year, this presentation style trains participants to propose their business ideas in an informal way with a higher confidence level.

Assessment centred
Assessment centred refers to the kind of assessment that helps participants to develop the quality of their learning by providing frequent opportunities for feedback, reflection and revision, which enhances continuous improvement (The IRIS Center, 2005). Assessments are encouraged to be formative instead of summative because it plays a vital function to assist learners to develop metacognitive skills (The IRIS Center, 2005).

Prior to the Sustainable Business Start-up Day, a series of workshops have been arranged to equip students with the relevant resources to prepare them for the various assessments during Sustainable Business Start-up Day. Students were provided with opportunities to obtain continuous feedback to improve their Business Idea, SDGs Idea, Poster Design and Pecha Kucha presentation skills. These feedback and efforts helped participants to perform well especially for the Poster Design assessment and Pecha Kucha presentation, whereby the winning team used the feedback that they received from their first Pecha Kucha presentation to perform even better for their final presentation.

Community centred
Community centred learning encourages the alignment of participants' and instructors' module expectations. Participants are encouraged to cooperate in groups where they can safely share their views in a supportive environment with the entire class as part of a wider community which encourages lifelong learning (The IRIS Center, 2005).

Participants were encouraged to work in smaller groups to develop business ideas which are commercially viable and socially beneficial for the community at large. They were guided to present and share their views to the whole class, whereby constructive feedback was provided by the panel of judges. In addition, participants also embraced scenario-based learning because social entrepreneurs may encounter different scenarios faced by the community and this may influence their respective business ideas. Students employ critical thinking skills and reflect their role as global citizens and are more likely to see that their actions have consequences in the real world. To be specific, they face the problems in which the community is facing and solving by incorporating the SDGs.

Findings and Discussion

The Sustainable Business Start-up Day clearly evidenced the abilities of participants to integrate their existing knowledge with their new learnings to address the various assessments which promotes the development of community centred learning especially enforcing social entrepreneurship and scenario-based learning.

Table 1: Business Idea presented on Sustainable Business Start-up Day

Social Problem in Malaysia	Relevant SDGs	Group Name and Business Idea	Excerpt from Participants' Reflection
Scarcity of clean and safe water	SDG 6: Clean water and sanitation SDG 15: Life on land	<u>CrystalH2O (Champion)</u> Provide customers with clean water to drink from a water bottle with an automatic filtration system.	P05: Very Interesting P16: Very Good P25: I think all is good P32: Very good and fun
High unemployment rate for People with Disabilities (PWD)	SDG 8: Decent work and economic growth	<u>Netty Craft (1st Runner up & Pecha Kucha Presentation)</u> To collaborate with Society of Disabled People and provide employment opportunities for them to produce net tote bags.	P20: Very good! P31: Everything is good P36: Perfect P48: Very good
Children who have financial difficulties and cannot afford tuition lessons	SDG 4: Quality education SDG 8: Decent work and economic growth	<u>Genius Education Group (2nd Runner up & Best Group Presentation)</u> Provide tuition lessons to students who come from lower income families. To provide teaching opportunities to fresh graduates.	P01: Good P09: Very Good P39: Very Interesting
High amount of plastic waste	SDG 12: Responsible consumption and production	<u>Helping Hands (Best Poster Design)</u> Placing recycled vending machines at strategic locations and establishing a factory to manufacture furniture from the recycled plastic waste materials.	P03: Very fun but too early P12: Good job very nice P40: Interesting

Other than the business idea, the responses received after the Sustainable Business Start-up Day were overwhelming. Many of the students commented that they felt excited to participate in the event and learned from other groups. The excerpts from Table 1 showed that participants enjoyed this enriching activity. The reflections of participants 5, 9, 36, and 40 also indicated that this activity is very interesting, very good, perfect and interesting. Students have also embraced assessment centred learning which is part of the How People Learn framework. Participants 26, 34, 54 and 57 provided feedback that they have learnt many new ideas and knowledge from the presentations of different groups, which is important in assessment centred learning.

Conclusion and Recommendation

In conclusion, the How People Learn framework is a very useful framework to integrate knowledge centred, learner centred, assessment centred and community centred learning to develop a more wholistic learning experience for the participants. By adopting this framework into BENT 1013 Small Business Management, participants were able to use their existing knowledge and learn new knowledge such as Pecha Kucha and SDGs to successfully develop ideas through scenario-based learning which were commercially viable with an emphasis on social entrepreneurship while addressing the assessments in the Sustainable Business Start-up Day. This activity also promoted community centred learning because it encourages participants to learn many new ideas and knowledge from the presentations of different groups in the whole class, which is important in the How People Learn framework.

Therefore, it is highly recommended that the How People Learn framework be consistently adopted for future modules because it is highly relevant, useful and enriching to create a wholistic learning environment to develop well-rounded and multi-disciplinary participants who can contribute to a better community and a better environment.

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ID 71: Canvas LMS: A Tool for Personalized Learning

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Highlights: This research explores the potential of Canvas LMS to facilitate personalized learning. By examining its features, the study suggests that Canvas can enhance student engagement, motivation, and academic performance through personalized approaches. Key features such as accessibility, interactivity, and adaptive learning capabilities contribute to this potential. However, empirical research is necessary to validate these claims and explore the specific conditions under which Canvas LMS can be most effective in supporting personalized learning.

Keywords: *Canvas; Learning Management System; Personalized Learning*

Introduction

With the introduction of technology, the field of education has seen a radical transformation, with a shift in emphasis from universally applicable methods to customized learning experiences. Learning Management Systems (LMS) have become essential instruments in this change. LMS are web-based software platforms that automate the administration, delivery, organization, and reporting of instructional materials and student outcomes in addition to offering an interactive online learning environment (Sabharwal, Chugh, Hossain, & Wells, 2018) (Turnbull, Chugh, & Luck, 2020). Canvas LMS has become well-known among these platforms due to its ability to meet the various needs of students. Canvas provides a range of advantageous features that teachers can use to enhance the efficiency of the teaching and learning process. It allows teachers to easily access discussions, course schedules, lecture videos, grades, assignments, message analytics, reports, groups, peer review tasks, and other educational applications (Santiana, Silvani, & Ruslan, 2021). It monitors and reports on student learning in courses and throughout an academic program, Canvas LMS provides assessment tools. It can gather learning outcome achievement ratings based on measurable criteria from assessment assignments integrated into courses and additional chances where students can show their proficiency.

This study explores how the Canvas LMS can be used to customize educational experiences to meet each student's unique needs and learning preferences of each student by examining its potential as a catalyst for personalized learning. Through an analysis of Canvas LMS's features, functions, and deployment tactics, this study seeks to determine how it can improve student motivation, engagement, and academic performance.

Content

Objectives

The objectives of this study are:

- To identify the key features of Canvas LMS that support personalized learning.
- To investigate the effectiveness of Canvas LMS in enhancing student engagement and motivation through personalized learning strategies.

NALI Approach Implemented in the Research

Novelty

The novelty of this research lies in its focused exploration of Canvas LMS as a catalyst for personalized learning. While previous studies have touched on personalized learning and LMS, a comprehensive investigation into the specific capabilities of Canvas LMS in tailoring education to individual student needs is lacking. By delving into Canvas LMS's features, examining implementation strategies, and measuring their impact on student outcomes, this study aims to contribute significantly to the field of educational technology and personalized learning. To adapt to the ever-changing demands of students, Canvas LMS has undergone continuous development. Enhanced collaboration tools, such as real-time document editing, are among the newest features. With integrated tools like Google Docs or Microsoft Office 365, students may work together easily on shared projects with their classmates. When an online course is required, educators and students can use asynchronous video conferences. For students with disabilities, the Canvas LMS offers accessibility capabilities that enable them to participate in a more inclusive learning environment. These features include keyboard navigation, screen reader compatibility, and alternative text for images. With the help of these characteristics, students should be able to learn in a way that is more effective, inclusive, and interesting (Nalyvaiko & Vakulenko, 2021).

Creativity

Gamification is the process of incorporating features and ideas of game design into non-gaming environments to encourage and engage students. Put another way, it involves incorporating aspects of games—like competition, rewards, challenges, and interactive experiences—into processes or activities that aren't often thought of as games. Gamification aims to stimulate student participation and raise engagement by capitalizing on their natural need for fun, accomplishment, and competitiveness. Active learning is motivated by gamification, which makes learning enjoyable. Canvas LMS provides digital badges, which are a fantastic way to provide students recognition and rewards for their achievements as well as an alternate means of skill and subject assessment. They can be used to acknowledge each student's unique accomplishments, regardless of proficiency level, and they can be connected to learning, effort, skills, and positive conduct. A gamified course can benefit from the addition of ranks and levels, which let each student learn at their own pace and provide them with a sense of accomplishment as they "level up" (Romano, 2023).

Leaderboards can display the rankings of students based on their performance in the course or the points they have earned. This pushes students to aim for the top rank and adds a healthy dose of competitiveness. Students can earn points by finishing assignments, quizzes, lessons, and other learning activities by utilizing a points system. Over time, these points can accumulate and aid in their overall development. In the end, these points may be redeemed for rewards, school materials, or even one or more extra credit points. Students feel encouraged to learn the topic and are motivated to finish the required assignments as a result. The learning process can be made more interesting by including quests or challenges that call on students to finish certain assignments or activities. These difficulties may have a connection to actual situations, enhancing the application of information in real-world contexts (Romano, 2023).

Innovativeness

When it comes to educational technology, Canvas LMS has been at the forefront, embracing innovation to offer a genuinely personalized learning experience. Adaptive learning technologies integration is one of its biggest innovations. These intelligent algorithms examine student data to determine each student's unique learning preferences, strong points, and areas for improvement. The data they examine includes participation in activities and exam scores. Canvas can customize tests and course materials to meet the specific needs of each student, ensuring that they receive the right amount of challenge and guidance. By ensuring that students are neither overburdened nor underwhelmed, this individualized approach promotes deeper engagement and motivation (Upadhyaya & Garg, 2019).

Canvas uses gamification components in addition to adaptive learning to make learning more entertaining and dynamic. Points, leaderboards, and badges can be given out for finishing tasks, hitting objectives, or taking part in conversations. These gamification elements not only increase learning enjoyment but also provide learners with a motivating and accomplished feeling. Canvas can improve students' overall learning experience and motivate them to pursue greatness by appealing to their competitive nature and need for recognition. To put it briefly, Canvas LMS's dedication to innovation has resulted in the creation of individualized learning capabilities that address each student's unique requirements and preferences. Canvas delivers a more effective, inspiring, and engaging learning environment by fusing gamification aspects with adaptive learning technologies. With the help of this creative method, students may take charge of their education, meet their learning objectives, and acquire the skills they need to thrive in the digital age (Upadhyaya & Garg, 2019).

Applicability

A more engaging and dynamic learning experience that accommodates various learning styles is made possible by the characteristics of the Canvas LMS, which includes enhanced interactivity through the integration of multimedia content including text, audio, and video. Students may access course materials anytime, anywhere because of Canvas's mobile compatibility, which is particularly useful in distance learning scenarios. Teachers and students are encouraged to enhance their digital abilities through the use of platforms like Canvas, as these are vital in today's educational environment. Through discussion boards and group projects, Canvas makes it easier for students and teachers to collaborate, promoting a feeling of community even in virtual environments. By tracking student progress and customizing learning experiences to match individual requirements, instructors can improve the effectiveness of training using the platform's analytics and assessment tools (Nalyvaiko & Vakulenko, 2021).

Impact to Student’s Learning

The impact of Canvas LMS on student’s learning is that students may access course materials, assignments, and resources from any location at any time with Canvas's centralized platform. Due to this flexibility, students can interact with the material at their own pace, accommodating a variety of schedules and learning styles. Student participation is increased by facilitated with Canvas's interactive features, which include discussion boards, quizzes, and multimedia content. These resources promote cooperation and communication between students and teachers, fostering a more lively learning environment. Canvas makes it possible to provide prompt feedback on tests and assignments. Quizzes and assignments can be completed instantly, giving students insight into their performance and opportunities for growth. An instantaneous feedback loop is essential to learning effectively. Canvas facilitates the alignment of course activities with particular learning outcomes, guaranteeing that students comprehend the educational objectives. Students can better understand the purpose of their coursework and how it advances their overall academic and professional growth when there is alignment between the two (Burrack & Thompson, 2021).

Research Methodology

This study is identified by conducting content analysis. It provides a thorough synopsis of Canvas LMS as a tool for personalized learning. The study emphasizes important characteristics such as ease of use, user engagement, and the ability to adjust to individual learning needs. This study contends that these characteristics can greatly enhance student involvement, drive, and scholastic achievement. An illustration of this is the accessibility of Canvas LMS, which enables students to retrieve course materials and engage in activities from any location and at any time, thereby fostering adaptability and catering to a wide range of learning preferences. In addition, the interactive elements, such as forums, assessments, and multimedia materials, can promote cooperation, communication, and a more captivating educational setting. Moreover, the Canvas LMS possesses adaptive learning capabilities that may customize course content and assessments according to the specific needs of each student, guaranteeing that students are provided with a suitable amount of difficulty and assistance. This customized strategy has the potential to result in more profound involvement, enhanced drive, and superior learning results.

Although the statement is based on a solid theoretical framework, it is necessary to do an empirical study to verify these assertions. Subsequent research might examine the precise influence of Canvas LMS on student learning outcomes, compare it with other LMS platforms, and delve into potential obstacles and constraints in applying personalized learning methodologies. Furthermore, analyzing the viewpoints of both students and instructors would yield a more comprehensive comprehension of the efficacy of Canvas LMS in facilitating personalized learning.

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ID 72: Garis Masa Sirah Interaktif

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Sorotan: Bahan pengajaran Sirah ini memaparkan kaedah interaktif dalam pembelajaran Sejarah yang berasaskan fakta, iaitu menggunakan teknik "garis masa" untuk menelesuri perjalanan hidup Rasulullah SAW dalam bentuk visual interaktif. Pendekatan ini dihasilkan sebagai respond kepada beberapa cabaran dalam pengajaran Sirah, termasuk tanggapan pelajar yang melihat Sirah suatu yang membosankan. Justeru, kaedah ini direka untuk menangani dengan menggabungkan teks, imej, dan unsur interaktif dalam satu garis masa yang memudahkan pembelajaran pelajar. Penggunaan teknologi dalam menjadikan Sirah lebih mudah difahami dan menarik dan semasa. Dengan menggunakan sebanyak 20 rujukan, "Garis Masa Sirah Interaktif" ini diharap dapat mengimbangi antara pengetahuan fakta dan pemahaman.

Keywords: *Garis Masa; Sirah; Interaktif*

Objektif Projek

- Meningkatkan pemahaman pelajar terhadap sirah kehidupan Rasulullah SAW.
- Menggalakkan penggunaan teknologi dalam pengajaran sirah Islam.
- Memupuk minat pelajar dalam mendalami sejarah Islam melalui bahan pengajaran yang menarik dan interaktif.

Keaslian (Idea Baru)

Projek ini memperkenalkan pendekatan baru dalam pengajaran sirah Islam dengan menggunakan kaedah "garis masa" yang menggabungkan elemen visual, serta penggunaan teknologi QR code untuk akses maklumat tambahan, menjadikan pembelajaran lebih interaktif dan mendalam.

Kreativiti (Reka Bentuk Idea)

Reka bentuk "garis masa Sirah" ini menggunakan pendekatan visual yang moden dengan gabungan warna-warna yang menarik serta ikon-ikon yang relevan dengan setiap peristiwa. Penggunaan QR code memudahkan pelajar mengakses maklumat tambahan melalui telefon pintar mereka.

Inovasi (Perubahan/Penambahbaikan)

Projek ini membawa inovasi dalam cara pengajaran sirah dengan memperkenalkan elemen interaktif (garis masa) dan teknologi digital, yang dapat meningkatkan keberkesanan ilmu berkaitan sirah serta meningkatkan minat pelajar.

Kebolehlaksanaan (Relevan kepada NALI)

Projek ini sejajar dengan konsep NALI (New Academia Learning Innovation) kerana ia memperkenalkan cara baru dalam pembelajaran Sirah yang menggunakan kaedah interaktif dalam penyampaian bidang Sejarah yang berfakta iaitu kaedah "garis masa" serta melibatkan teknologi dan pendekatan visual, selaras dengan keperluan pembelajaran abad ke-21.

Impak kepada Pembelajaran Pelajar (Penglibatan dan Pemerkasaan)

Pendekatan visual dan interaktif ini meningkatkan penglibatan pelajar dalam kelas serta membantu mereka memahami dan mengingat peristiwa sejarah dengan lebih baik. Hal ini memberi kesan yang lebih positif kepada pemerkasaan pelajar dalam pengajaran dan pembelajaran Sirah Rasulullah SAW.

Potensi Pengkomersialan

Bahan pengajaran ini mempunyai potensi untuk dikomersialkan sebagai sumber pendidikan interaktif bagi sekolah-sekolah dan institusi pendidikan di Malaysia dan luar negara, serta kepada pihak masyarakat seperti Masjid, Surau dan NGO.

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ID 73: Future-ready: Revolutionizing Service-Learning with TechFusion

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Highlights: The integration of service-learning with TechFusion represents a significant innovation in the Education 5.0 paradigm, enhancing traditional educational approaches. This paper introduces *TechFusion*, a transformative approach that integrates technology with service-learning in Technical and Vocational Education and Training (TVET). The study objectives include the development of the TechFusion Service-Learning Framework and the impact of integrating service-learning with TechFusion on TVET student's. This innovative model aims to equip students with the skills and competencies required for the Fourth Industrial Revolution (Industry 4.0) while addressing societal needs through service-learning projects. By harnessing the power of digital tools, *TechFusion* ensures that TVET students are not only technically proficient but also socially responsible, making them future-ready.

Keywords: *TVET; Service-Learning; TechFusion*

Introduction

Service-learning serves as a pedagogical approach that bridges educational institutions and the community, enabling students to actively involve in community service while applying their academic concepts and theories to address the specific needs of the community (Bringle and Hatcher 1995). Service-learning, unlike other experiential learning methods such as internships and volunteerism, creates a reciprocal learning environment, enabling both academicians, students, and community members to benefit from it simultaneously (Lee et al., 2018). Besides contributing to the establishment of a mutual teaching-learning environment, service-learning has various advantages for all the participants, namely, faculty, students, and the community involved in the service-learning experience (Molderez and Fonseca, 2018).

Kaye (2004) outlines a thorough service-learning framework that consists of five stages, which can be used as a guide for the educational experience. The stages comprise investigation, preparation, action, reflection, and demonstration. During the investigation phase, students identify the community's needs and study different potential projects whereby a meaningful engagement is established between the students and the community they aim to serve. The preparation stage is about planning and acquiring the necessary skills and knowledge to be able to address these needs properly. In the action stage, students take an active role in service activities, using their skills in real-life situations. Reflection encourages students critically analyze their experiences, fostering personal and academic growth. The last stage, demonstration provides students opportunities to showcase their learning outcomes as well as the impact of their service, reinforcing their contributions.

In the context of Technical, Vocational, Education and Training (TVET), service-learning plays a crucial role by allowing students to apply their technical and vocational competencies in real world environments. This approach would, in turn, enrich their practical experiences and strengthen theoretical understanding while making meaningful contributions to the community. However, traditional TVET service-learning initiatives often focus primarily on skill and technical acquisition, overlooking broader developmental benefits which could be obtained from service-learning. Furthermore, the absence of technological integration within these programs limits their overall efficacy and impact.

To overcome these limitations, the research team propose, 'TechFusion', a novel approach that transform traditional service-learning by leveraging digital tools dan platforms with the aims to enhance both students' collaboration and communication skills (Culcasi et al., 2023). Digital tools such as Canva, CapCut, TikTok, PicArt, AutoCAD, and Google Meet enable seamless participation for all students, creating more dynamic and engaging learning experiences. Thus, this technological integration not only allows for better organizational effectiveness and team communication but also provides students with creative ways to document and reflect on their projects (Salam et al., 2019).

The course, Teacher Development (Bina Insan Guru) gears towards the development of future educators as nation's human capital. This course focuses on promoting students' emotional, intellectual, and practical self-improvement while fostering interpersonal relationships. A total of 36 undergraduate students from the Bachelor of Education programs specializing in Mechanical Engineering and Electrical and Electronics participated in this course. These students successfully organized a Techfusion service-learning project with an orphanage community. They effectively demonstrating how technology can enhance service-learning experiences and extend their benefits.

Content

Objectives

The objectives of developing TechFusion service-learning is:

- To develop TechFusion Service-Learning Framework based on the students' service-learning experiences.

NALI approach implemented in the research

Novelty: TechFusion service learning represents a paradigm shift in education that especially benefits Technical and Vocational Education and Training (TVET). This innovative approach aligns seamlessly with the Education 5.0 strategy, fostering a technology-enhanced, student-centered, and dynamic learning environment. It extends beyond the traditional service-learning models by incorporating digital tools and platforms into the learning process, enhancing students' engagement and 21s century competencies. By integrating technologies like Canva, CapCut, TikTok, AutoCAD, and Google Meet in service learning, students can easily document, reflect, and share their experiences which facilitates students to illustrate their learning journey clearly.

TechFusion fosters a more balanced learning experience, emphasizing collaboration, creativity, and effective communication alongside technical skills and theoretical knowledge which enabling them to contribute meaningfully to their communities. By investigating the TechFusion Service-Learning Framework within real-world contexts, it potentially revolutionizes experiential learning. This paradigm shift promises to establish new standards for both academic excellence and community engagement, bridging the gap between theoretical knowledge and practical application in ways previously unexplored.

Creativity: This innovative pedagogy creatively combines digital technology with service-learning, employing diverse tools such as Canva, CapCut, TikTok, PicArt, AutoCAD, and Google Meet. This integration enables TVET students to actively participate in service-learning projects in novel ways. With these technologies, TVET students can capture and share their experiences using videos and graphics on online platforms, thus making learning more interactive and fun. The result is a more interactive and engaging learning environment that bridges theoretical knowledge and real-life application.

Innovativeness: The introduction of TechFusion service-learning revolutionizes the traditional TVET programs which are usually concentrated on training in the technical skills, incorporating digital competencies for future ready educators. This innovative approach places digital platforms at the core of the learning experience, enabling students to communicate, collaborate, and create engaging content in real-time. TechFusion empowers students to make meaningful impacts in their communities while gaining a holistic educational experience that addresses the challenges of the digital age. By seamlessly integrating technology, TechFusion transforms Service-Learning programs into more efficient and enjoyable experiences for students, equipping them with the digital competencies essential for their future careers.

Applicability: The TechFusion Service-Learning Framework offers a versatile and practical tool for educators across diverse educational settings. Serving as a comprehensive guide, it facilitates the planning, execution, and assessment of Service-Learning activities in a systematic manner, ensuring both relevance and effectiveness in the educational experience. Its adaptability across various academic disciplines and community contexts makes it an invaluable resource for promoting student engagement and enhancing learning outcomes. By emphasizing real-world skill application and incorporating digital technologies, the framework remains relevant and effective in preparing students for the modern workforce while nurturing a symbiotic relationship between academia and the community.

Impact: The effect of the TechFusion service-learning framework is multifaceted as it yields significant impacts on both individual learning process and the overall service-learning project outcomes. The approach encourages TVET students to engage in deep reflection and critical analysis by leveraging digital technology to document and evaluate their projects. In addition, it provides an opportunity for students to showcase their work more effectively, providing concrete and tangible evidence of their capabilities in real-world setting. The framework's emphasis on collaborative and reflective learning significantly contributes to the development of crucial soft skills, including communication, teamwork, and critical thinking. On the other hand, TechFusion service-learning allows for wider dissemination of project outcomes on digital platforms, leading to increased awareness and support for community initiatives. By combining technological innovation with community service, the TechFusion framework not only enhances the educational experience for TVET students but also amplifies the positive impact of their work on the community. This synergy between education, technology, and community service sets a new standard for experiential learning in the digital age.

Research Methodology

A total of 36 undergraduate students from the Bachelor of Education in Mechanical Engineering and the Bachelor of Education in Electrical and Electronic programs are enrolled in the Teacher Development (Bina Insan Guru) course, which aims to develop teachers as human capital. This course places a strong emphasis on service-learning to enhance students' professional skills. To ensure that the service-learning activity give impact to the students therefore the service-learning programme is basically grounded on the five important stages of service-learning: investigation, preparation, action, reflection, and demonstration. This systematic way guarantees that the service-learning is organized and corresponds to the learning objectives. At the investigation stage, students first contact the person in charge of the orphanage through WhatsApp to arrange a meeting and get to know what the orphanage problems and needs are. After this, the students introduce their solutions to the problems just identified using PowerPoint presentations. When their planning is sanctioned, the preparation phase kicks off where the students compose, design a schedule, and assign duties. Through this phase, students use a set of different digital tools that include Canva for the modules and presentation slides, AutoCAD for product design, Google Meet for the video conferencing app for meetings, and the other tools such as CapCut and PicArt for the editing of videos and images to be uploaded to TikTok. The performing phase is where students are giving presentations, distributing the modules that are already prepared to the orphans, teaching them how to build robots, donating podiums, and interviewing the orphans in order to gather their opinions, experiences, and feedback regarding the service-learning program. Apart from taking a step back and looking inward, students are also mandated to prepare and submit a report through the e-learning platform, using available digital tools in a creative way. Back demonstration stage, the students finish a peer evaluation using Google Forms, and lecturers conduct the final assessment. The final output is a creatively designed coffee book that encapsulates the entire service-learning experience. This structured methodology not only promotes effective learning and community engagement but also fosters students' creativity and digital literacy.

Finding and discussion of the project or innovation

To develop and apply a solid framework of technology integration, it is essential to understand the whole process of embedding service-learning within disciplines. Experiential learning theory, recognized as a suitable base for this work, enables the determination of the basic phases of service-learning pedagogy (Kaye, 2004). Accordingly, this research has used these phases (Fig.1) to develop a technology integration framework with a layer of technological support. Meanwhile, the activities of each phase are based on course learning outcome and Service-Learning project implementation, which was infused with TechFusion.

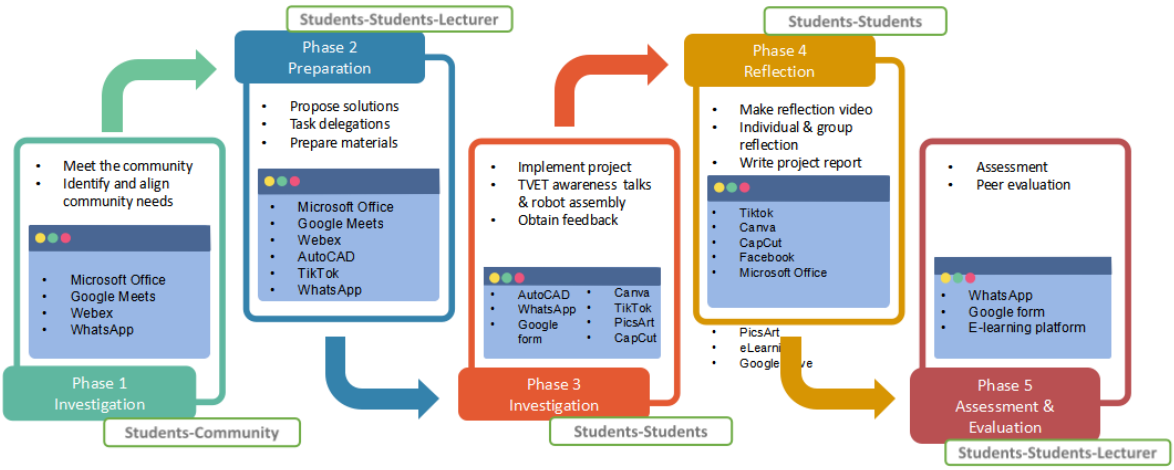

Figure 1: TVET TechFusion Service-Learning Framework

Some of the TechFusion used by the TVET students in the service-learning activity are shown in Figure 2:

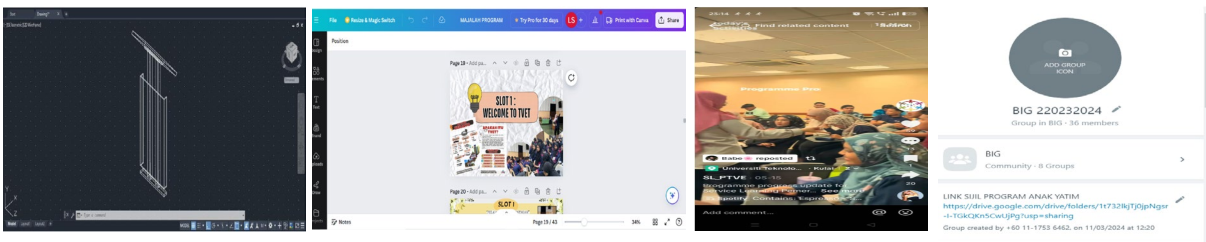

Figure 2: Students' Work

Key findings were derived from both semi-structured interviews and theme-based analysis of students' feedback. The students confirmed that the use of different technologies in the service-learning process increased their level of participation and independence. There was also a sense of ownership and responsibility realized through the integration of improvements in communication, teamwork, and problem-solving skills.

Commercialization Potential

TechFusion Service-Learning Framework has commercialization potential as its targeted in the field of service-learning methodologies embraced by digital tools. The framework can be developed into an integrated, comprehensive service-learning platform or service-learning toolkit that can be used by educational institutions, training organizations, and corporate training programs to facilitate learning experiences. It can be marketed to different higher institutionss as it is packed in a digital application or software that includes modules for planning, execution, and evaluation of service-learning projects, along with the use of embedded digital tools for communication, collaboration, and content creation.

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ID 74: Inovasi Kit MARA- Membaca Aktif Rangsangan Awal

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Sorotan: Pendidikan inklusif merupakan satu program yang ditawarkan dalam sistem pendidikan di Malaysia. Kepelbagaian murid berkeperluan khas yang terdapat dalam kelas pendidikan inklusif memerlukan guru merancang Pengajaran dan Pembelajaran (PdP) yang kreatif dan sesuai dengan semua variasi murid. Dalam hal ini, Pengajaran pedagogi terbeza amat ditekankan supaya kedua-dua kumpulan iaitu murid normal dan murid berkeperluan khas dapat menerima objektif yang sama daripada guru tentang sesuatu pengajaran. Inovasi MARA (Membaca Aktif Rangsangan Awal) direka untuk meningkatkan kemahiran berbahasa dalam kalangan murid-murid inklusif dengan menggunakan pendekatan pedagogi terbeza. Keberkesanan inovasi ini telah diuji kepada 20 orang murid daripada kelas pendidikan inklusif yang terdiri daripada 14 orang murid normal (kumpulan A) dan 6 orang murid berkeperluan khas (kumpulan B) bagi melihat keberkesanannya sebagai medium interaktif kemahiran bahasa murid. Hasil ujian mendapati terdapat peningkatan markah murid dalam ujian pos berbanding ujian pra. Murid memperlihatkan pemahaman mereka dengan mudah dalam sesi PdP yang dijalankan bersama Kit MARA. Secara keseluruhan, penggunaan inovasi MARA dapat memberi manfaat kepada murid yang mempunyai masalah pembelajaran.

Kata kunci: *bahan bantu belajar; kemahiran berbahasa; pedagogi terbeza; murid inklusif*

Pengenalan

Inovasi MARA- Membaca Aktif Rangsangan Awal merupakan set bahan bantu belajar yang direka khusus untuk meningkatkan keupayaan membaca dalam kalangan murid inklusif yang sedang menjalani fasa mengenali huruf dan perkataan. Alat ini menggabungkan teknik-teknik pendidikan moden dengan pendekatan yang interaktif dan berpusatkan murid. Alat ini turut bertujuan merangsang minat dan keterlibatan dalam proses pembelajaran kemahiran berbahasa. Inovasi ini memberi tumpuan kepada pembangunan bahan bantu belajar yang fleksibel dan dapat disesuaikan dengan pelbagai kaedah pengajaran seperti visual, auditori, dan kinestetik bagi menyokong pembelajaran bahasa. Inovasi ini juga dibangunkan untuk memberi pengalaman pembelajaran yang lebih efektif dengan mengambil kira keperluan dan potensi setiap murid. Kepelbagaian potensi murid disesuaikan dengan Kit pembelajaran ini dengan pendekatan pedagogi terbeza. Penerapan pedagogi terbeza (differentiated instruction) dalam inovasi bahan bantu belajar ini bertujuan untuk memenuhi keperluan pembelajaran yang pelbagai dalam kalangan pelajar iaitu antara murid biasa dan murid lemah. Pedagogi terbeza melibatkan penyesuaian strategi pengajaran, bahan, dan aktiviti untuk memaksimalkan potensi setiap pelajar berdasarkan kekuatan, minat, dan keperluan mereka yang unik (Sousa, D. A., 2016).

Pernyataan Masalah

Pembelajaran literasi awal merupakan asas penting dalam pendidikan, namun dalam persekitaran pembelajaran inklusif, terdapat pelbagai cabaran yang perlu dihadapi oleh guru dan murid. Murid inklusif, termasuk mereka yang mempunyai keperluan khas seperti kesukaran pembelajaran atau kecacatan fizikal, sering kali menghadapi halangan yang lebih besar dalam memperoleh kemahiran berbahasa (Ainaa Hamdan & Ain Bustaman, 2023). Sistem pendidikan konvensional mungkin tidak sepenuhnya memenuhi keperluan khas mereka dan boleh menyebabkan jurang dalam pencapaian akademik dan penglibatan murid-murid ini. Oleh itu, murid inklusif memerlukan pendekatan pembelajaran yang disesuaikan dan responsif untuk memastikan mereka dapat menguasai kemahiran berbahasa dengan berkesan. Namun, alat dan bahan pembelajaran yang sedia ada sering kali tidak direka untuk menampung keperluan pelajar dengan pelbagai tahap keupayaan, menyebabkan mereka ketinggalan dalam pembelajaran (Siti Fatimah Salleh & Mustafa Che Omar, 2018). Ketiadaan alat yang berupaya untuk menyediakan rangsangan awal yang mencukupi dan disesuaikan dengan keperluan murid inklusif mengakibatkan kesukaran untuk melibatkan mereka secara aktif dalam proses pembelajaran. Hal ini menjejaskan perkembangan literasi awal mereka sekaligus meningkatkan jurang antara murid inklusif dan rakan sebaya mereka yang tidak menghadapi cabaran yang sama. Oleh itu, terdapat keperluan mendesak untuk menghasilkan sebuah alat pembelajaran yang mampu menyediakan pengalaman kemahiran berbahasa secara interaktif dan bersesuaian. Alat Inovasi MARA - Membaca Aktif Rangsangan Awal direka untuk memenuhi keperluan ini dengan menyediakan pendekatan yang lebih holistik serta mesra murid inklusif untuk membantu mereka mengatasi cabaran dalam pembelajaran kemahiran berbahasa.

Objektif

Secara khususnya, projek inovasi ini dibangunkan untuk:

- Membantu murid terutamanya murid inklusif mengenal huruf, membaca perkataan dan membina ayat dalam proses pembelajaran kemahiran berbahasa.

- Meningkatkan penglibatan murid dalam proses pembelajaran kemahiran berbahasa.
- Menggalakkan pembelajaran kendiri dalam kalangan murid pelbagai tahap.

Rasional Membangunkan Inovasi

- Memenuhi keperluan pembelajaran murid inklusif dalam proses pembelajaran kemahiran berbahasa.
- Meningkatkan keberkesanan PdP lebih responsif kepada keperluan individu dengan menggunakan bahan bantu belajar yang sesuai dan pendekatan pedagogi yang fleksibel.
- Bahan bantu belajar yang bersifat fleksibel dan universal yang boleh disuaikan dengan pelbagai topik dan murid
- Meningkatkan motivasi dan minat murid dalam sesi PdP.
- Kemudahan penggunaan dan penyesuaian bahan bantu belajar.
- Alat pemantauan dan penilaian kefahaman murid tentang kemahiran berbahasa.

Kumpulan Sasaran

Projek inovasi MARA (Membaca Aktif Rangsangan Awal) telah diuji ke atas 20 orang murid yang melibatkan 2 kelas daripada murid tahun 3 di sekolah A. Keseluruhan kebolehan pelajar daripada kedua-dua kelas ini adalah pada tahap lemah, sederhana dan baik. Lazimnya, dalam kedua-dua kelas berkenaan, terdapat beberapa orang murid yang menghadapi masalah pembelajaran iaitu murid disleksia, murid ADHD dan murid lembam. Umumnya, murid disleksia merupakan murid yang mengalami kecelaruan dalam membezakan huruf dan menyesuaikan huruf dengan bunyi (Vijaya Subramaniam & Kavenia Kunasegran, 2022). ADHD iaitu Attention Deficit Hyperactivity Disorder adalah masalah gangguan, kecelaruan dan kurangnya fokus dalam aspek pembelajaran. Masalah pembelajaran ini melibatkan penguasaan kosa kata bahasa pertama murid ADHD (Siti Noridayu Abd. Nasir et al., 2022). Murid lembam pula merujuk kanak-kanak yang lemah dari segi kemahiran membaca, menulis dan mengira pada tahap umur tertentu serta umur fizikalnya tidak melambangkan tahap pemikiran mereka (Puteri Roslina & Nur Azimah, 2016). Oleh itu, kajian tindakan melalui inovasi bahan bantu belajar MARA dilaksanakan bagi membantu murid-murid yang mengalami masalah dalam pembelajaran.

Metodologi Kajian

Reka bentuk kajian berbentuk kuasi eksperimen dan data kajian dianalisis melalui pendekatan kuantitatif. Dalam kajian kuasi-eksperimen ini, pengkaji hanya menggunakan dua kumpulan murid dari tahun 3 iaitu sebanyak 20 orang murid yang terlibat sebagai responden. Murid-murid ini dibahagikan kepada dua kumpulan iaitu 14 orang murid normal (kumpulan A) dan 16 orang murid berkeperluan khas (kumpulan B). Ujian Pra dan ujian pos telah dilakukan bagi melihat perbezaan prestasi murid-murid tersebut dalam kemahiran berbahasa.

Pemerhatian

Pengkaji telah melakukan pemerhatian yang sistematik selama 40 hari untuk memantau penggunaan inovasi Kit MARA kepada murid-murid yang terlibat. Borang pemerhatian dengan kriteria yang jelas telah digunakan dalam kaedah pemerhatian ini. Tujuan pemerhatian dilakukan bagi melihat respons murid terhadap bahan dan kesesuaian penggunaan bahan permainan dalam Kit MARA.

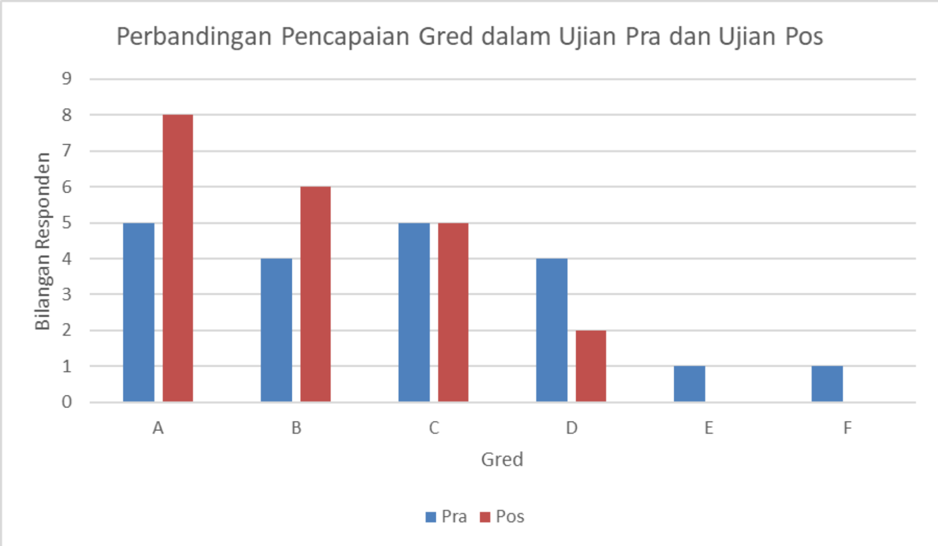
Ujian Pra

Ujian Pra telah dilakukan bagi melihat pengetahuan dan tahap kemahiran berbahasa iaitu kemahiran membaca dan kemahiran menulis murid-murid sasaran sebelum murid-murid mengaplikasi atau menggunakan Kit MARA. Ujian Pra dilaksanakan untuk mendapatkan gambaran awal mengenai pemahaman dan penguasaan murid bagi topik yang diuji.

Ujian Pos

Ujian Pos dilakukan untuk menilai perubahan dalam kemahiran berbahasa murid selepas menggunakan bahan bantu belajar inovatif. Penggunaan ujian ini penting untuk mengetahui pemahaman dan penguasaan murid kesan daripada penggunaan model Kit MARA dalam PdP Bahasa Melayu.

Dapatan Kajian



Rajah 1: Perbandingan pencapaian gred dalam ujian pra dan ujian pos.

Jadual 1: Keputusan gred ujian pra dan ujian pos bagi kumpulan A terhadap Kit Inovasi MARA.

Gred / Ujian	A	B	C	D	E	F
Pra	5	4	4	1	0	0
Pos	8	4	2	0	0	0

Jadual 2: Keputusan gred ujian pra dan ujian pos bagi kumpulan B terhadap Kit Inovasi MARA.

Gred / Ujian	A	B	C	D	E	F
Pra	0	0	1	3	1	1
Pos	0	2	2	2	0	0

Hasil ujian mendapati terdapat peningkatan markah murid dalam ujian pos berbanding ujian pra. Murid memperlihatkan pemahaman mereka dengan mudah dalam sesi PdP yang dijalankan bersama Kit MARA. Inovasi MARA dilihat dapat meningkatkan kemahiran berbahasa murid terutama dari aspek membaca dan menulis. Dapatan daripada kumpulan A menunjukkan peningkatan gred kepada yang lebih baik berbanding dapatan sebelum kit MARA digunakan. Hal yang sama juga berlaku pada kumpulan B menunjukkan keberkesanan kit MARA apabila ada peningkatan gred terhadap murid berkeperluan khas. Secara keseluruhannya, penggunaan Inovasi dalam pembelajaran dapat memberi impak yang positif kepada murid yang pelbagai dan berbeza kebolehan.

Rumusan

Hasil dapatan daripada pemerhatian dan ujian yang dijalankan menunjukkan bahawa inovasi MARA (Membaca Aktif Rangsangan Awal) berjaya meningkatkan penglibatan murid inklusif dalam proses pembelajaran serta kemahiran berbahasa mereka terutamanya kemahiran membaca dan menulis. Murid yang terlibat dalam pemerhatian dan ujian ini menunjukkan peningkatan kemahiran berbahasa yang lebih ketara berbanding kumpulan kawalan. Dapatan kajian ini mengesahkan bahawa MARA merupakan satu inovasi yang berkesan dalam konteks pendidikan inklusif. Inovasi ini bukan sahaja membantu murid-murid inklusif untuk mengatasi cabaran dalam pembelajaran bahasa, tetapi juga memperkasakan mereka dengan kemahiran yang penting untuk mencapai kejayaan akademik dan sosial. Melalui pendekatan yang disesuaikan dan sokongan yang mencukupi, inovasi MARA berpotensi untuk diterapkan secara lebih meluas dalam sistem pendidikan sekaligus menyumbang kepada usaha global untuk menyediakan pendidikan yang adil dan inklusif bagi semua murid.

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ID 75: Membina Pengetahuan: Pengalaman Pembelajaran Aktif dan Kolaboratif dalam Kursus Pengenalan Kepada Komputer

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Sorotan: Inovasi ini melaporkan kesan pelaksanaan amalan aktif dan kolaboratif dalam Kursus Pengenalan kepada Komputer. Kedua-dua pendekatan ini memindahkan banyak tanggungjawab daripada pensyarah kepada pelajar, dengan harapan untuk mempromosikan pembelajaran yang lebih mendalam dan kemahiran penaakulan pada tahap yang lebih tinggi. Kajian ini menerangkan persekitaran khusus yang menggunakan alat kolaboratif, seperti wiki dan forum dalam platform e-pembelajaran, serta perisian lain seperti carian bahan dari internet seperti carian enjin dan ChatGPT yang digunakan oleh pelajar semasa sesi pembelajaran dijalankan. Bagi menganalisis bagaimana persekitaran pembelajaran ini melibatkan pelajar secara aktif dalam pembelajaran dan bekerjasama dengan cara yang produktif, pelajar telah menjalani ujian pre-kuiz dan pos-kuiz selepas sesuatu topik yang dibincangkan dan untuk tujuan itu, kajian ini mennguna tajuk peranti input/output dan peranti simpan dalam bidang teknologi dan sistem maklumat. Hasil pos-kuiz yang dijalankan menunjukkan prestasi pelajar yang melakukan sesi amalan pembelajaran aktif dan kolaboratif adalah lebih baik berbanding dengan menggunakan syarahan.

Katakunci: *Pembelajaran aktif; kolaboratif; sains computer; teknologi maklumat dan komunikasi*

Pengenalan

Pembelajaran aktif dan kolaboratif dikenali sebagai strategi alternatif kepada model pengajaran konvensional (contohnya Kaufman, Sutow & Dunn, 1997; Prince, 2004). Secara khususnya, amalan aktif dan kolaboratif dalam kursus Pengenalan Kepada Sains Komputer (teknologi maklumat dan komunikasi-TMK) merupakan pembelajaran yang berkaitan komponen asas dalam komputer seperti pemproses utama, peranti input/output, simpanan computer, rangkaian dan lain-lain. Kursus ini ditawarkan kepada pelajar semester 1 Diploma Sains Komputer. Kuasa pedagogi dan sosio-ekonomi yang telah mendorong institusi pengajian tinggi untuk mengadopsi dan mengintegrasikan TMK dalam pengajaran dan pembelajaran (Sife, Lwoga & Sanga, 2007). Namun, seperti yang dikatakan oleh Silva et al. (2002), masih banyak yang perlu dilakukan dalam budaya universiti untuk mengatasi matriks individualistik ke arah budaya pembelajaran kolaboratif.

Dalam kajian ini, kami mengetengahkan persekitaran khusus yang menggunakan alat teknologi kolaboratif, seperti wiki dan forum dalam platform e-pembelajaran serta perisian lain seperti carian bahan dari internet seperti carian enjin, ChatGPT, WhatsApp yang digunakan oleh pelajar semasa sesi pembelajaran dijalankan. Berdasarkan latar belakang permasalahan ini, tujuan umum kajian ini untuk menyumbang kepada perbincangan teori tentang bagaimana pengalaman aktif dan kolaboratif dalam kursus Pengenalan Kepada Sains Komputer dalam pembinaan pengetahuan di institusi pengajian tinggi (IPT). Walau bagaimanapun, kami menghadkan bidang kajian kami kepada konteks peranti input/output dan peranti penyimpanan dalam TSM. Pelajar yang terlibat ialah pelajar tahun 1 Diploma Sains Komputer yang mengambil kursus Pengenalan Kepada Sains Komputer. Kajian ini melibatkan (1) memahami bagaimana persekitaran pembelajaran kolaboratif melibatkan pelajar secara aktif dalam proses pembelajaran; (2) memperspektifkan peranan alat kolaboratif pada tahap kerja berkumpulan; dan (3) mengetahui bagaimana pelajar menilai prestasi mereka dalam kumpulan kerja melalui pra kuiz dan pasca kuiz.

Kandungan

Objektif

- Mengaplikasi pembelajaran aktif dan berkolaborasi di dalam kelas Pengenalan Kepada Sains Komputer untuk pelajar Semester 1.
- Melaksanakan konsep pengajar rakan sebaya.
- Membuat perbandingan pencapaian pelajar di dalam pra dan pasca kuiz untuk menilai pembelajaran dan pengajaran menggunakan cara traditional atau pembelajaran aktif dan berkolaborasi

Inovasi

Pelaksanaan konsep pembelajaran aktif, kolaborasi, rakan sebaya dalam pembelajaran Semester 1 di universiti.

Perbandingan hasil pentaksiran pelajar jika kaedah tradisional dan pembelajaran aktif dilaksanakan

Metodologi

Kursus Pengenalan Kepada Sains Komputer dirancang bukan sahaja untuk membolehkan penglibatan maksimum pelajar, tetapi juga untuk memberi tumpuan kepada promosi pembelajaran mendalam dan kemahiran penaakulan oleh pelajar. Bagi membolehkan perkara ini, perancangan kursus direka untuk melibatkan pelbagai metodologi untuk setiap hasil pembelajaran yang khusus. Untuk mencapai ini, pelajar telah dibahagikan kepada kumpulan mengikut beberapa garis panduan tertentu. Kumpulan tersebut terdiri daripada tiga hingga empat orang pelajar dengan secara random dengan menggunakan perisian Webex tetapi pensyarah telah mengambil kira ciri-ciri tambahan seperti kaum, jantina, dan dalam Kumpulan kursus yang sama. Terdapat dua seksyen yang terlibat dalam kursus Pengenalan Kepada Sains Komputer. Secara bergilir (mengikut aktiviti), setiap kumpulan memilih seorang pelajar untuk menjadi ketua kumpulan. Selain daripada peranan sebagai ahli kumpulan, ketua mempunyai tanggungjawab tambahan untuk memastikan pemerhatian terhadap set peraturan kerja, membaca dan membetulkan semua dokumen yang dihasilkan untuk memastikan keseragaman dalam kerja yang dilakukan, serta mempromosikan kerjasama dan bantuan antara ahli.

Berpandukan kepada matlamat yang disampaikan, dua hasil pembelajaran utama yang dikaji. Pertama, pelajar yang berjaya dalam topik peranti input/ouput dari segi jenis, komponen, keupayaan dan lain-lain. Untuk menunjukkan bahawa hasil pembelajaran kursus ini telah dicapai, pelajar digalakkan untuk menyediakan dan membentangkan pelajaran mengenai setiap fasa proses tersebut. Oleh itu, selepas guru memperkenalkan topik dan mendorong pelajar dengan soalan-soalan untuk refleksi (dua pelajaran), pelajar dijemput untuk menyediakan dan membentangkan pelajaran mereka sendiri tentang peranti input/output. Akhirnya, topik ini ditutup dengan pensyarah membentangkan dan membincangkan dengan pelajar beberapa isi penting dalam tajuk peranti input/output.

Berkenaan dengan hasil pembelajaran kedua, iaitu pelajar mesti mampu mengenali pelbagai jenis peranti penyimpanan dalam teknologi maklumat. Untuk menunjukkan bahawa hasil pembelajaran kedua ini telah dicapai, pelajar digalakkan untuk membuat nota dan bahan pembentangan yang menerangkan jenis peranti penyimpanan, keupayaan dan lain-lain. Dalam kes ini, dalam setiap kelas dan selepas pensyarah akan membuat kesimpulan mengenai kepelbagaian jenis peranti penyimpanan data dalam komputer. Pada bahagian kedua setiap kelas, satu kumpulan membentangkan bahan mengikut model format yang telah ditetapkan oleh pensyarah. Secara khusus, pelajar diberi panduan untuk mengenal pasti jenis peranti, keupayaan, dan situasi pengguna peranti tersebut. Seperti peranti penyimpanan enterprise lebih sesuai digunakan oleh syarikat berbanding dengan penyimpanan awan umum adalah lebih sesuai untuk penyimpanan data individu.

Akhir sekali, sebelum kelas dijalankan pelajar akan menjawab soalan pre-kuiz dengan menggunakan platform Quizizz dan selepas sesi kelas berakhir, juga akan menjawab pos-kuiz. Hasil pre-kuiz dan pos-kuiz akan dianalisa untuk menilai kaedah pembelajaran yang lebih berkesan. Pelajar 2 seksyen pelajar yang terlibat iaitu Kumpulan A dan B di mana setiap seksyen mempunyai lebih kurang 33 orang pelajar dan melibatkan 11 kumpulan. Teknik statistik deskriptif digunakan untuk menganalisis data kuantitatif.

Hasil dan perbincangan

Pelajar semester 1 yang mengambil kursus Pengenalan kepada sains computer. Dalam kajian ini melibatkan 2 seksyen pelajar yang terlibat iaitu Kumpulan A dan B di mana setiap seksyen mempunyai lebih kurang 33/34 orang pelajar dan melibatkan 11 kumpulan bagi setiap seksyen.

Jadual 1: Pencapaian pelajar melalui pra and pasca Kuiz

Seksyen/Pembelajaran	Tajuk	Pra-Kuiz (%)	Pasca-Kuiz (%)
A (Syarahan)	Peranti /Output	20	50
A (Aktif)	Peranti Penyimpanan	45	83
B (Syarahan)	Peranti Penyimpanan	38	53
B (Aktif)	Peranti /Output	25	66

Ujian pra dan pasca dijalankan menggunakan kuiz yang telah dijalankan menggunakan Quizizz iaitu sebelum dan selepas sesi pembelajaran dilakukan seperti dalam Jadual 1. Bagi setiap tajuk, pensyarah telah menggunakan Teknik pembelajaran yang berbeza iaitu kuliah dan pembelajaran aktif. Hasil pembelajaran menggunakan pembelajaran aktif dan kolaborasi adalah lebih baik berbanding menggunakan kaedah pemeblajaran tradisional iaitu syarahan.

Komersial

Menggunakan strategi pentaksiran autentik dalam PII di Malaysia atau kawasan setempat memudahkan pelajar mendapat pendedahan dan peluang pekerjaan dalam industri di Malaysia.

Penggunaan teknologi

Perisian yang digunakan untuk E-learning, Wiki, enjin carian seperti Google, ChatGPT dan yang bersesuaian. Selain itu, perisian kolaborasi khas seperti ClickUP dan WhatUp turut digunakan. Penilaian Quizizz digunakan untuk Kuiz. Pelajar juga menggunakan perisian seperti Canva dan Power Point untuk persediaan pembentangan.

Element Pendidikan 4.0

Pembelajaran dan pengajaran secara berkumpulan, terdiri daripada tiga hingga empat pelajar, di mana setiap pelajar bertanggungjawab menyiapkan sub topik yang berkaitan. Untuk memeastikan setiap pelajar mempunyai masa untuk membuat pembentangan di dalam kelas, mereka telah membuat sesi pembentangan sesama pelajar iaitu antara dua kumpulan. Ini melatih pelajar memahami isi kandungan dan bahan yang disediakan, mencari bahan tambahan di internet, oleh itu mereka perlu berkomunikasi, berkolaborasi, serta menggunakan kemahiran berfikir dan kreativiti. Pada akhir sesi, setiap kumpulan akan membuat pembentangan di antara dua kumpulan terpilih.

Impak

Impak dan kelebihan strategi pembelajaran aktif dari segi pentaksiran pelajar yang semakin baik. Penilaian pembentangan juga dilakukan sesame pelajar iaitu pentaksiran rakan sebaya digunakan. Pelajar menerima maklum balas daripada pensyarah dan rakan sebaya.

Impak kepada pembelajaran dan pengajaran dapat meningkatkan 4C (*Collaboration, Communication, Critical Thinking, Creativity*) atau 4K pelajar, iaitu dari segi komunikasi, kreativiti, pemikiran kritikal dan kolaborasi iaitu pelaksanaan kerja berkumpulan.

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ID 78: PEMBELAJARAN SERVIS: PENDEKATAN INOVASI MELALUI KEM SEMARAK RUKUN ISLAM

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Sorotan: Pembelajaran servis merupakan pendekatan inovatif yang menggabungkan elemen pembelajaran akademik dengan pengalaman praktikal melalui khidmat komuniti. Kajian ini meneliti keberkesanan pelaksanaan **Kem Semarak Rukun Islam** sebagai platform pembelajaran servis dalam kursus Kaedah Dakwah dan Pengurusan. Kem ini direka untuk mengasah kemahiran kepimpinan dan dakwah pelajar dengan lebih mendalam, sambil memperkukuhkan pemahaman mereka terhadap lima Rukun Islam. Melalui penglibatan langsung dengan komuniti, pelajar didorong untuk mengaplikasikan pengetahuan teori dalam situasi sebenar, sekaligus memperkaya pengalaman pembelajaran mereka. Hasil kajian menunjukkan bahawa pelaksanaan Kem Semarak Rukun Islam bukan sahaja meningkatkan kefahaman pelajar mengenai prinsip-prinsip Islam, tetapi juga mengembangkan keupayaan mereka dalam menyampaikan dakwah secara berkesan dan membina jati diri yang kuat sebagai pemimpin masa depan. Kem ini membuktikan bahawa pembelajaran servis dapat menjadi kaedah yang efektif dalam membina kemahiran kritikal dan empati pelajar dalam konteks dakwah dan pengurusan, sekaligus mempersiapkan mereka untuk menghadapi cabaran kepimpinan dalam dunia yang semakin kompleks dan dinamik.

Keywords: *Pembelajaran Servis; Inovasi Pelajar; Pendekatan Dakwah*

Latar Belakang

Projek ini bertujuan untuk memperkenalkan pembelajaran servis dalam kursus Kaedah Dakwah dan Pengurusan melalui pelaksanaan pendekatan Kem Semarak Rukun Islam. Ia berfokus kepada pembangunan kemahiran dakwah, kepimpinan, dan pengurusan pelajar melalui aktiviti praktikal yang berasaskan komuniti, sambil mengukuhkan pemahaman terhadap lima Rukun Islam. Projek ini beraspirasi untuk menghubungkan teori dengan amalan, memperkasakan pelajar sebagai pemimpin dakwah yang berwawasan, dan membentuk jati diri serta daya juang yang mantap. Kajian mengenai tahap pemahaman kanak-kanak tentang Rukun Islam adalah merupakan bidang yang sangat penting dalam pendidikan agama Islam. Berikut adalah beberapa permasalahan utama yang sering timbul dalam kajian tersebut:

- Tahap Pemahaman Berbeza Mengikut Umur:

Kanak-kanak pada pelbagai peringkat umur mempunyai tahap pemahaman yang berbeza terhadap konsep Rukun Islam. Kajian perlu mengkaji bagaimana kanak-kanak pada peringkat pra-sekolah, sekolah rendah, dan sekolah menengah memahami dan menghayati setiap rukun tersebut.

- Perbezaan Kaedah Pengajaran:

Kaedah pengajaran yang berbeza boleh mempengaruhi tahap pemahaman kanak-kanak. Kajian boleh meneliti kesan kaedah tradisional (seperti ceramah dan hafalan) berbanding kaedah moden (seperti penggunaan teknologi dan pembelajaran interaktif) dalam menyampaikan ilmu tentang Rukun Islam.

- Peranan Keluarga dan Persekitaran:

Pengaruh keluarga dan persekitaran sosial terhadap pemahaman kanak-kanak juga merupakan aspek penting. Kajian boleh melihat bagaimana amalan keluarga, persekitaran sekolah, dan komuniti setempat menyumbang kepada pemahaman kanak-kanak tentang Rukun Islam.

- Motivasi dan Minat Kanak-Kanak:

Tahap motivasi dan minat kanak-kanak untuk mempelajari Rukun Islam juga mempengaruhi pemahaman mereka. Kajian boleh meneliti faktor-faktor yang mempengaruhi motivasi dan minat ini, seperti gaya pengajaran guru, suasana kelas, dan ganjaran yang diberikan.

Objektif Projek

- Meningkatkan pemahaman dan penghayatan pelajar terhadap lima Rukun Islam melalui pengalaman praktikal dan refleksi kritis.
- Membina dan mengukuhkan kemahiran dakwah dan kepimpinan pelajar dalam situasi kehidupan sebenar.
- Menggalakkan penglibatan komuniti melalui aktiviti khidmat masyarakat yang berteraskan nilai-nilai Islam.
- Membangunkan sikap empati, tanggungjawab sosial, dan semangat sukarelawan di kalangan pelajar.

- Menilai keberkesanan pembelajaran servis sebagai kaedah pengajaran dan pembelajaran dalam kursus ini.

Reka Bentuk Projek

Projek ini melibatkan pelajar dalam satu program kem intensif satu yang dikenali sebagai Kem Semarak Rukun Islam. Program ini akan dijalankan dengan kerjasama masjid dan komuniti setempat dan akan merangkumi beberapa komponen utama:

- Modul Interaktif dan Kuliah: Sesi ini akan memfokuskan kepada teori dan konsep lima Rukun Islam, kaedah dakwah, dan kemahiran pengurusan. Kuliah akan melibatkan simulasi, permainan peranan, dan kajian kes untuk mengasah kemahiran komunikasi, kerjasama, dan penyelesaian masalah.
- Aktiviti Khidmat Komuniti: Pelajar melaksanakan aktiviti khidmat komuniti seperti ceramah dan **program *explorace*** dan **Kuiz** untuk **anak-anak Mualaf** dan anak-anak staf UTM
- Dalam menjayakan "KEM SEMARAK RUKUN ISLAM" yang dianjurkan kepada para peserta, pihak penganjur telah menyediakan beberapa aktiviti menarik yang berkaitan dengan objektif program ini. Antaranya *Explorace* "RUKUN ISLAM" dan kuiz. Oleh yang demikian, diharapkan program ini dapat memberi sedikit sebanyak ilmu pengetahuan serta dapat meningkatkan lagi kefahaman peserta berkaitan rukun islam.
- Aktiviti pertama yang dijalankan ialah *Explorace* "RUKUN ISLAM". Peserta akan dibahagiakan kepada 5 kumpulan, di mana setiap kumpulan terdiri daripada 8 peserta. Kem ini mempunyai 5 checkpoint utama aktiviti yang berlatar belakangkan rukun islam pada setiap checkpoint. Setiap kumpulan perlu menyelesaikan aktiviti di semua checkpoint dalam tempoh masa yang diberikan dan mengumpul mata daripada setiap checkpoint untuk menyelesaikan aktiviti ini.
- Aktiviti kedua ialah Kuiz. Setiap kumpulan perlu berbincang untuk menyelesaikan kuiz tersebut.Fasilitator perlu bersama-sama memberi pendapat ke pada peserta dalam membatu mereka untuk mendapatkan jawapan yang betul.
- Aktiviti ketiga: Nyanyian lagu rukun Islam setiap kali sebelum mula aktiviti pertama dan kedua. Pendekatan ini sangat sesuai diaplikasi pada anak-anak sebagai kaedah dakwah.
- Sesi Refleksi dan Tindak Balas: Pelajar akan mengambil bahagian dalam sesi refleksi harian untuk berkongsi pengalaman, pembelajaran, dan pandangan mengenai aplikasi praktikal Rukun Islam dan nilai-nilai dakwah.





Rajah 1

Kaedah Penilaian

- Keberkesanan projek ini akan dinilai melalui pelbagai kaedah, termasuk
- Penilaian awal dan akhir terhadap pemahaman pelajar mengenai Rukun Islam dan kaedah dakwah.
- Soal selidik kepuasan pelajar mengenai pengalaman pembelajaran mereka semasa kem.
- Pemerhatian langsung terhadap penglibatan pelajar dalam aktiviti kem.
- Ulasan daripada komuniti mengenai impak dan keberkesanan aktiviti yang dijalankan oleh pelajar.
- Sesi refleksi pasca-program untuk menilai impak peribadi dan profesional pelajar.

Novelty

Projek ini memperkenalkan konsep **Pembelajaran Servis** dalam kursus Dakwah dan Pengurusan dengan menggunakan **Kem Semarak Rukun Islam** sebagai platform praktikal untuk mengintegrasikan teori dan amalan. Keunikan pendekatan ini terletak pada penggunaan aktiviti kem yang interaktif, di mana pelajar tidak hanya belajar mengenai prinsip-prinsip Islam dan kaedah dakwah secara teori, tetapi juga menerapkan pengetahuan mereka dalam situasi kehidupan sebenar melalui aktiviti khidmat masyarakat. Kaedah ini memberikan dimensi baru dalam pengajaran kursus yang biasanya dilaksanakan secara konvensional di dalam bilik kuliah.

Kebolehgunaan

Pendekatan ini mudah diterapkan di institusi pendidikan lain yang menawarkan kursus serupa kerana ia menggunakan model pembelajaran yang fleksibel dan boleh disesuaikan mengikut konteks lokal. Program **Kem Semarak Rukun Islam** boleh diadaptasi untuk pelbagai tahap pendidikan dan kumpulan pelajar, menjadikannya sangat berkesan untuk pembelajaran interaktif. Selain itu, pelajar dapat mengaplikasikan pengetahuan yang diperoleh terus kepada komuniti, memperkukuhkan kebolehgunaan ilmu dalam kehidupan sebenar dan memperkuat hubungan antara institusi pendidikan dan masyarakat setempat.

Inovasi

Pendekatan pembelajaran servis melalui **Kem Semarak Rukun Islam** merupakan satu inovasi yang menggabungkan pengalaman praktikal dengan pendidikan formal. Ia mendorong pelajar untuk belajar secara aktif, berfikir secara kritis, dan bertindak sebagai agen perubahan dalam komuniti mereka. Dengan menggunakan pendekatan yang berpusatkan pelajar dan mengutamakan penglibatan aktif, projek ini menawarkan inovasi dalam pedagogi kursus yang berfokus kepada keberkesanan dakwah dan pengurusan Islam.

Kreativiti

Projek ini memanfaatkan pendekatan kreatif dalam pengajaran dan pembelajaran dengan menggunakan aktiviti seperti permainan peranan, simulasi, bengkel interaktif, dan aktiviti khidmat masyarakat yang menyeronokkan tetapi penuh makna. Elemen kreatif ini tidak hanya menjadikan proses pembelajaran lebih menarik dan berkesan, tetapi juga memberi peluang kepada pelajar untuk meneroka dan mengembangkan cara baru untuk berdakwah dan memimpin, sesuai dengan keperluan serta cabaran dunia moden.

Impak Diharapkan

Projek ini diharapkan dapat:

- Mencipta pengalaman pembelajaran yang bermakna dan relevan bagi pelajar dalam kursus Kaedah Dakwah dan Pengurusan.
- Menghasilkan pelajar yang lebih bersedia, berkeyakinan, dan berkemahiran dalam menyampaikan dakwah dengan pendekatan yang inovatif dan efektif.
- Memperkukuhkan hubungan antara institusi pendidikan dengan komuniti melalui aktiviti yang bermanfaat dan bersifat kolaboratif.
- Menyumbang kepada pembentukan pemimpin dakwah yang berintegriti dan berwawasan bagi masa depan.

Kesimpulan

Projek Kem Semarak Rukun Islam ini merupakan inisiatif inovatif yang menyepadukan pembelajaran akademik dengan amalan praktikal melalui pembelajaran servis. Dengan memberi penekanan kepada aplikasi nilai-nilai Islam dalam kehidupan harian dan pembangunan kemahiran kepimpinan, projek ini diharap dapat melahirkan generasi pelajar yang bukan sahaja cemerlang dalam ilmu, tetapi juga unggul dalam akhlak dan tindakan.

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ID 79: Integrating Immersive Blended-Cooperative Learning (IBCL) with Essential Industrial-Based Skills Development for Future-Ready Engineering Graduates

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Highlights: This innovation focuses on enhancing engineering education by integrating Immersive Blended-Cooperative Learning (IBCL) with essential industrial-based skills development. The project aims to equip future-ready engineering graduates with critical skills such as teamwork, software proficiency, problem-solving, and practical engineering competencies. By combining advanced technological tools with cooperative learning strategies and real-world problem-solving, the framework ensures that students are not only academically proficient but also well-prepared to meet the demands of the modern engineering industry. This approach fosters a comprehensive learning experience that bridges the gap between academic knowledge and industry expectations.

Keywords: *Immersive Blended-Cooperative Learning (IBCL); Industrial-Based Skills; Teamwork; Problem-Solving; Engineering Education.*

Innovation Introduction

The engineering industry is rapidly evolving, requiring graduates to possess not only technical proficiency but also critical industrial-based skills such as teamwork, software proficiency, problem-solving, and engineering competencies. Traditional engineering education, which often emphasizes theoretical knowledge, falls short in preparing students for the complexities of the modern workforce. To address this gap, this innovation introduces the integration of Immersive Blended-Cooperative Learning (IBCL) with a focus on developing these essential skills (Evenhouse et al., 2023). This approach builds upon the UMS Active Learning in Engineering Education (UMS-ALIEN) framework as shown in Figure 1, which has already shown significant improvements in student engagement and learning outcomes through the use of active, collaborative, and problem-based learning strategies (Blanch et al., 2022).

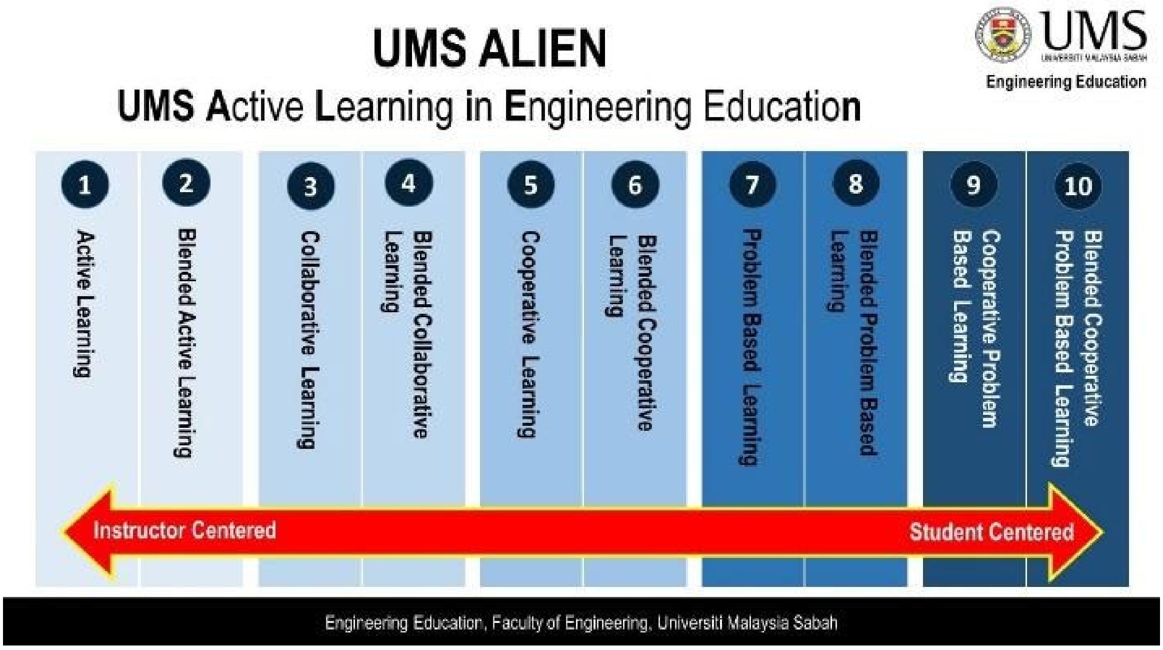

Figure 1: UMS Active Learning in Engineering Education (UMS-ALIEN).

This innovation framework is crucial because it meets the growing demand for engineering graduates to possess not only technical expertise but also essential industrial-based skills. By integrating IBCL with real-world applications and advanced technological tools, the framework ensures that students are not only engaged and motivated but also fully prepared to meet the complex demands of modern engineering industries, effectively bridging the gap between academic learning and professional practice (Vodovozov et al., 2022).

In achieving this innovation key goals, several objectives have been planned:

Enhance Collaboration and Technical Proficiency: Implement cooperative learning strategies that foster teamwork and integrate advanced, industry-relevant software tools into the curriculum, ensuring students develop both collaboration skills and technical proficiency necessary for modern engineering practices.

Strengthen Problem-Solving and Engineering Competencies: Utilize problem-based learning (PBL) to engage students in real-world engineering challenges, enhancing their critical thinking, problem-solving abilities, and practical application of engineering principles, aligning their skills with industry expectations.

Improve Student Engagement and Learning Outcomes: Leverage the IBCL framework to create an interactive and dynamic learning environment that boosts student engagement, retention, and overall academic performance, preparing them to excel in a fast-evolving engineering landscape.

These objectives concisely address the key goals of the innovation, ensuring a comprehensive development of essential skills for future engineers.

NALI Implementation

The NALI implementation through the integration of IBCL and the UMS-ALIEN framework represents a significant advancement in engineering education. The novelty of this innovation lies in its unique blend of traditional face-to-face instruction with digital tools and cooperative activities, creating a comprehensive, adaptive learning environment tailored specifically for engineering students. This approach prioritizes real-world applicability by incorporating industry-relevant software tools and problem-solving exercises, ensuring that students develop practical skills directly transferable to the workplace. The creativity of the innovation is reflected in its seamless fusion of active, blended, and cooperative learning strategies into a cohesive framework that enhances each component's effectiveness while addressing the limitations of traditional education methods. By fostering an immersive and interactive learning environment that emphasizes essential industrial-based skills like teamwork, software proficiency, and problem-solving, this innovation ensures that graduates are well-prepared to meet the demands of the modern workforce.

The innovation's impact is profound, significantly enhancing student engagement, motivation, and learning outcomes. It transforms traditional teaching methods by creating a dynamic and relevant educational experience that aligns closely with industry expectations. Furthermore, the innovativeness of this approach lies in its scalability and adaptability, making it applicable across various disciplines and educational settings. The structured framework can be seamlessly integrated into existing curricula, allowing institutions to adopt it at a pace that suits their needs. This broad applicability ensures that the benefits of this approach extend beyond engineering, supporting lifelong learning and continuous improvement in various educational contexts. Ultimately, the NALI approach, as implemented through IBCL and UMS-ALIEN, not only prepares students to excel in a rapidly evolving industry but also contributes to the development of a skilled and adaptable workforce, benefiting both the industry and society as a whole. Figure 2 shows the developed IBCL framework for UMS Process Simulation course.

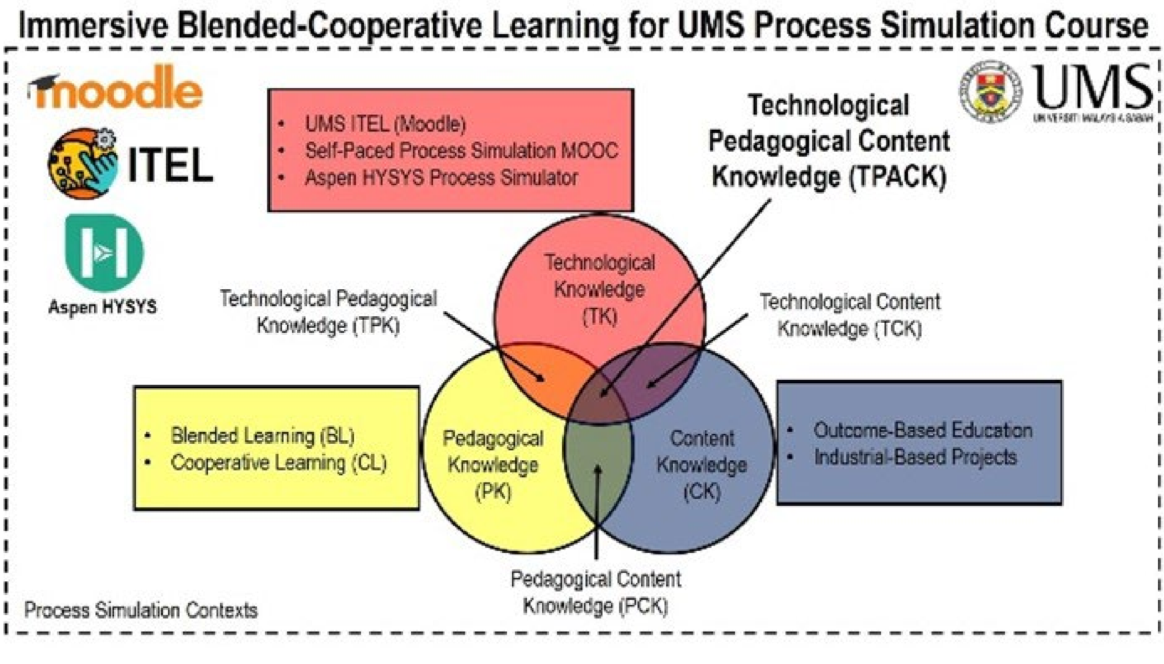

Figure 2: Immersive Blended-Cooperative Learning for UMS Process Simulation Course

Research Methodology

This research follows a systematic approach to integrate and evaluate the IBCL framework within the UMS-ALIEN model:

Design and Implementation:

Framework Integration: IBCL is combined with traditional and digital teaching methods in engineering courses, incorporating industry-relevant tools.

Curriculum Adaptation: Courses are redesigned to build skills progressively, from foundational to advanced levels, with clear industry-aligned outcomes.

Data Collection:

Quantitative Data: Surveys and assessments track student engagement, knowledge retention, and skill development before and after IBCL implementation.

Qualitative Data: Focus groups, reflection journals, and interviews provide insights into student experiences and challenges.

Analysis:

Comparative Analysis: Data is compared to measure improvements in student outcomes, using statistical methods.

Thematic Analysis: Qualitative data is analyzed to identify key themes like teamwork and problem-solving effectiveness.

Evaluation and Iteration:

Feedback Loop: Analysis results guide continuous improvements to the IBCL framework through iterative cycles.

This approach rigorously evaluates the innovation's impact on enhancing engineering education and preparing students for the workforce.

Findings and Discussions

Figure 3 presents the results of a thematic analysis of students' learning reflection journals from the KC32603 Process Simulation & Integration course. The analysis identifies the top 10 skills that students developed through their participation in the course, with the skills ranked according to their normalized scores.

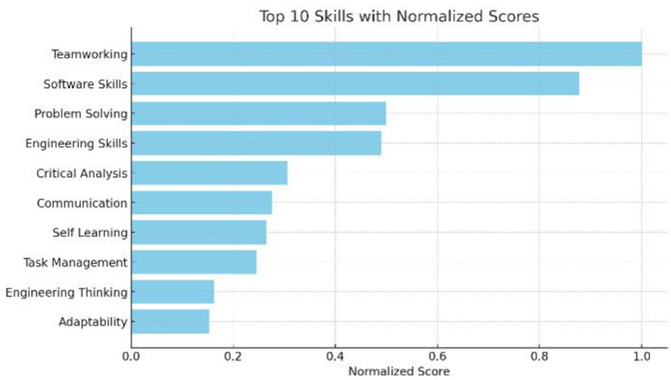

Figure 3: Top 10 Skills Developed by Students under IBCL Implementation

Analysis of the Top Four Skills from Thematic Analysis:

Teamworking (Highest Score):

Teamworking being the highest-scoring skill indicates that the KC32603 Process Simulation & Integration course strongly promotes collaboration among students. This is crucial in engineering, where projects often require multidisciplinary teamwork to solve complex problems. The high score suggests that students are not only engaging in teamwork but also mastering the ability to work effectively in teams, sharing responsibilities, and learning from each other.

Software Skills:

The significant emphasis on software skills highlights the course's focus on ensuring students are proficient with the technical tools required in the engineering industry. This likely includes simulation software such as Aspen HYSYS, which is central to process engineering. The high score in software skills indicates that students are gaining practical, hands-on experience with these tools, which is essential for their future roles in the industry where digital competency is increasingly important.

Problem Solving:

Problem-solving is a critical skill in engineering, and its high ranking reflects the course's success in developing students' abilities to approach and resolve complex challenges. The course likely uses PBL techniques to engage students in real-world scenarios, requiring them to apply their knowledge and critical thinking skills to find effective solutions. This skill is particularly vital in process simulation, where students must navigate and resolve intricate system behaviors and design issues.

Engineering Skills:
The high score in engineering skills underscores the course's effectiveness in teaching core engineering principles and practices. Students are likely engaging in activities that require the application of theoretical concepts to practical situations, bridging the gap between classroom learning and real-world engineering. This suggests that the course successfully equips students with the fundamental engineering skills needed for their professional careers, ensuring they can translate academic knowledge into practical applications.

Overall Analysis:
The top four skills - teamworking, software skills, problem-solving, and engineering skills - are all essential for success in the engineering industry. The high scores in these areas suggest that the KC32603 Process Simulation & Integration course is effectively preparing students to meet the demands of their future careers. By focusing on these critical skills, the course ensures that graduates are not only technically proficient but also capable of working collaboratively, using industry-standard tools, and applying engineering principles to solve real-world problems. This holistic development of skills aligns with the objectives of the IBCL and UMS-ALIEN frameworks, aiming to produce future-ready engineers who are well-prepared for the challenges of a rapidly evolving industry.

Awards Received

Table 1 shows a summary of the awards received for various teaching and learning innovations in engineering education:

Table 1: List of Awards Received in Competition

No.	Title of Project/Innovation	Award	Competition	Year
1.	Empowering Chemical Engineering Student's Teamworking Skills through Blended Cooperative Learning	Silver	The 3rd International Competition on Sustainable Education 2024 (SUSED 2024)	2024
2.	Immersive Blended-Cooperative Learning Experience in Developing Engineering Student's Team Working Skills	Bronze	International University Carnival on e-Learning 2023 (IUCEL 2023)	2023
3.	Process Simulation using Aspen HYSYS	Gold	International Virtual e-Content Development Competition (e-CONDEV 2023)	2023
4.	Aspen HYSYS for Supporting Blended-Cooperative Learning Chemical Engineering Process Design Class	Silver	International Teaching and Learning Innovation Carnival (iTELIC 2023)	2023
5.	Immersive Blended-Cooperative Learning Experience for Engineering Programming Course	Gold	International Competition for Educational Innovation and Research (EDUINNOVATION 2023)	2023
6.	An Immersive Experience in Process Equipment Design Course: Real Industrial Project Oriented Role Playing Learning Experience	Bronze	International Competition for Educational Innovation and Research (EDUINNOVATION 2023)	2023
7.	Immersive Blended-Cooperative Learning Experience in Chemical Engineering Courses	Gold	International Putra Innocreative Competition (i-PicTL 2022)	2022
8.	UMS-ALIEN: UMS Active Learning in Engineering Education	Silver	Pertandingan Rekacipta UMS 2022 (PEREKA 2022)	2022
9.	Introduction to Process Simulation using Aspen HYSYS	Gold	International Virtual e-Content Development Competition (e-CONDEV 2022)	2022

Summary

This innovation integrates Immersive Blended-Cooperative Learning (IBCL) with the UMS Active Learning in Engineering Education (UMS-ALIEN) framework to enhance engineering education by developing essential industrial-based skills such as teamwork, software proficiency, problem-solving, and engineering competencies. Through a combination of traditional face-to-face instruction, digital learning tools, and cooperative activities, this approach fosters a dynamic and interactive learning environment that mirrors real-world engineering challenges. The innovation has been recognized with multiple awards for its effectiveness in preparing students to meet the demands of the modern engineering industry, ensuring they are not only technically proficient but also equipped with the critical soft skills needed to succeed in their careers.

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ID 80: Immersive Learning: Empowering TVET Education through Virtual Reality

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Highlights: In the rapidly evolving TVET Education, bridging the gap between theoretical and practical remains a significant challenge. Traditional methods often struggle to provide a seamless integration of these essential components, leading to a disconnect that can hinder students' ability to apply what they learn in real-world settings. This paper explores the potential of Virtual Reality (VR) as a transformative tool to bridge this gap in TVET education. By leveraging the capabilities of VR, educators can create environments where students can simultaneously engage with theoretical concepts and apply them in practical scenarios. VR offers a safe, controlled space for hands-on learning, allowing students to experiment, make mistakes, and refine their skills without real-world risks. The paper concludes that the adoption of VR in TVET education can significantly improve the quality of vocational training, ensuring that graduates are not only knowledgeable but also proficient in applying their knowledge in practical, real-world situations.

Keywords: *Virtual Reality(VR), TVET Education, Bridging Gap, Transformative Tool*

Introduction

Technical and Vocational Education and Training (TVET) plays a critical role in equipping individuals with the practical skills necessary for the workforce. However, one of the ongoing challenges in TVET education is effectively bridging the gap between theoretical knowledge and practical application. While theory provides the essential foundations, practical skills are what enable students to perform tasks efficiently and confidently in their chosen professions. The integration of both is crucial for the success of TVET programs and the development of a competent workforce.

The gap between theoretical knowledge and practical application has long been a challenge in education, professional training, and various industries. Theoretical learning involves understanding concepts, principles, and frameworks that form the basis of a given discipline. Traditionally, this knowledge is conveyed through textbooks, lectures, and discussions. However, these methods often fail to engage students deeply or to demonstrate the relevance of theoretical knowledge in real-world scenarios. Virtual Reality (VR) offers a transformative solution by providing immersive, interactive environments that bridge the gap between theory and practice. VR can provide instant feedback, allowing learners to understand the consequences of their actions and decisions in real time.

Objective

The objectives of this project are as per following;

- to integrate Virtual Reality (VR) technology into Technical and Vocational Education and Training (TVET) programs to create a seamless connection between theoretical knowledge and practical application.
- **to provide hands-on experience in safe setting through** VR simulations where students can practice applying theoretical knowledge in realistic, yet risk-free environments, particularly in high-risk fields like construction etc.
- **to increase student engagement and motivation** by utilize the engaging nature of VR to make learning more dynamic and enjoyable, encouraging students to explore the relationship between theory and practice more deeply.

Literature Review

Introduction

Technical and Vocational Education and Training (TVET) plays a critical role in equipping individuals with the practical skills and knowledge necessary for various professions. With the rapid advancement of digital technologies, traditional TVET methods are increasingly being complemented or even replaced by virtual learning environments.

The Role and Benefits of Virtual Learning in TVET

<u>Enhancing Practical Skills Through Simulations</u>
Virtual Learning in TVET often includes the use of simulations to replicate real-world tasks in a controlled environment. According to Thakur et al. (2024), virtual reality enhances learning by creating interactive virtual worlds for students to engage with, revolutionizing education by providing innovative teaching methods for better understanding of concepts.

<u>Flexibility and Accessibility</u>
Digital pedagogies, such as blended learning and simulation-based learning, promote autonomous learning and educational collaboration, significantly enhancing flexibility in TVET settings (Chen & Chan, 2024). A study conducted by Richa Kapoor Mehra (2024) stated that VR in education enhances student engagement, critical thinking, and

problem-solving skills. It offers immersive experiences that empower learners, fostering a transformative learning environment post-pandemic.

Personalized Learning Experiences
Virtual learning environments offer the possibility of personalized education, where learners can progress at their own pace and focus on areas where they need the most improvement. VR in higher education enhances student engagement and learning outcomes through simulations, virtual labs, and experiential learning, fostering cognitive skills, teamwork, and career readiness for graduates (C.L Goi, 2024). Challenges like costs and technical issues exist but VR shows promise in education (Paramita et al. 2024). Adaptive learning technologies can tailor content to individual needs, ensuring a more effective learning experience.

Cost-Effectiveness
Traditional TVET programs often require expensive materials, equipment, and facilities. VR in education enhances learning by providing interactive, risk-free experiences. Despite challenges like cost and accessibility, VR technology advancements offer promising solutions for teachers and students (Rinku Chauhan & Shavnam, 2024). This makes TVET more accessible to a broader population.

Challenges of Virtual Learning in TVET

Technological Barriers
Despite the advantages, many regions in developing countries suffer from unreliable internet access, which hampers the effectiveness of VR. Offline solutions, such as the offline virtual laboratory provide a viable alternative, allowing students to engage with educational content without constant internet reliance (Agieb et al. 2023). The lack of advanced hardware is a critical barrier. Latifi et al.(2022) identified that inadequate telecommunications infrastructure and low hardware literacy contribute to dissatisfaction with virtual learning experiences.

Lack of Hands-On Experience
While simulations and virtual labs are useful, they cannot entirely replace the hands-on experience that is crucial in many vocational fields. Research shows that blended learning, which combines physical and online methods, is more effective for vocational skills training than purely online formats (Hu et al., 2024). This limitation suggests that virtual learning should complement rather than replace traditional hands-on training.

Instructor Readiness and Pedagogical Challenges
The success of virtual learning in TVET depends heavily on the readiness and willingness of instructors to adapt to new technologies. Many educators face difficulties in adopting Information and Communication Technology (ICT) tools due to inadequate training and technical skills.

Future Directions and Research Gaps

Integrating Emerging Technologies
The future of virtual learning in TVET is likely to be shaped by the integration of emerging technologies such as Artificial Intelligence (AI), Augmented Reality (AR), and Machine Learning (ML). These technologies have the potential to create even more immersive and adaptive learning environments, further enhancing the effectiveness of virtual learning (Bailenson, 2018).

Longitudinal Studies on Learning Outcomes
While there is substantial evidence supporting the short-term benefits of virtual learning in TVET, there is a lack of longitudinal studies examining its long-term impact on skill retention, job performance, and career progression. Understanding how virtual learning influences these outcomes is crucial for evaluating its effectiveness as a training tool (Means et al., 2014).

Addressing Equity and Inclusion
Ensuring equitable access to virtual learning in TVET remains a significant challenge. Future research should focus on developing strategies to overcome technological barriers and ensure that all students, regardless of their socio-economic background, can benefit from virtual learning (Jensen & Konradsen, 2018).

NALI approach

In the rapidly evolving landscape of Technical and Vocational Education and Training (TVET), the integration of Virtual Reality (VR) as part of the New Academia Learning Innovation (NALI) approach represents a shift towards immersive, student-centered learning.

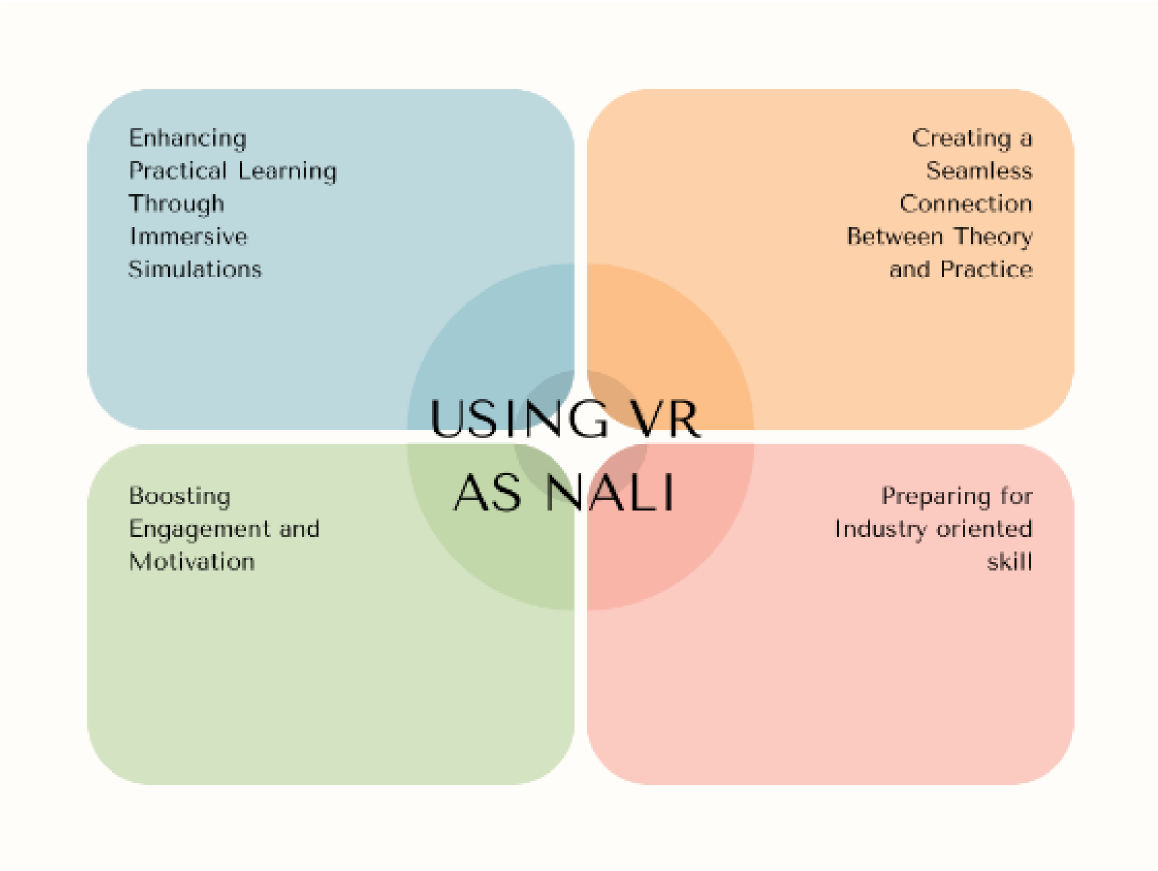

Figure 1. NALI Approach related to VR based learning

Enhancing Practical Learning Through Immersive Simulations

At the core of TVET education is the need to equip students with hands-on skills that are directly applicable in the workforce. VR addresses these challenges by providing students with immersive simulations where they can practice applying their theoretical knowledge in a controlled, risk-free environment. This not only enhances the safety of the learning process but also allows students to experiment, make mistakes, and learn from them without real-world consequences.

Creating a Seamless Connection Between Theory and Practice

One of the key principles of the NALI approach is the seamless integration of theory and practice. VR plays a pivotal role in achieving this by offering a platform where students can immediately apply what they have learned in a virtual setting that closely mirrors real-life scenarios. For example, a student studying building components can learn about joint and connection systems in the classroom and then use VR to disassemble and reassemble a virtual system, reinforcing their understanding through direct application.

Boosting Engagement and Motivation

The engaging nature of VR is another significant advantage in the context of NALI. Traditional teaching methods can sometimes struggle to capture students' interest, especially when dealing with complex or abstract concepts. VR, with its interactive and immersive nature, makes learning more dynamic and enjoyable. By allowing students to "step into" the learning environment, VR fosters a deeper connection to the material, encouraging them to explore the relationship between theory and practice more thoroughly. This increased engagement often translates into higher motivation levels, better retention of knowledge, and ultimately, more successful learning outcomes. VR provides immersive and interactive environments, which can significantly improve students' engagement and retention of complex concepts compared to traditional methods (Henstrom et al. 2023).

Industry-oriented skills

Industry-oriented skills refer to the specific abilities and competencies that are directly aligned with the needs and demands of the job market and industries. These skills are tailored to ensure that individuals are well-prepared to meet the challenges of their specific fields and can contribute effectively to their workplaces. VR facilitates collaborative learning experiences, enabling students to work together in virtual environments, which mirrors industry practices (Henstrom et al. 2023). Industry-oriented skills are often developed through practical training, hands-on experience, and education programs that focus on real-world applications. Effective Clash Detection: Utilizing VR tools allows students to visualize and resolve clashes in 3D models, fostering a deeper understanding of spatial relationships and design coordination (Raimbaud et al. 2019).

Research Methodology

Flowchart

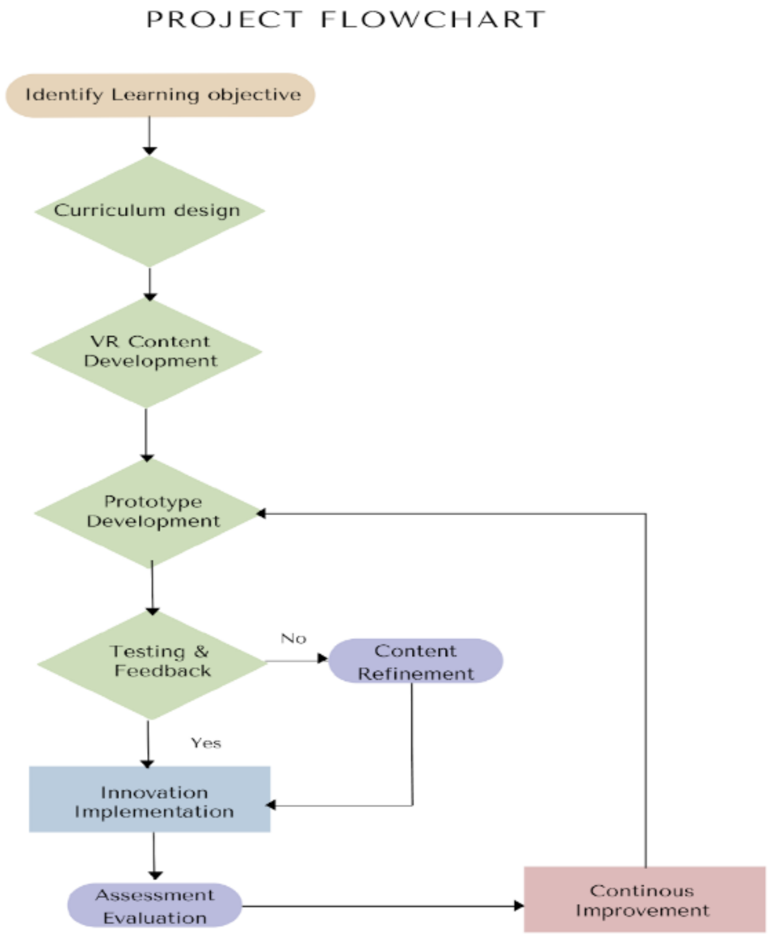

Figure 2. Innovation Process Flow chart

Software & Hardware Application

Virtual learning in TVET encompasses a range of software and hardware to enhance the learning experience.

Figure 3. VR Apparatus: Meta Oculus

Figure 4. BIM Lab in POLISAS

Finding and Discussion

Bridging Gaps Between Theory and Practical

VR allows students to "enter" a virtual construction site, where they can explore and interact with the various elements of a building project in a 3D environment. This hands-on, immersive experience is invaluable for students with no prior site exposure, as it enables them to visualize construction processes, understand the sequence of tasks, and comprehend the roles of different trades involved in a project. They can witness how structures are built from the ground up, how materials are assembled, and how systems like plumbing and electrical wiring are integrated into the overall design.

On another aspect, safety, a major concern on any construction site, can also be effectively taught through VR. Students can be exposed to simulated hazardous scenarios, where they learn to identify potential risks and practice safety protocols in a controlled, virtual environment. This helps them develop situational awareness and understand the importance of safety measures before stepping onto a real construction site.

Enhancing comprehension on Clash Detection and BIM

Clash detection within BIM involves the automatic identification of interferences or overlaps between various components in the design. BIM simplifies this process by offering a 3D model where all elements are visible, making it easier to spot and resolve clashes before construction begins. However, understanding clash detection and its implications can be challenging, especially for students. This is where Virtual Reality (VR) technology plays a transformative role in enhancing comprehension. VR allows students to immerse themselves in a 3D virtual environment, where they can interact with complex building models by allowing users to "walk through" the building model and visualize potential clashes between different components.

Providing Intuitive and Engaging Learning Session

For TVET students, this combination of VR and BIM provides a more intuitive and engaging learning experience. Interactive nature of VR promotes active learning, allowing students to engage directly with BIM models by making changes, testing scenarios, and solving problems collaboratively. This dynamic approach fosters deeper comprehension, enhances retention, and provides a more engaging and stimulating educational experience compared to conventional classroom methods. The synergy between VR and BIM transforms learning into a hands-on, engaging process, improving students' understanding of complex concepts while encouraging collaborative problem-solving and prepares students for the challenges they will face in their professional careers.

Conclusion

As part of the NALI approach in TVET education, VR is redefining the way students acquire and apply knowledge. By offering immersive, practical experiences in a safe and engaging environment, VR not only enhances the effectiveness of skill development but also aligns perfectly with the core principles of student-centered learning and innovation. As this technology continues to evolve, its potential to revolutionize TVET education and prepare students for the challenges of the modern workforce will only grow, making it a critical component of future learning strategies.

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ID 81: ICCubeX: Experiential Learning through the Transformational Incubation Programme

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Highlights: The transformational ICCubeX incubation is a novel methodology that is intended to facilitate the transition from theoretical knowledge to practical application in the fields of innovation, leadership, and entrepreneurship. It provides a dynamic environment in which participants can develop critical skills through hands-on experience, in contrast to traditional learning methods that largely rely on classroom instruction. This program aims to enhance the university's technology commercialisation ecosystem by cultivating high-quality techno-entrepreneurs and boosting income through tech transfer. The program offers workshops, mentorship, and training, promoting a comprehensive approach to innovation and entrepreneurship. The incubator provides experiential learning for real-world ventures, fostering entrepreneurial independence, resilience, and social awareness. ICCubeX supports researchers and students in three phases: Novice, Competence, and Advance. It provides tools, facilities, and industry connections to aid in transforming ideas into commercial ventures. Currently, 11 of 34 participants are poised to commercialise their products, reflecting the program's success and ongoing potential. The study shows strong consensus on technology entrepreneurship's importance, with 93.3% valuing legal, IP, and business model knowledge.

Keywords: *incubation program; experiential learning; transformational incubation; practice-based entrepreneurship.*

Introduction

The ICCubeX incubator initiative to enrich the university's technology commercialisation ecosystem. It focuses on cultivating high-quality techno-entrepreneurs, enhancing income generation through technology commercialisation, and creating a favorable ecosystem for techno-entrepreneurs at Technovation Park. Workshops, mentorship, and training covering various entrepreneurial aspects are critical for sustained success. The ICCubeX incubator initiative stands as a testament to the holistic and forward-looking approach that Universiti Teknologi Malaysia (UTM) is undertaking to foster a thriving ecosystem for innovation and entrepreneurship. The aim of the programme is to embed a blended, experiential learning approach to practice-based entrepreneurship education via an incubator designed to support scalable business start-up and growth. Championing this effort is UTM's Innovation and Commercialisation Centre (ICC), the University's technology transfer office that assists researchers and students in commercialising their research products and establishing spin-offs and start-ups through three phases. Through collaborations with the Centre for Student Innovation & Technology Entrepreneurship, UTM Career Centre, and Students Entrepreneurship Clubs, ICC has developed a three-phase strategic program comprising "Novice", "Competence", and "Advance". Those on board the program are provided with the tools and know-how to become technopreneurs through knowledge transfers, facilities, funds and industry connections support. Novice is an initial stage in which researchers and students are guided through the journey of producing an idea and prototype through experiments and developing proof of concept until it gains Intellectual Property (IP) protection.

Generating innovative ideas requires researchers and students to work on scalable projects. Therefore, final year projects are designed to suit this purpose and are further strengthened by business idea competitions and hackathons. Competence and Advance are phases that accelerate the commercialisation process. For this purpose, UTM has introduced a unique incubation program to support researchers in advancing from Lab-to-Market process called ICCubeX. ICCubeX comprises a mentorship program involving numerous groups of technopreneurs for researchers and a Symbiosis program for postgraduate and undergraduate students that focuses on integrating prospective technologies developed by universities and research centres. In these final phases, spin-offs and start-ups are also provided with facilities such as office, networking room, laboratory or manufacturing spaces and more at UTM's own Technovation Park, reflecting its commitment to end-to-end support for researchers and students.

The incubator offers an opportunity to engage with practice-oriented and experience-based learning applied to real-world venture creation, business development, and acceleration. By focusing on business incubation and start-up in terms of experiential learning, we aim to help support greater entrepreneurial independence and resilience as well as helping to develop greater 'pro-social' awareness amongst incubatees. From the programme, 11 out of 34 participants are currently ready to commercialise products and as a continual process it is expected that all of the participants will continue to develop learning based around the support of the two key axes of 'efficacy' and the 'proposition'.

Content ICCubeX

Objectives

- To enhance the university's technology commercialisation ecosystem
- To provide experiential learning for real-world ventures, fostering entrepreneurial independence, resilience, and social awareness

NALI Approach

Traditionally, entrepreneurship has been valued for driving economic growth and job creation (Anand et al., 2021; Greco & de Jong, 2017; Schumpeter, 1934; Shane & Venkataraman, 2000; Teran-Yepez et al., 2020), but in recent years, its potential to address societal and environmental challenges has gained recognition (Anand et al., 2021; Klapper and Lusardil., 2020; Munoz & Cohen, 2018; Shepherd et al., 2020). Transformational Learning Theory (TLT), rooted in the works of Freire (1971) and Mezirow (1978), has become a key framework in this shift, emphasizing experiential and interactive educational methods (De Satpio, 2017; Kevany, 2007). Social entrepreneurship education (SEE) is crucial in raising awareness and equipping individuals with the skills needed to tackle global issues (Schaltegger & Wagner, 2011). For instance, Coventry University's Transformational Incubation Programme in Ghana, which collaborates with the British Council, applies experiential learning to support scalable business start-ups and growth, demonstrating the practical application of these educational theories (Dobson et al., 2018). However, there is still an absence of a comprehensive, step-by-step upskilling transformational incubation program utilizing modern digital tools, tailored for training young university technopreneurs and new technology transfer officers.

As a leading research university, Universiti Teknologi Malaysia (UTM) plays a crucial role in advancing innovation and commercialisation efforts. Through its Innovation and Commercialisation Centre (ICC), UTM facilitates the protection and commercialisation of research outputs. The university's robust IP portfolio, comprising patents and other forms of IP rights, underscores its commitment to fostering a culture of innovation. Initiatives such as the ICCubeX incubator program provide researchers and entrepreneurs with the necessary resources and support to transform their ideas into viable businesses, startups or spin off companies, further contributing to Malaysia's innovation ecosystem. These programs equip researchers and innovators with the necessary skills and knowledge to navigate the complexities of the commercialisation process. From market analysis and intellectual property protection to business development and marketing strategies, participants gain a holistic understanding of the innovation ecosystem embedded with mentorship and student-researcher-collaborator nexus program. Figure 1 illustrates the innovative ICCubeX incubation program, which integrates students, researchers, technology transfer officers, successful technopreneurs, and industry professionals to foster sustainable entrepreneurial education at an R&D-based university.

At the core of a thriving commercialisation ecosystem are professional technology transfer officers. These key individuals bridge the gap between academia and industry by applying their expertise in technology transfer and commercialisation. They assist researchers through every stage of the lab-to-market process, from identifying commercialisation opportunities and securing intellectual property rights to fostering industry partnerships and navigating regulatory requirements. Their support is crucial throughout the journey. By utilizing the comprehensive ICCubeX playbook, which includes training modules, role plays, case studies, and digital learning tools, we have effectively shared our experience with researchers and other stakeholders, leading to successful international commercialisation.

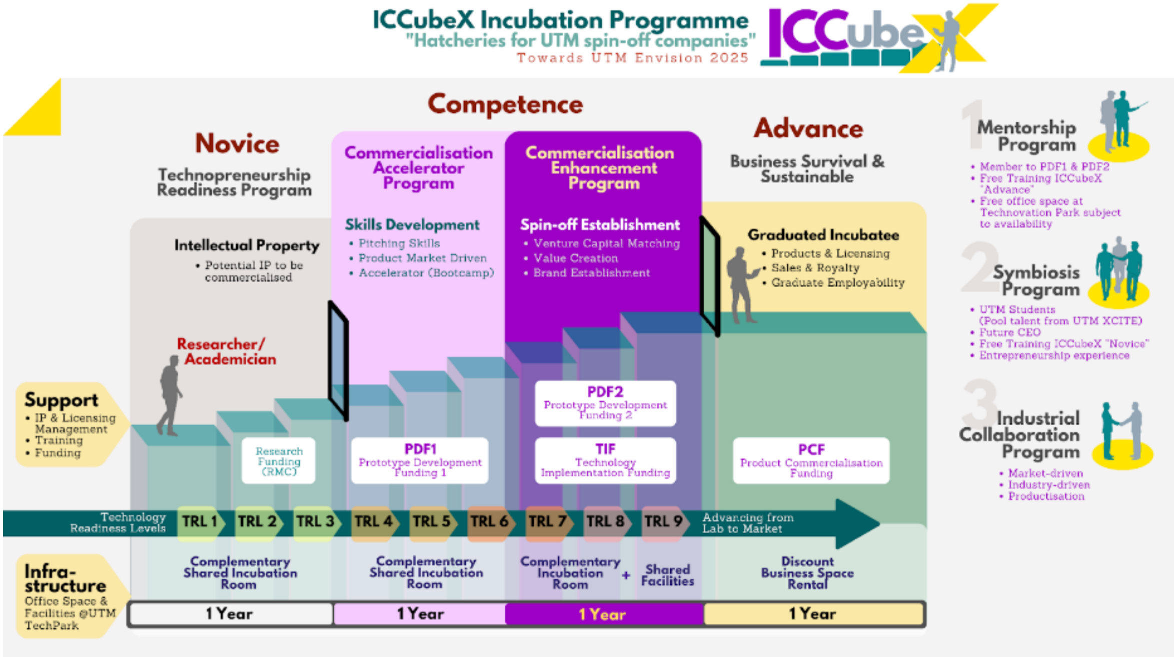

Figure 1 : The novel transformational university ICCubeX incubation Programme

Research Methodology

Bouchrika (2023) divides research approach into quantitative and qualitative. The quantitative approach must contain numerical data for the researchers to analyse to make data-driven decisions that can possibly solve the research questions. Qualitative data can be obtained by observing and analysing people's patterns, emotions, and behaviours. As stated by Solanki (2022), if the research data is collected from the quantitative approach, this type of research design will be experimental or causal research. Since the study used the quantitative approach, this means that this study is applying the survey as the research instrument to collect the relevant data from the target respondents. According to Trigueros, Juan, & Sandoval (2017), the survey contains various types of answering methods, for instance, the questionnaire can apply multiple-choice answers, short answers, checkboxes, linked scale and others. The questionnaires were prepared and distributed via Google Form and later analysed to obtain the impact of ICCubeX innovation program. The targeted respondents in the research were the participants from Sepuluh Nopember Institute of Technologies (ITS) who had attended the training held in Innovation and Commercialisation Centre (ICC), Universiti Teknologi Malaysia.

Finding And Discussion

Table 1 shows the impact of the ICCubeX Incubation Programme. Based on the table, it reflects the ICCubeX Incubation Programme had successfully produced a total of 11 graduated incubatee. Incubatees receive varying amounts of training (ranging from 6 to 18 sessions). Most of the incubatees have received 1 or 2 rounds of pre-commercialisation funding. The graduated incubatee is defined as an incubatee who manages to complete at least 6 sessions of training on the technopreneurship and secure pre-commercialisation funding internally or externally or commercialise their innovation. All 11 incubatees have successfully graduated from the programme, suggesting that the programme completion rate is high.

Table 1: The impact of the ICCubeX Incubation Programme

Incubatee	Training	Pre commercialisation Funding/Sales	Graduated Incubatee	Future CEO Talent
Incubatee 1	13	2	1	1
Incubatee 2	16	2	1	1
Incubatee 3	7	1	1	1
Incubatee 4	7	1	1	1
Incubatee 5	18	1	1	1
Incubatee 6	7	1	1	1
Incubatee 7	9	1	1	1
Incubatee 8	6	1	1	1
Incubatee 9	6	1	1	0
Incubatee 10	13	1	1	0
Incubatee 11	8	0	1	1

Case study on the participants from ITS shows that **66.7% strongly** *agree* that awareness of technology entrepreneurship is crucial for boosting innovation. Additionally, **26.7%** *agree* with this statement, highlighting a strong consensus on the importance of entrepreneurship for driving innovation in the technology space. There are three key knowledge areas for TTOs which are legal knowledge, intellectual property and business model canvas. **40%** of respondents *strongly agree* and **53.3%** *agree* that legal knowledge is a critical competency for TTOs. This suggests that nearly all participants recognize the importance of understanding legal frameworks when handling technology transfer. An overwhelming **73.3%** *strongly agree* and **20%** *agree* that intellectual property (IP) is vital for enhancing the competencies of TTOs. IP management is seen as a cornerstone of technology transfer, given the role it plays in protecting innovations. **53.3%** *strongly agree* and **40%** *agree* that knowledge of the Business Model Canvas is important. This reflects an understanding that structuring and strategizing business models are essential for commercializing technology successfully. Further, **53.3%** of respondents indicated they are *likely* to want practical skills in creating technology-intensive ventures, with **40%** saying they are *extremely likely* to seek these abilities. Only **6.7%** remained *neutral*, which shows a strong demand for entrepreneurial skills among participants. These results reflect a broad consensus on the importance of both theoretical knowledge and practical skills in enhancing the capabilities of Technology Transfer Officers, particularly in legal, intellectual property, and business strategy areas.

Overall, the ICCubeX program has achieved significant commercial success and influence. The program's endeavours have resulted in substantial financial gains, with RM1.97 million and RM2.78 million in commercialised revenue reported in 2022 and 2023, respectively. This suggests an effective application of the technology and training provided, as well as a strong market reception. The ICCubeX initiatives' efficacy in promoting innovation and converting it into substantial commercial value is emphasised by the astounding figures. In the future, these findings indicate a promising trajectory for sustained expansion and additional commercial successes.

Copyrights

- ICCubeX Playbook (ISBN no: 978-967-26777-1-0)
- ICCubeX Technology Training Handbook (LY2023J06439)
- ICCubeX Incubation Program (LY2021E02634)

Commercialised Modules

The ICCubeX Playbook and Training Handbook were successfully commercialized internationally by UTIM Sdn Bhd, generating RM80,000 in gross sales in 2023 from training fees and handbooks. In 2024, we expanded into the Indonesian market with the Advanced Module of ICCubeX, achieving RM90,000 in sales.

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ID 82: From Words to Wisdom: Profiling Students' Case Study Writing Competency

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Highlights: The objective of this profiling assessment is to evaluate students' skills in developing case studies for solving work-based issues. In the MMHR2206 (Master Project) course, students are guided through hands-on fieldwork focused on case study analysis. Course lecturers, coordinators, and supervisors serve as facilitators, providing step-by-step guidance in crafting case studies and developing teaching notes (including case study instructions and answer schemes). This process involves both in-class activities and learning beyond the classroom. This method of assessment allows the facilitators to evaluate students' competencies and state of mind.

Key words: *Profiling; case study writing; case study analysis*

Introduction

The Master of Human Resource Development (HRD) aims to produce graduates who are versatile HRD practitioners, excelling not only as administrators and managers, but also as trainers, instructors and consultants. In the spirit of pedagogical innovation, the MMHR2206 course incorporates the case study teaching method as part of the final project. This approach, widely used in business, law, medicine and the social sciences, represents a forward-looking shift in teaching that emphasises experiential learning. By immersing students in real-world situations, this method encourages critical thinking, problem solving and the application of theoretical knowledge to practical challenges—and prepares students to succeed in dynamic, real-world work environments.

In training and development, the ability to deliver training programmes effectively is critical to their success. Trainers and educators can use case studies in training activities to address real-world applications, such as management fundamentals, conflict resolution, leadership, organisational development, change management and organisational behaviour. To effectively incorporate case studies into training programmes, trainers need to understand the art of creating case studies and have skills in problem solving, using analytical tools (both quantitative and qualitative), making decisions in complex situations and dealing with ambiguity. They need to immerse themselves in the scenarios to fully develop their skills. This approach suggests that students who have mastered the case study teaching techniques have a greater potential to become successful HR professionals or training consultants after graduating from Universiti Teknologi Malaysia.

Content

In teaching case studies, the content typically includes the main issues or case questions, a description of the problem's context, and supporting data. There are two primary types of cases: decision cases and descriptive cases. Decision cases tend to be more engaging and analytical. In contrast, a teaching note provides a case synopsis, learning objectives, the target audience, case-leading procedures, suggested questions, and potential answers.

To integrate a profiling assessment into the MMHR2206 course, it is essential to first identify the major competencies. We refer to the National Occupational Skills Standards (NOSS) from the Department of Skills Development in Malaysia and the Case Study Writing Guidelines by Emerald to map the competencies for MMHR2206. NOSS outlines relevant competencies for occupations such as Training Consultant, Training Manager, Training Executive, Training Officer, and Training Instructor. Based on these references, we have identified five major competencies for this course. Each competency is categorized into knowledge (K), skills (S), and abilities (A), which are essential for students as they complete tasks in both classroom and fieldwork settings.

In order to measure the outcome of students in MMHR2206 course, the level of understanding on the following skills and knowledge through two main outcomes of Case Study and Teaching Note are measured:

Table 1: Competency Profile for Training Plan, Delivery and Measurement (adapted from NOSS)

Competency	Knowledge	Skills	Abilities	Task/activity in Class
Develop T&D plan	Case type (decision/descriptive) HR case issue	Identification of case type, suitable case in real world/organisation, case plan	Rationale Resourceful/reliable	Case proposal
Prepare T&D instrument	Types of instrument (case type)	Interpretation	Integrity Reliable	Case proposal

		Data collection (secondary data, interview)		Case proposal presentation
Conduct knowledge assessment session	What to ask What to collect Whom to ask	Determine type of instrument Data collection	Observance Proactive Reliable Consistent	Case proposal Case writing Teaching note
Conduct performance assessment session	Factors to consider in assessing case issues	Follow checklist Determine procedure	Proactive Accountable	Case writing Teaching note
Measure performance	Findings analysis Gap analysis	Interpretation Prepare case questions Prepare case answers suggestions	Clarity Accountable	Case writing Teaching note

In order to measure the outcome of students in MMHR2206 course, the level of understanding on the following skills and knowledge through two main outcomes of Case Study and Teaching Note are measured:

Table 2: Competency in MMHR2206

Competency			**Marks**		
NOSS Competency Cluster	**MMHR 2206 Competency**		**Above standard (5-4)**	**At standard (3-2)**	**Below standard (1-0)**
Develop T&D plan	Develop a case study plan in the HR field	A case must fulfil specific criteria: Relationship of case learning objective, issues, and future lessons. Appropriate pace for target audience's understanding. Case is appropriate to student (author) experience and knowledge in HR field.			
Conduct knowledge assessment session	Initiate organizational issue for case-based project	Selection of case (type, company, audience) is appropriate to the course. Topic of the case is suitable to the case content.			
Prepare T&D instrument	Collecting data to ensure it is presented systematically and effectively	Use analytical tools, quantitative and/or qualitative, depending on the case. Data/figures/statistics are appropriate to be used.			
Conduct performance assessment session	Following case writing structure	Use industry note/epilogue/ Flashback events to introduce the case. Structure the body of the case to intersperse issues and problems throughout the text. Close the case with a sense of urgency, a challenging statement, or a thought-provoking question. Adhere to case writing procedures to avoid unsuitable elements, such as anti-climactic statements.			
Measure performance	Recommend case questions and case answers	Propose case study questions and provide suggested answers based on relevant academic references. Ensure that the solutions are grounded in appropriate and relevant literature, theories, or fields of study.			

All relevant competencies in case study writing are integrated into the project to assess the final outcomes related to these competencies. The project requires students to develop teaching cases that provide an opportunity to explore real-world challenges. Students must present their proposals in a classroom setting, allowing them to test their assumptions and decision-making skills before applying their knowledge in a professional environment. The details are as follows:

Project Instructions (Individual-Based)

- Choose a suitable case to research, focusing on a compelling narrative about an individual or a group facing a decision in an organizational setting.
- Write the case in the third person, using past tense, and maintain objectivity while presenting the core dilemmas. Clearly establish the teaching objectives for your case.
- Cases can be based on primary data, secondary data, or a combination of both. Conducting interviews with relevant individuals, such as managers or key decision-makers, is recommended. Most case studies benefit from a mix of primary and secondary sources to accurately capture the essence of the protagonist's challenges.
- Structure the case study with a clear introduction, body, and conclusion.
- Obtain permission from the relevant protagonist or company to use their data/material and to publish the case study.
- Write a comprehensive teaching note that includes suggested answers to the case questions.

Sample of findings

The sample provided in Table 2 illustrates teaching case study writing competencies. The student selected a case focused on Organizational Behaviour issues, offering valuable insights for target audiences and instructors aiming to understand group dynamics, communication challenges, and leadership strategies, particularly within demanding organizational contexts, such as enforcement agencies. Overall, the sample demonstrates that the student possesses strong competency in teaching case study writing. However, there is room for improvement in formulating case questions and utilizing secondary data to create a more balanced and comprehensive case study.

Table 3: Sample of A Profiling on Teaching Case Study Writing Competencies

Competency	Outcome	Level
Develop T&D plan	**Synopsis**: This case study explores the Department of Force Defender (DFD), an enforcement agency, to uncover the complexities of intergenerational workforce dynamics. The case highlights communication gaps, leadership challenges, and the motivational struggles of junior officers in a structured enforcement environment. Through officers' experiences at various levels, the case offers insights into fostering unity across generations and enhancing organizational performance. **Learning Objectives**: This case can teach learners how to manage intergenerational employees in the workplace, especially within strict hierarchical organizations where discipline and regulations were practiced. The organizational behaviour idea was the dimension to investigate in this case study inside the human resources framework. The case objectives are as follows: 1. Understand the distinct characteristics of diverse generational cohorts within the organizations to cultivate a productive work environment. 2. Identify the communication challenges young employees face within the organizations and implement strategies that improve communication skills and practices. 3. Assess how the authoritative leadership of the company might help to close the generation gap and improve harmony among employees. 4. Identify the absence of drive among newly hired employees in the organization and create strategies that link individual aspirations with organizational goals to cultivate a feeling of meaning and inclusion.	Above standard (5)
Conduct knowledge assessment session	**Position In Course/Target Group (Audience)**: This case study is highly applicable for Organizational Behaviour courses at the university level. It serves as an insightful resource for students and professionals keen on developing a nuanced understanding of workforce dynamics, communication challenges, and leadership strategies, particularly within demanding organizational contexts like enforcement agencies. The primary intended audience consists of individuals who are passionate about grasping and proactively addressing the complexities that emerge due to generational differences and gaps in the modern workplace. This includes human resource professionals, current and prospective managers, organizational leaders, and undergraduate students preparing to enter the professional ranks. The case promises to engage those invested in dissecting dilemmas around intergenerational communication breakdowns and devising strategies for bridging such divides through effective, cohesive leadership approaches. Overall, it provides a rich lens into the intricate realities of leading and unifying multigenerational, hierarchical workforces.	Above standard (5)

<table>
<tr><th>Competency</th><th>Outcome</th><th>Level</th></tr>
<tr><td>Prepare T&D instrument</td><td>

Table 1: Intergenerational Workforce in The Enforcement Agency

<table>
<tr><th>GENERATIONS COHORT (Appelbaum et al, 2022)</th><th>POSITION</th><th>PLACEMENT</th><th>ROLE</th></tr>
<tr><td>Baby Boomer (1946 – 1964)</td><td>Higher Officer</td><td>Agency Headquarters</td><td>Develop policy and strategic decision makers</td></tr>
<tr><td>X (1965 – 1980)</td><td>Senior Officer</td><td>Agency Department</td><td>Lead, trained and administer the department</td></tr>
<tr><td>Y (1980 – 1995)</td><td>Intermediate Officer</td><td>Department Cell</td><td>Managing cell according to respective fields</td></tr>
<tr><td>Z (1996 – 2012)</td><td>Junior Officer</td><td>Expertise/Operational Units</td><td>Perform assigned duties</td></tr>
</table>

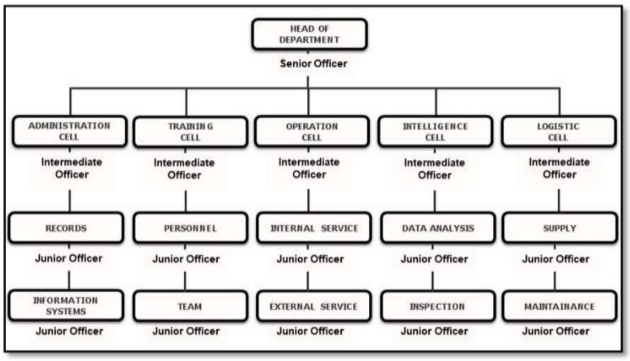

Figure 1: Department of Force Defender (DFD) Organizational Structure

</td><td>At standard (2)

The selection of secondary data or material does not adequately capture the essence of the case protagonist. One of the facilitator's comments was: "Is it possible to include the number of officers in each generational category?"</td></tr>
<tr><td>Conduct performance assessment session</td><td>

What 's Actually Happen

Intergenerational challenges have emerged within the Department of Force Defender (DFD), particularly among its officers, especially the junior officers who began entering the agency in 2020. This situation is not isolated to DFD but also impacts other departments across the country. The series of incidents indicates that this matter has already escalated into serious issues, which will have a negative impact on the enforcement agency in the future. Junior Officer Aster within DFD stands out as a case where the agency expectations have not been fully met. This individual, representative of the new generation workforce, showcases a gap in attitude, behavior, adaptability to change, and a proactive approach to collaboration and innovation, which are typically associated with expected agency goals and objectives.

Unexpected Revelations

On the first day of Junior Officer Aster's reporting to the DFD with his two peers in 2020, Senior Officer Skipper and Intermediate Officer Griffin asked him why he choose to join the agency. The answer was truly shocking. "I joined because there are no other job opportunities for me outside".

</td><td>Above standard (5)</td></tr>
<tr><td>Measure performance</td><td>

Case Questions:

Q1. By explaining generations cohort, discuss how intergenerational demographic profile in the Department of Force Defender (DFD) influence the organization's dynamics.

Q2. Examine how Senior Officer Skipper's authoritative leadership style impacts the performance of junior officers of the DFD.

Q3. Identify the strengths and weaknesses of the authoritative leadership style towards junior officers in the DFD.

Q4. Discuss the communication challenges faced by Junior Officer Aster and suggest strategies to overcome them.

Q5. Discuss how DFD leadership could use the concepts from McGregor's Theory X and Theory Y to boost the motivation of junior officers.

Methodology

1. Pre-class preparation:

 a. Learners will read the case study and other reading material as suggested in the Relevant Readings/References section.
 b. Learners will reflect on their personal experiences with intergenerational communication and leadership, noting any challenges or observations.

2. Case study discussion:

 a. Introduction (**15 minutes**): Briefly introduce the case study and its relevance to current organizational challenges. Highlight the key themes, which are intergenerational dynamics, leadership styles, communication challenges, and motivation.
 b. Group Discussion (**30 minutes**): Divide the class into small groups and assign each group a specific question from the case study. Encourage them to discuss and analyse their questions in depth.
 c. Group Presentations (**30 minutes**): Each group presents their analysis and proposed solutions to the class. Encourage questions and discussions to deepen understanding.

</td><td>Above standard (5)</td></tr>
</table>

Competency	Outcome	Level
	Q3. Identify the strengths and weaknesses of the authoritative leadership style towards junior officers in the DFD. *Suggested Answer* Authoritative leadership, also known as autocratic leadership, involves making decisions independently with little to no input from subordinates (Khan et al, 2021). Leaders set clear expectations and provide specific instructions, often maintaining strict control over all aspects of work and decision-making processes. This leadership style is essential in a disciplined environment like an enforcement agency. The strengths are quite effective in crisis situations as portrayed in DFD on junior officers' behavior where quick decisions are necessary, provide clear structure and expectations, and can ensure compliance and discipline. However, it may suppress creativity and innovation, lead to low morale among those who seek autonomy, and create a disengaged workforce over time. **Case Analysis**:	

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ID 83: Kembara Scratch: Engaging Primary School Students in Coding through Scratch Programming

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Highlights: "Kembara Scratch," a collaborative effort between the Faculty of Computing at Universiti Teknologi Malaysia (UTM), Sekolah Sri Skudai as the host school, and Pejabat Pendidikan Daerah Johor Bahru (PPD JB). Held at Sekolah Sri Skudai on June 5, 2024, the workshop involved 50 students and 10 teachers from five primary schools in Johor Bahru. The collaboration included 10 staff members from the Faculty of Computing, UTM, who played key roles in establishing mentor-mentee relationships with the participating schools and also served as judges for the competitions. A unique aspect of this year's workshop was its focus on peer-to-peer knowledge transfer, empowering students to teach and learn from one another. With support from UTM and teachers from both the organizing and participating schools, who took on roles as chaperones and creators of quizzes and competitions, this program successfully demonstrated that effective peer-to-peer knowledge transfer can be achieved. This approach not only fostered collaboration among students but also resulted in the successful development of foundational programming skills, laying a strong groundwork for their future learning and growth in the field of technology.

Keywords: *scratch programming; peer-to-peer programming; STEM education; computational thinking; digital literacy in primary education*

Introduction

In today's digital age, coding has become a crucial skill, fundamental to preparing students for the challenges of the 21st century. Early exposure to programming fosters logical thinking, creativity, and problem-solving abilities, which are essential for success in STEM-related fields (Grover, Pea, & Cooper, 2020). Recognizing the growing importance of digital literacy, the Faculty of Computing at Universiti Teknologi Malaysia (UTM), in collaboration with Sekolah Kebangsaan Sri Skudai, organized the "Kembara Scratch" workshop on 5th June 2024, which was officiated by Associate Professor Dr. Siti Zaiton binti Mohd Hashim, Deputy Dean of Research and Innovation at the Faculty of Computing, UTM. This program is a direct continuation of the highly successful "Bengkel Scratch 1.0," previously led by Dr. Farkhana Muchtar. The initiative, supported by Pejabat Pendidikan Daerah Johor Bahru (PPD JB), was designed to introduce primary school students to the basics of coding through Scratch, a visual programming language developed by MIT. The program aligns with the Malaysian government's efforts to promote 21st-century education, particularly in developing skills related to Design and Technology (Reka Bentuk dan Teknologi, or RBT), as outlined in the Revised Primary School Standard Curriculum (Kurikulum Standard Sekolah Rendah, 2017).

Building on the success of Bengkel Scratch 1.0, "Kembara Scratch" engaged students from five primary schools in Johor Bahru, providing them with hands-on opportunities to explore the fundamentals of programming. With a focus on peer-to-peer learning, the workshop encouraged students to collaborate, share knowledge, and apply their creativity in developing digital games. This approach not only supported the development of computational thinking but also empowered students to take ownership of their learning, fostering a sense of leadership and responsibility.

The Faculty of Computing played a central role in the workshop’s success, not only by organizing the event but also by actively participating in its implementation. A team of experienced faculty members and staff acted as mentors and facilitators, ensuring that students were guided effectively throughout the learning process. Their involvement went beyond simple instruction, as they also designed and supervised the collaborative activities, quizzes, and competitions that reinforced the core coding concepts taught in the workshop. The faculty’s dedication to fostering a culture of peer-to-peer learning was key to the workshop's positive outcomes, as it allowed students to engage deeply with the material while learning from and supporting one another.

In summary, the efforts of the Faculty of Computing are seen as highly significant in preparing the beneficiaries with the skills and knowledge necessary in the current digital era, providing them with an advantage in preparation for secondary education, especially in the field of STEM (Science, Technology, Engineering, and Mathematics). This aligns with the objectives outlined in the Malaysia Education Development Plan 2013-2025, which emphasizes the need for innovative educational practices that equip students with the skills necessary to thrive in a rapidly evolving technological landscape. Through initiatives like "Kembara Scratch," the Faculty of Computing is playing a pivotal role in shaping the future of young learners, ensuring they are ready to meet the demands of the digital world.

Objectives

Empowerment through Interactive Learning: To empower primary school students with foundational coding skills through interactive Scratch programming activities, while encouraging them to share and teach these skills to their peers, laying the groundwork for future digital literacy.

Fostering STEM Interest: To foster an early interest in STEM fields by introducing students to programming concepts in a fun and accessible way, and promoting peer-to-peer learning as a tool for creative expression and problem-solving.

Enhancing Computational Thinking: To enhance students' logical and systematic thinking by guiding them through the process of designing and developing their own digital games, and enabling them to transfer this knowledge to fellow students, thereby strengthening their computational thinking skills.

Methodology

The workshop employed a blended learning approach, combining hands-on Scratch programming sessions with collaborative peer-to-peer teaching activities (Cabrera & McLoughlin, 2020). The methodology encompassed the following steps:

Pre-Workshop Training for Teachers and Students: Prior to the workshop, teachers and students from the participating schools received training on Scratch programming and effective peer-to-peer teaching strategies to ensure they could effectively support their students (Sáez-López et al., 2019).

Interactive Scratch Sessions: Students engaged in structured Scratch programming activities designed to introduce and reinforce fundamental coding concepts. These sessions included guided tutorials, project-based learning, and interactive challenges (Moreno-León & Robles, 2019; Kotsopoulos et al., 2019).

Peer-to-Peer Teaching: A significant portion of the workshop was dedicated to peer-to-peer knowledge transfer. Selected students who demonstrated proficiency in Scratch were designated as "student mentors" and facilitated learning among their peers through group activities and collaborative projects (Cabrera & McLoughlin, 2020; Hsu & Liang, 2021).

Competitions and Quizzes: The workshop included coding competitions and quizzes created by teachers and UTM staff, aiming to motivate students and provide practical applications of their coding skills (Sentance, Waite, & Kallia, 2019).

Mentor-Mentee Relationships: The UTM staff members worked closely with the teachers and students to establish mentor-mentee relationships, providing ongoing support and guidance throughout the workshop (Akcaoglu & Koehler, 2020).

Assessment and Feedback: Both qualitative and quantitative data were collected through pre- and post-workshop surveys, observations, and interviews to assess the effectiveness of the workshop and the peer-to-peer learning model (Lye & Koh, 2020).

Impact on Learning

Students participating in this program successfully designed and developed their own digital games using Scratch. The peer-to-peer teaching model enabled them to not only enhance their programming skills and creativity but also assist their classmates in improving their coding abilities (Hsu & Liang, 2021; Moreno-León & Robles, 2019). This collaborative process fostered analytical thinking and problem-solving skills among the students, indicating a significant positive impact on their overall cognitive development (Kotsopoulos et al., 2019). Furthermore, the program nurtured a sense of community and mutual support, essential for sustained interest and growth in technological fields (Akcaoglu & Koehler, 2020).

Novelty & Innovation

A unique 'scaffolding' approach was employed in this workshop, allowing students to learn at their own pace while simultaneously guiding their peers through the learning process (Sentance, Waite, & Kallia, 2019). This method, combined with specially curated modules tailored to primary school students, ensured that both theoretical knowledge and practical skills were effectively shared among participants. The innovative integration of peer-to-peer teaching not only reinforced learning through teaching but also promoted leadership and communication skills among student mentors (Cabrera & McLoughlin, 2020). This combination of scaffolding and peer-to-peer learning represents a novel contribution to educational methodologies in programming instruction at the primary school level (Lye & Koh, 2020).

Applicability & NALI

This program adopts a playful and accessible learning methodology, making it ideal for primary school students. The peer-to-peer knowledge transfer model ensures that the skills acquired are immediately applicable and disseminated among participants, laying a solid foundation for further exploration in STEM fields (Wang & Liu, 2022). By integrating game development into the curriculum, the program taps into children's natural interest in digital games, thereby enhancing both engagement and learning outcomes (Hsu & Liang, 2021). The alignment with the New Academia Learning Innovation Model (NALI) ensures that the program is scalable and adaptable to various educational settings, promoting continuous improvement and innovation in teaching practices (Lye & Koh, 2020).

Commercialization Potential

The workshop's curriculum, which has been continuously refined through participant feedback, holds significant promise for integration into standard school programs or as specialized workshops (Sáez-López et al., 2019). The peer-to-peer learning model, by fostering collaboration and skill-sharing, greatly enhances the overall learning experience and could serve as a valuable addition to existing educational frameworks (Cabrera & McLoughlin, 2020). Additionally, some of the student projects, with further development and refinement, may have the potential to be commercialized as educational tools or digital content (Hsu & Liang, 2021). This could include developing comprehensive Scratch modules, interactive tutorials, or even marketable digital games created by the students, thereby extending the program's impact beyond the immediate participants (Wang & Liu, 2022).

Findings and Discussion

Before conducting the "Kembara Scratch" workshop, a pre-scratch workshop survey (as shown in Table 1) was distributed to all participants to assess their reasons for joining and their prior knowledge of Scratch programming. The primary objective of this pre-scratch workshop survey was to identify the main motivations of the participants, which in turn would allow us to tailor the teaching materials to better suit the needs of young learners.

The survey revealed that the majority of participants joined the workshop with the intention of increasing their knowledge and improving their programming skills. It was also noted that most of the participants had learned about the workshop through their teachers, highlighting the important role that educators play in encouraging students to pursue coding activities. Additionally, the participants indicated that their main purpose for attending the workshop was to learn how to create games using the Scratch platform. However, the survey also indicated that many participants were less proficient in using the Scratch application prior to the workshop, suggesting a need for foundational instruction.

Following the completion of the workshop, a post-scratch workshop survey (as shown in Table 2) was conducted to evaluate the effectiveness of the workshop in enhancing the participants' skills and knowledge in Scratch programming. The results of this survey were promising, with a majority of participants reporting that they understood how to create the games taught during the workshop. Furthermore, the participants expressed a high level of enjoyment in learning how to create games using Scratch, which is a positive indicator of the workshop's engagement strategy.

The survey also revealed that the methods taught during the workshop were considered beneficial by the participants, with many noting that they did not find the material overly difficult to learn. This feedback suggests that the workshop was well-structured and accessible to young learners. Moreover, a significant number of participants expressed happiness and satisfaction with their learning experience, further reinforcing the success of the workshop.

Importantly, the survey indicated that most participants were eager to apply what they had learned by attempting to create additional games independently. This enthusiasm for continued learning is a key outcome, as it suggests that the workshop not only imparted technical skills but also fostered a lasting interest in programming. Additionally, a strong majority of participants indicated that they would be interested in participating in similar workshops in the future, demonstrating the positive impact that the "Kembara Scratch" workshop had on their perception of coding and digital literacy.

In conclusion, the results from the post-scratch workshop survey indicate that the "Kembara Scratch" workshop was successful in achieving its goals of enhancing young learners' creativity and fostering an interest in Scratch programming. The workshop effectively increased the participants' knowledge and skills while also providing an enjoyable and engaging learning experience. These findings suggest that such workshops are valuable in promoting digital literacy and should be considered as a regular part of educational programs for primary school students.

Table 1: Pre-Kembara Scratch Workshop Survey

Item	Answer
What is the main reason for joining this Kembara Scratch Workshop?	Increasing the knowledge and programming skills - 60% Self-Interest – 25% Teacher asked to join – 10% Parents request them to join – 4% Follow friend – 1%
How did you know about Kembara Scratch Workshop?	From Teacher – 70% From Internet – 20% From parents – 7% From friends – 3%
What is the purpose of using Scratch Application?	Creating animation – 30% Creating game developments – 65% Learning programming – 25%

Table 2: Post-Kembara Scratch Workshop Survey

Item	Answer
Do you understand how to create the game taught in this workshop?	Very understand – 45% Understand – 50% Less understand – 5% Not understand at all – 0%
Do you enjoy learning how to create games using Scratch Apps in this workshop?	Really enjoying – 65% Enjoy – 30% Less enjoy – 5% Not enjoying at all – 0%
Is the way of creating games learned in this Scratch Apps workshop beneficial for you?	Very good – 55% Good – 40%

	Less good – 5% Not good at all – 0%
Is the way of creating games taught in this Scratch Apps workshop difficult for you to learn?	Very Difficult – 2% Difficult – 10% Easy – 30% Very Easy – 58%
Are you very happy to learn how to create games using Scratch Apps in this workshop?	Very happy – 70% Happy – 28% Less happy – 2% Not happy at all – 0%
Will you attempt to create other games based on what you've learned in this workshop?	Yes – 85% No – 2% Unsure – 13%
Are you interested in participating in workshops like this in the future?	Yes – 90% No – 1% Unsure – 9%

Conclusion

The "Kembara Scratch" workshop has demonstrated the efficacy of integrating peer-to-peer learning with interactive Scratch programming activities in engaging primary school students in coding. By fostering collaboration, enhancing foundational programming skills, and sparking an early interest in STEM fields, the program has laid a strong foundation for students' future learning and growth in technology. The innovative scaffolding approach and the focus on peer-to-peer knowledge transfer have proven to be effective strategies in promoting digital literacy and computational thinking among young learners. Moving forward, the program holds significant potential for broader implementation and commercialization, contributing to the advancement of educational methodologies in programming instruction.

Recognition & Awards

This project has garnered notable recognition, including a 3 star and 5 Stars Rating CCIN Award from UTM and acknowledgment from Pejabat Pendidikan Daerah Johor Bahru (PPD JB). These accolades highlight the success and effectiveness of the peer-to-peer knowledge transfer approach employed in the workshop, underscoring its value in contemporary educational practices (Moreno-León & Robles, 2019). The recognition also serves as a testament to the collaborative efforts between UTM, Sekolah Sri Skudai, and PPD Johor Bahru in fostering an innovative and impactful learning environment for primary school students.

Acknowledgement

We would like to extend our heartfelt gratitude to the Faculty of Computing at Universiti Teknologi Malaysia (UTM), Sekolah Sri Skudai, and the Johor Bahru District Education Office (PPD Johor Bahru) for their unwavering support and collaboration in making the "Kembara Scratch" workshop a success. Special thanks to the eight UTM staff members for their dedication in establishing mentor-mentee relationships and serving as competition judges. We also acknowledge the efforts of the participating teachers and students whose enthusiasm and participation were instrumental in achieving the program's objectives.

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ID 85: Pendekatan Berpusatkan Pelajar Melalui Aplikasi iSMART: Strategi Pengajaran dan Pembelajaran (PdP) untuk Pelajar OKU Pendengaran

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Sorotan: Pendigitalan bahan rujukan dalam Bahasa Melayu yang dilengkapi Bahasa Isyarat Malaysia (BIM) amat penting untuk pelajar Orang Kurang Upaya (OKU) Pendengaran Sijil Kemahiran Politeknik (Rekabentuk Grafik). Menerusi era Pendidikan 5.0, aplikasi mudah alih ini dilihat sebagai medium pengantaraan yang penting dan merupakan satu transformasi yang perlu diadaptasikan dalam PdP serta pendekatan berpusatkan pelajar. Walaupun tahap penerimaan pembelajaran pelajar khas ini tidak setara dengan pelajar biasa, keperluan pendidikan mereka tidak harus diketepikan. Oleh itu, satu kaedah PdP berpusatkan pelajar perlu diperhalusi supaya tidak berlaku keciciran dalam proses pembelajaran yang berlangsung. Pelajar OKU pendengaran cenderung dan berminat untuk menggunakan imej visual interaktif serta imej-imej pegun dan visual bergerak sebagai kaedah tambahan pengajaran dan pembelajaran. Maka, iSMART telah dibangunkan untuk proses PdP berpusatkan pelajar. Metodologi kajian ini melibatkan tiga bahagian. Pertama, Analisa keperluan. Kedua, pembangunan bahan rujukan digital. Ketiga, dapatan maklum balas. Kajian melibatkan responden pelajar OKU (Pendengaran) di Jabatan Rekabentuk Dan Komunikasi Visual, pelajar SMPKV Indahpura, dan pengguna luar. Hasil kajian menunjukkan bahawa 100% responden bersetuju, medium iSMART membantu pelajar dalam memperoleh bahan rujukan yang berkesan, kos yang rendah, serta mengurangkan kebergantungan kepada pensyarah di luar waktu kuliah (Pendekatan berpusatkan pelajar).

Keywords: *Pendigitalan; OKU (Pendengaran); Pengajaran dan Pembelajaran; Pendekatan Berpusatkan Pelajar; Ilustrasi*

Pengenalan Projek

Pendigitalan bahan rujukan telah dinyatakan oleh (Asmawan, 2019; Victoria & Sutanto, 2023). Namun begitu, bahan rujukan ilustrasi dalam Bahasa Melayu yang disertai Bahasa Isyarat Malaysia (BIM) sukar diperoleh untuk pelajar Orang Kurang Upaya (OKU) Pendengaran. Tenaga pengajar perlu memiliki tahap kesabaran yang tinggi dan perasaan kasih (love and action) semasa menyantuni mereka sikap ini tidak hanya membantu dalam menyampaikan PdP dengan cara yang paling sesuai untuk setiap pelajar. Tambahan lagi, sikap ini juga dapat membangunkan hubungan yang berempati dan membina keyakinan dalam diri (Mohd Yassin et al., 2020; Toran et al., 2009). Jesteru itu, pelbagai kaedah Pengajaran dan Pembelajaran (PdP) dijalankan termasuk penggunaan mobile apps (Ching & Zainudin, 2023; Muhammad Nazmi Mohd Jamil Aris & Fadzillah Abd Aziz, 2021; Mustari Lamada et al., 2022) sebagai medium untuk mengurangkan kebergantungan pelajar di luar waktu kuliah serta penggunaan laman sesawang (Abadi, 2020; Divayana et al., 2016; Pratama & June 2022).

Seiring dengan transformasi pendidikan yang dilaksanakan, pendidikan khas juga tidak terkecuali untuk pelaksanaan PdP. Paling utama ia perlu bercirikan interaktif (Bagja, 2022; Hasnaa & Sahronih, 2022; Sutarno et al., 2015). Menerusi era Pendidikan 5.0, aplikasi mudah alih ini dilihat sebagai medium pengantaraan yang penting dan ini merupakan satu transformasi yang perlu diadaptasikan dalam PdP. Walaupun tahap penerimaan pembelajaran pelajar khas ini tidak setara dengan pelajar biasa, keperluan pendidikan mereka tidak harus diketepikan. Tambahan lagi, tiada sumber rujukan dalam Bahasa Melayu serta BIM di dalam pasaran kini.

Oleh itu, satu kaedah PdP perlu diperhalusi supaya tidak berlaku keciciran dalam proses pembelajaran yang berlangsung. Melalui penyelidikan oleh (Alias et al., 2016) menjelaskan bahawa pelajar cacat pendengaran cenderung dan berminat untuk menggunakan imej visual interaktif serta imej-imej pegun dan visual bergerak sebagai kaedah tambahan pengajaran dan pembelajaran. Maka, iSmart telah dibangunkan untuk proses PdP bagi kursus SVG2044 Ilustrasi ini. Hasilnya, ia membantu pelajar dalam memperoleh bahan rujukan yang berkesan, kos yang rendah, serta mengurangkan kebergantungan kepada pensyarah di luar waktu kuliah

Kandungan Projek

Kaedah Pengajaran dan Pembelajaran (PdP)

Pembelajaran sepenuhnya secara konvesional tidak lagi relevan bagi pelajar berkeperluan khas OKU (Pendengaran) Sijil Kemahiran Khas Politeknik (Rekabentuk Grafik). Selain daripada keterbatasan komunikasi dan limitasi fizikal, golongan ini cepat bosan dan keletihan sekiranya melalui proses pdp bagi tempoh yang agak lama di bilik kuliah. Dalam keadaan yang memerlukan, Pendidikan hibrid perlu dilaksanakan seperti yang dinyatakan oleh (Riyanda et al., 2022; Sulistyanto, 2021a, 2021b). Justeru, tenaga pengajar secara langsung mendapat kesedaran untuk menyuntik elemen digital seperti mengaplikasikan penggunaan video, aplikasi smart phone dan laman sesawang bercirikan interaktif.

Konsep pembelajaran interaktif dan lebih mesra pengguna amat penting dalam menerangkan konsep tentang ilustrasi. Sejajar dengan itu, (Bowers et al., 2016; Conceição, 2021; Iacono, 2023) ada menyatakan tentang pendigitalan dalam proses PdP yang dapat mewujudkan suasana student engagement semasa proses PdP berlangsung dengan efektif dan tidak membosankan. Malah, ia dapat membantu tenaga pengajar mahu pun pelajar meningkatkan pengetahuan dan mengoptimumkan masa dan tenaga serta penjimatan kos. Hal ini kerana, kefahaman pelajar terhadap sesuatu topik pembelajaran sangat terbatas setiap pelajar. Tambahan lagi, pelbagai kaedah interaktif telah dilakukan bagi mendukung keperluan untuk OKU (Pendegaran) seperti kajian (Huda, 2019; Ridwang, 2017; Shahlan et al., 2023), namun masih kurang sumber yang menjurus kepada kursus ilustrasi.

Pernyataan Masalah

Keperluan pembelajaran OKU (Pendengaran) ini perlu di ambil perhatian termasuk pengunaan bahan-bahan khas, peralatan khas, teknik pengajaran dan pembelajaran mengikut tahap dan kebolehan dan keupayaan pelajar (Ahmad Sabri et al., 2018; Asalal et al., 2023; Azman Ab Rahman et al., 2020; Rahman et al., 2021). Hal ini kerana tahap pencapaian setiap pelajar berkeperluan khas adalah tidak sama. Ada yang berkebolehan berfikir secara kreatif dan ada juga yang terlalu lemah. Jesteru itu, satu kaedah pengajaran dan pembelajaran perlu dibangunkan untuk memastikan tiada keciciran bagi mereka dalam mencapai cita-cita dan menempuhi halangan alam kerjaya (Dr Hjh Sarimah & Norshahril Abdul, 2006). Menurut (Alias et al., 2016) menjelaskan bahawa pelajar cacat pendengaran cenderung dan berminat untuk menggunakan imej visual interaktif serta imej-imej pegun dan visual bergerak sebagai kaedah tambahan pengajaran dan pembelajaran. Oleh itu, pembangunan Alat Bantu Mengajar (ABM) bercirikan digital bagi kursus Ilustrasi adalah salah satu usaha menambah baik kualiti PdP.

Objektif Kajian

Kajian ini berfokus untuk mewujudkan sumber bahan rujukan digital dalam Bahasa Melayu dengan dilengkapi video Bahasa Isyarat Malaysia (BIM) yang dapat mengurangkan kebergantungan penuh pelajar kepada pensyarah di luar waktu kuliah. Di samping itu, ia dapat mengatasi masalah ketiadaan bahan rujukan digital dalam Bahasa Melayu dengan dilengkapi Bahasa Isyarat Malaysia (BIM). Kaedah PdP ini juga ini dapat mengatasi isu kos bahan rujukan yang tinggi serta beorientasikan pendekatan berpusatkan pelajar.

Metodologi

Kajian ini meliputi tiga bahagian. Pertama, keperluan pembangunan sumber rujukan digital (Haslin & Hamzah, 2023; Salleh et al., 2023) melibatkan 9 pelajar Sijil Kemahiran Khas Rekabentuk Grafik Semester 2, Sesi 2: 2023/2024. Bentuk soal selidik dilakukan secara menggunakan google form dengan dibantu penterjemah di hadapan. Ia dilakukan dengan penggunaan laras Bahasa Melayu yang mudah difahami. Bahagian kedua adalah pembangunan bahan rujukan digital menerusi kaedah analisa Kerangka 4 langkah E.R.R.C. Grid (Kim & Mauborgne, 2022; Suci et al., 2020) dalam NBOS. Manakala bahagian ketiga ialah analisa dapatan maklum balas menerusi uji lari Alat Bantu Mengajar (ABM) di tiga lokasi berbeza:

- Politeknik Ibrahim Sultan (9 pelajar)
- SM Pendidikan Khas Vokasional Indahpura (5 pelajar)
- Karnival STEM MRSM Johor Bahru (49 pelajar, 11 tenaga pengajar)

Analisis Keperluan

Bahagian Pertama: Keperluan Bahan Rujukan Digital

Dapatan daripada soal selidik menyatakan bahawa 100% pelajar tidak mempunyai masa yang cukup di dalam kelas bersama pensyarah. Maka, inisiatif pembangunan bahan digital yang boleh dirujuk selepas waktu kuliah amat penting. Tambahan lagi 100% pelajar mahir dengan penggunaan aplikasi dalam talian dengan Bahasa Melayu menjadi pilihan utama. Maka, atas latar pengetahuan ini, satu aplikasi PdP dalam talian perlu dibangunkan. Justeru, permasalah pelajar perlu dilihat secara khusus bagi membangunkan aplikasi ini.

Sebanyak 66.7% pelajar menyatakan tidak dapat menemui bahan rujuan yang mempunyai terjemahan Bahasa Isyarat Malaysia. Ini ditambah lagi dengan 88.9% pelajar sukar untuk menemui bahan rujukan kursus. Ini disokong oleh 100% pelajar bersetuju dengan bahan rujukan sedia ada di pasaran yang mahal. Sumber rujukan semasa yang digunakan sekarang ini mengandungi rujukan Bahasa Inggeris. 100% pelajar bersetuju bahawa rujukan dalam Bahasa Inggeris ini sukar untuk difahami. Justeru, dapatan daripada 100% yang memerlukan bahan rujukan interaktif, satu rujukan perlu dilakukan khususnya dengan penggunaan bahan interaktif secara digital dengan disertai video Bahasa Isyarat Malaysia (BIM).

Bahagian Kedua: Pembangunan Bahan Rujukan Digital

iSMART merupakan aplikasi mudah alih telefon bimbit yang terdapat di dalamnya dua keaslian produk. Pertama, ia adalah bahan rujukan interaktif pembelajaran dengan disertai Bahasa Isyarat Malaysia (BIM). Kedua, paparan ilustrasi yang disertakan adalah karya asli pelajar semasa dan alumni Sijil Kemahiran Reka Bentuk Grafik, Politeknik Ibrahim Sultan.

Strategi: Aplikasi Telefon Bimbit dan Laman Sesawang

Aplikasi telefon bimbit iSMART boleh di muat turun dan install ke dalam telefon bimbit dengan mengimbas kod QR yang disediakan oleh pensyarah mengajar. Aplikasi telefon bimbit ini dibangunkan dalam Bahasa Melayu untuk memenuhi fahaman pelajar. Isi kandungan aplikasi ini adalah terdiri daripada tiga (3) bahagian topik pembelajaran ilustrasi iaitu 1. Pengenalan, 2. Kategori dan Video dan 3. Karya Pelajar. Terdapat juga video ringkas pembelajaran daripada pensyarah mengajar dan demonstrasi media.

Rajah 1: Paparan skrin aplikasi Android iSMART

Bahagian Ketiga: Dapatan Maklum Balas

Bagi memastikan aspek pembelajaran digital ini memenuhi keperluan pelajar dan pengguna lain, kajian impak melalui perkongsian terus telah dilakukan. Maklum balas ini dibahagikan kepada dua bahagian. Pertama, berfokus kepada pelajar semasa yang mengambil kursus Ilustrasi di Politeknik Ibrahim Sultan. Kedua, pengguna umum dalam kalangan pelajar dan tenaga pengajar.

Dapatan Maklum Balas

Maklum Balas Pelajar Khas

Penggunaan sepanjang semester pengajian dilihat memberi impak yang positif terhadap aplikasi dan laman sesawang yang dibangunkan. Semua soalan memperoleh 100%, di mana iSMART ini mudah dan interaktif, membantu di luar waktu kuliah, menjimatkan kos, sumber rujukan Bahasa Melayu dengan video Bahasa Isyarat Malaysia (BIM), membantu pembelajaran kendiri serta fleksibel. Natijahnya, kebergantungan penuh kepada pensyarah untuk pembelajaran Ilustrasi dapat diminimumkan.

Maklum Balas Umum

Sebanyak 65 catatan bertulis telah diperoleh menerusi maklum balas daripada perkongsian umum yang dilakukan. Hasil daripada itu memaparkan impak penggunaan iSMART ini. Sebanyak 71.67% menyatakan kebaikan dalam pembangunan Alat Bantu Mengajar (ABM) untuk OKU (Pendengaran) ini. Lebih memberangsangkan, 20% menyatakan ia menarik di samping 16.67% mampu menimbulkan minat bidang ilustrasi.

Perbincangan dan Cadangan

Melihat kepada 100% pelajar bersetuju dengan cadangan pembelian bahan rujukan yang disertai Bahasa Isyarat Malaysia (BIM), satu bahan rujukan komersial perlu dibangunkan bagi memenuhi keperluan pelajar OKU (Pendengaran) ini. Tambahan pula, mereka adalah penerima biasiswa dengan akses kepada dua peranti elektronik untuk proses pendigitalan PdP. Maka, kesanggupan mereka ini membolehkan aplikasi pendigital secara holistik dijalankan. Perlu diambil cakna adalah sebanyak 66.7% pelajar tidak mahir dalam Bahasa Inggeris. Atas dasar itu, 100% bersetuju bahawa bahan rujukan dalam Bahasa Melayu dengan video Bahasa Isyarat Malaysia (BIM) harus diwujudkan. Ini tidak melambangkan bahawa Bahasa Inggeris akan diketepikan. Namun, bagi memudahkan proses pembelajaran kendiri, Bahasa Melayu adalah keutamaan.

Dalam membangunkan pelajar bercirikan jiwa Malaysia, 100% pelajar menyatakan kekurangan bahan rujukan seni lukis yang mencerminkan budaya Malaysia. Maka, penting untuk melakukan inisiatif khusus dalam menghasilkan sumber lakaran ilustrasi yang mencerminkan identiti negara bagi sumber rujukan serta bahan Pembelajaran dan Pengajaran (PdP). Pembangunan bahan digital yang boleh diakses selepas waktu kuliah ini amat signifikan memandangkan 100% pelajar mengakui kekurangan masa dalam kelas. Ini dapat mengatasi masalah pembelajaran kendiri serta kebergantungan kepada pensyarah di luar waktu kuliah.

Cadangan penambahbaikan untuk Pembelajaran dan Pengajaran (PdP) bagi OKU (Pendengaran) ini sememangnya memerlukan responden yang lebih meluas di peringkat umur dan kepelbagaian kursus. Namun, penggabungan penyediaan bahan pengajaran visual yang disertai video Bahasa Isyarat Malaysia (BIM) ini amat memberi kesan positif melalui maklum balas sedia ada. Ia disebabkan oleh pembangunan aplikasi teknologi yang bukan sahaja mampu digunakan di bilik kuliah, malah di luar waktu kuliah. Pelajar OKU (Pendengaran) yang lebih cenderung kepada visual bergerak (Alias et al., 2016) perlu diambil kira bagi setiap kursus PdP yang terlibat.

Novelti

Sumber bahan rujukan digital dalam Bahasa Melayu dengan dilengkapi video Bahasa Isyarat Malaysia (BIM) untuk pembelajaran sepusat. Produk ini telah berdaftar dengan MYIPO: LY2024J04019

Impak

Impak produk:

- Pembelajaran lebih flexsibel kepada semua pelajar serta menyahut seruan Education 5.0
- Mudah digunakan, mudah dikemaskini dan jimat kos, senang dibawa ke mana-mana dan boleh dilihat berulang-ulang kali.
- Penjimatan masa, penggunaan masa yang optimum di bilik kuliah. Mudah faham, tingkatkan motivasi dan merangsang deria pelajar.

Penghargaan

Penghargaan buat Politeknik Ibrahim Sultan, SMPKV Indahpura, responden serta semua yang terlibat di dalam pelaksanaan Alat Bantu Mengajar (ABM) ini.

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ID 88: eLestari system for school improvement in Education for Sustainable Development (ESD)

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Highlights: The implementation of sustainable practices is crucial for the Johor State Environmental Education Action Plan 2019–2023 policy, as it is necessary to oversee the monitoring of 1189 schools in Johor. This will ensure the establishment of an effective learning environment for Education for Sustainable Development (ESD). eLestari system is a system developed using action competence framework to help state department to address reform for education for sustainable development (ESD) in holistic way. The data collected and analyzed from eLestari offers an opportunity to assess the effectiveness of schools, districts, local authorities, and states that have been focusing on areas related to Education for Sustainable Development (ESD). The eLestari was created with three ESD action competencies: multi-tier school governance, ESD initiatives, and carbon reduction audit calculator. The multi-tier school governance measured all aspects related to schools' action plan to execute the policy in the four aspect; curriculum & co-curricular, involvement of school community, achievement and outreach program and community learning. Meanwhile, their initiatives were measured for composting, landscape, recycling, environment and cleanliness, innovation for ESD and ESD management. As for carbon reduction audit, there are four components calculated for their impact which are electricity saving, water saving, used cooking oil and recycling. As the results from using eLestari as a monitoring system, each school are now able to monitor their yearly performance and accreditation for ESD initiatives. Schools will be categorized as showcase, transition and novice according to the final analysis. From year 2019 until 2023, the highest numbers of carbon reduction recorded is 47,672,976.56 CO2 with RM 3,077,347.24 savings from these collective efforts. Achievements in carbon reduction and the annual number of schools certified as showcase schools are the primary foci of the analysis. To sum up, ESD is now an integral component of schools' curricula thanks to systematic methods of reviewing and assessing their actions towards ESD from eLestari system.

Keywords: *education for sustainable development (ESD); wide school reform; school performance analysis; action competence*

Introduction

The state of Johor has been selected as a case study in this research because to its effective collaboration between local authorities, developers, state government, and state education in Johor. This collaboration is facilitated by the implementation of the Environmental Education Action Plan 2019-2023, the policy developed by Johor State Education Department and Universiti Teknologi Malaysia. To implement this policy for schools learning, it is necessary for the school to transform into a learning community that focuses on environmental education. Hence learning in this sense has bigger scope which include enculturation of practice for wide school improvement.

This project intends to assess and validate the impact of school reform on Education for Sustainable Development (ESD) by examining the progress made by the state during a five-year period of policy implementation. Initially, the project has been collected data manually using portfolio files collected from school to help. This method however is time consuming and has poor document management practice.

The project aims to offer distinctive insights that will enhance our comprehensive understanding of the impact of action competence in an integrated environmental education setting using databased system approach. Thereby, the eLestari project aims to address the following inquiries: Has the policy had a beneficial and substantial impact on the school as a learning community? Has the policy had a positive impact on the economy and ecology of Johor state?

Research Methodology

The development of the project followed The Successive Approximation Model (SAM) (Allen & Sites 2012) begin from 2022.

Preparation Phase

The inception of eLestari commenced with a preparatory phase, during which the core team discerned the requirements and objectives of the system. This stage entailed collecting primary requirements from state and district officers that directly involved with the action plan initiative. The baseline document using during this time is a manual checklist developed by state department for school visitation. Gaining a comprehensive understanding of these requirements was crucial to guarantee that the system would prioritize the needs of the users and effectively facilitate educational activities. Three focus to conducted between July and September 2022, each involving a different target user.

Iterative Design

The Iterative Design phase was crucial in SAM, as it allowed for the creation of prototypes that could be tested and refined. For eLestari, this meant developing early versions of the system that included basic functionalities, such as dashboard, priority areas in ESD for learning, and carbon reduction calculator. The decision is made based on the Reasonable Person Model (RPM) framework to understanding humans, their actions, and convictions (Basu, Kaplan & Kaplan, 2015). Feedback was gathered from users during each iteration. Educators and district officer tested the prototypes, providing insights into what worked well and what needed improvement. This feedback loop enabled the development team to adjust quickly, ensuring that the system met the actual needs of its users.

Iterative Development

The Development phase was not a one-time event but an ongoing process. With each cycle, the system's functionalities were expanded and refined. For instance, initially there is no built-in certification, but later was added to help school for their record of recognition.

Implementation and Continuous Improvement

Once the core features of eLestari were solidified, the system was rolled out to 1189 school in October 2022. Each year, schools are required to use the system as monitoring from January until December. The system was regularly updated based on user experiences, with new features being added and existing ones being enhanced, especially on data analysis and dashboard experience. This ongoing cycle of implementation and improvement ensured that eLestari remained relevant and responsive to the evolving needs of its users.

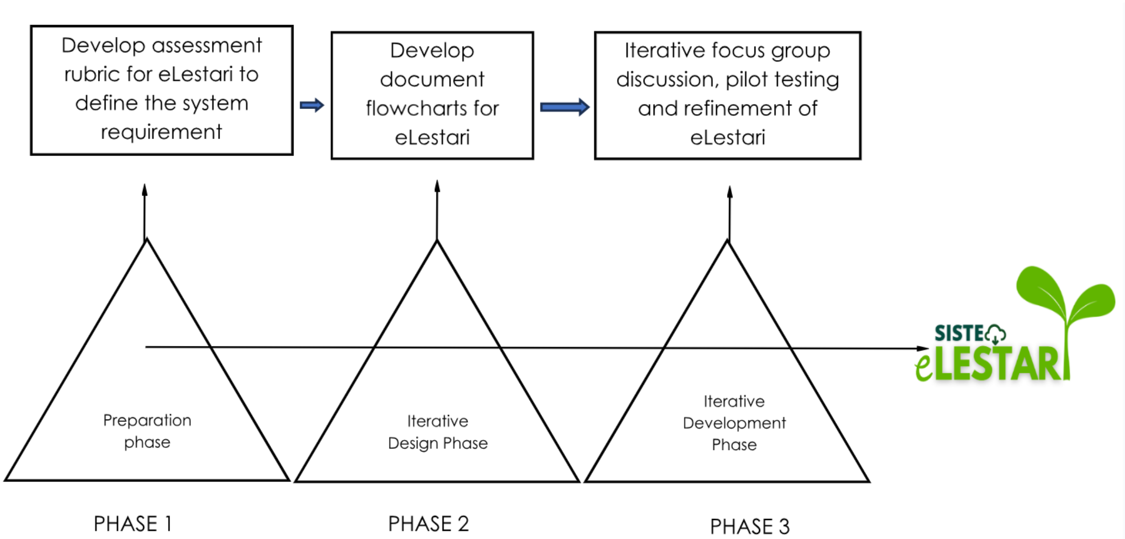

Figure 1: The Successive Approximation Model (SAM) for developing eLestari system documentation framework.

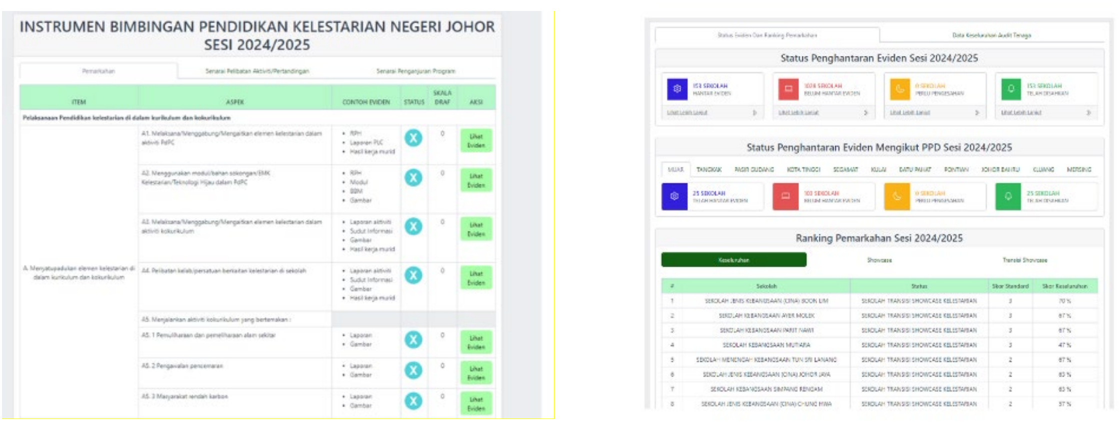

Figure 2: Dashboard interface (right) and the requirement for ESD learning set by eLestari (left)

Findings and Discussion

According to Table 1, the results indicate that the quantities of showcase and transition schools are progressively rising from 2019 to 2023. The trend from 2019 to 2020 was impacted by the epidemic and the subsequent quarantine measures that were implemented. Consequently, the number of schools able to carry out activities during this period has decreased due to limited access to schools and learning resources. In 2023, there was a significant increase in school performance, with a recorded improvement of 39.0% after five years of implementation.

Table 1

Year			Percentage		
	Showcase	Transition	Progress (total numbers of active school)	Percentage of Schools that become community learning	Impact of Carbon reduction CO_2
Trend of wide reform without eLestari					
2019	32	40	72	6.0%	Not available
2020	0	40	40	3.4%	Not available
2021	12	187	209	16.7%	Not available
Trend of wide reform with eLestari					
2022	20	211	231	19.4%	47,672,976.56 CO_2
2023	77	387	474	39.0%	7,586,983.36 CO_2

Conclusion

The trend from 2019 to 2020 was impacted by the epidemic and the subsequent quarantine measures that were implemented. Consequently, the number of schools able to carry out activities during this period has decreased due to limited access to schools and learning resources. In 2023, there was a significant increase in school performance, with a recorded improvement of 39.0% after five years of implementation.

Commercialization Potential

Two major stakeholders, Majlis Bandaraya Iskandar Puteri (RM20,000) and Majlis Bandaraya Johor Bahru (RM47,500), have shown interest in this system because of the data and analysis it can provide. IP of this system is registered with IP/CR/04904.

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This project is conducted in collaboration with Johor Education State Department (JPNJ), Ministry of Education, (MoE), malaysia and sponsored by Universiti Teknologi Malaysia, UTMFR grants Q.J130000.3853.23h96 / PY/2024/01524 for A self-directed learning competencies framework of science teachers to use Environmental, Science, Technology, Engineering, and Mathematics (ESTEM) for interdisciplinary project-based learning.

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ID 89: Integrating Sustainable Innovation in Fashion Design through Problem-based Learning

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Highlights: Sustainability now playing important role in industries globally. Fashion industry is one of the industries which currently embracing sustainability. Sustainable innovation in fashion design education is crucial for higher education, especially for graduates who seek to involve in fashion industry. To promote the understanding of sustainable innovation in fashion design education, educators can implement through problem- based learning in the course. This type of learning methods solves authentic problems that are highly related to the objective of this course, which is related to real- world problem. By conducting this learning method, students will be able to analyse critically on the development of idea, technical skills, sustainable and innovative method in the fashion garment production.

Keywords: *Problem- based Learning; Sustainable Innovation; Fashion Design*

Introduction

Sustainability now playing important role in industries globally. Fashion industry is one of the industries which currently embracing sustainability. According to SWCorp and KlothCares, 31 per cent or 432,901 metric tonnes of total waste generated in Malaysia in 2021 were fabric waste (Khalid et al., 2022). Malaysia Education Development Plan (PPPM) 2013-2025 (Ministry of Education Malaysia (MoE), 2015), has outlined the National Education Philosophy (FPK) which is to produce Malaysians who are knowledgeable, skilled, virtuous, responsible, and able to achieve personal well-being and can contribute to the harmony and prosperity of the country, community, and family. Thus, by 2030, all students must acquire the knowledge and skills needed to promote SD through education for sustainable development (United Nations, 2015) (Bedor et al., 2021).

Fashion Design is a subject in which the learning outcomes of students can demonstrate the ability to apply and make various fashion design (Ernawati et al., 2023) and can promote sustainable innovation. Designs proceed from creative ideas, and creativity improvement in design education could be developed through creative thinking education and systematic training (Jung & Bae, 2021). Fashion design education also requires new ideas in designing process for improvement in creativity, and a practical problem-solving process through creative thinking skills (Jung & Bae, 2022). Sustainable fashion design education is crucial for higher education, especially to graduates who seek to involve in fashion industry. It is important for every level of design development, where students are learned, educated, and trained before entering design careers within the fashion industry (De Wet & Smal, 2023). The objective of sustainable education is to demonstrate the fashion design students about real problems in the context of the fashion industry and to provide an understanding of clothing design that considers ethical fashion throughout the design supply chain.

Sustainable design education trains students to investigate the underlying concepts and prospects of sustainable development, determine societal challenges, and propose approaches to challenges. By introducing innovative concepts concerning sustainable design and widening the context, effective instruction on sustainability may transform the mindset of students who will eventually work as designers, leading to better-developed design abilities (Kim & Lee, 2022).

Educators can play an activist role, and the fashion education system can be challenging as a medium for large-scale change (Minhus et al., 2024). However, there have been several studies on sustainable fashion design education and its implementation via different approaches. Sustainable materials, energy-efficient design, and waste minimization may all be included in sustainable design education. So, sustainable education can play a vital role in the fashion industry, as designers are responsible for providing initial ideas and specifying products for clothing construction with raw materials selection.

Problem-based learning (PBL), a problem-oriented teaching method, is a student-centered educational approach based on the real world pioneered by Barrows and has now become an internationally popular teaching method (Ali, 2019). The educational philosophy of this model is guided by constructivist theory, problem-oriented, and student-oriented, breaking the traditional teaching mode and cultivating students' creative thinking, innovation, independent learning ability, and critical thinking ability. Through the Problem Based Learning model, students are expected to gain direct experience of what is being studied. The learning experience is a learning activity that must be carried out by students to achieve mastery of competency standards, basic abilities, and learning materials (Ghani et al., 2021).

According to a study by Seo Yeon-hwa and Shim Hyun-ae (2019), learners acquire an integrated knowledge base through the process of PBL learning methods that solve authentic problems that are highly related to field practice. It is said that there is an advantage to cultivate practical competence by learning solution strategy, practical knowledge, skills and attitude (Park, 2019). Problem-based learning (PBL), a teaching approach particularly suitable for tertiary education, involves students in authentic problem-solving processes and fosters students' self-regulation and teamwork (Amerstorfer & Von Münster-Kistner, 2021).

These PBLs can be subdivided into individual learning, self-directed learning, and small group learning. These PBLs can be used to study specific problems and facilitate relationships between individuals or minority groups faced by learners. Their learning effect will also increase. Therefore, PBL is a small group discussion class that can find information and solve problems through learner's experience or knowledge. It can be said to be self-directed problem-solving learning method to cultivate education (Ulger, 2018). Students taught using the Problem-Based Learning (PBL) model experienced a significant increase in critical thinking skills (Islamiati et al., 2024).

Content

Objectives

- The objectives of the PBL in fashion design aim to:
- To integrate elements of sustainable innovation in fashion design course through PBL
- To analyse the effectiveness of PBL in promoting sustainable innovation fashion design course

NALI approach implemented in the research

Novelty: PBL in fashion design subject promotes the development of critical thinking of the students, which to produce sustainable and innovative fashion design. The elements of sustainable innovation have been applied throughout the production process of the fashion garment. In comparison from the previous teaching strategies, students have prepared digital portfolio for the documentation.

Creativity: The elements of sustainable innovation through PBL in fashion design develop the use of technology, through Canva, Power Point and Adobe software. The digital portfolio consists of development of idea; inspiration and theme, elements and principles of design, sketches, fashion boards, pattern drafting, toile making, sewing process and styling.

Innovativeness: The innovativeness of PBL in fashion design is based on the technical skills of the students. To solve the real- world problem which is their own body type and shape, the students need to analyze the suitable eco material and fabric waste which can be use as part of the fashion design. Apart from that, some of the components of fashion garment should be functional, according to their theme.

Applicability: The relevance of sustainable innovation of PBL is applicable in other courses, which able educators to integrate in the teaching and learning strategies. Educators can assess the understanding of sustainable innovation elements of their students through the assessment rubric.

Impact: Learning through PBL in fashion design does give positive impact for students to enhance their understanding about sustainable innovation. Their analyzation of materials to be used and technical skills to produce sustainable innovation fashion design will be further improvised and to be implemented in their future career of solving real- word problem.

Research Methodology

PBL has been implemented in Fashion Design (SHPL 4122) course, aims to develop understanding of sustainable innovation in fashion production, with the application of technical skills; fabric and clothing and clothing studies. A total of 21 students from final year of Fashion Design course are involved. For this course, students need to produce a fashion design which integrate sustainable innovation; application of zero- waste and functionality. The real- world problem is related to their own body type and shape; to find the solution of suitable materials and innovate functional fashion design to solve their body shape problem. Apart from that, the students need to documented all the related findings in digital portfolio.

The development of idea started with; 1) Ideation: research of inspiration; subject matter and theme. The students need to explore and research on subject matter which give solution to the outcome of fashion design. They need to analyses the elements and principles of design to be applied in the design sketches. 2) Sketches: A total of 10 design sketches will be filtered into 3 final sketches before proceed with the final design for production. The sketches must solve the problem which consists of elements of design such as colours, lines, shapes, form, texture, value and space and principles such as proportion, balance, unity, repetition, and emphasis. Students need to use their critical thinking to develop the suitable sketches. 3) Storyboard. Students are encouraged to apply technology skills by using Canva and Power Point software or other software. In this phase, students will develop their inspiration board 4) Technical board: Students will develop technical drawings of the final sketches by using traditional method before apply in Adobe Illustrator 5) Pattern drafting: Drafting and modification of pattern before garment production, 6) Toile making: The prototype is important as students need to study on the outcome of the chosen materials, fabric and techniques of sewing; experimentation of fabric sampling, embellishments, shape of the fabric and functional features of garment and 7) Styling: coordination of accessories. The outcome of the fashion design was then assessed from the showcase and fashion show. The design criteria were assessed based on the originality, functionality, innovative, sustainable aspects, styling and commercial aspect.

Findings

The final product of the students' works is shown in Table 1.

Table 1: Product outcome of the sustainable innovative fashion design

Problem: Types of body shape	Application of Sustainable Innovation in fashion garment	Outcome of fashion design
Pear shaped and petite	1. Element of Princess line 2. Detachable corset with vertical lines featured from fabric waste 3. A- line gown 4. Black colour design	
Undefined waist, lack of curves and balance and proportion	1. Outer layer: Detachable A-line skirt from fabric waste	
Oval shaped body, big belly	1. Element of lines on body part: Fashion to function, reversible as *pelikat* to bag 2. Dark colored top	

Discussion

The integration of sustainable innovation in the fashion design course has given new challenges to the students, positively. The students were able to analyzed and critically applied their technical skills in designing and sewing in producing innovative fashion garment. Students had given the opportunities to explore the challenges of sustainable fashion, learning about materials, supply chain ethics, and the environmental impact of fashion. They develop innovative solutions to reduce waste and promote sustainability in their designs. Apart from that, they had upskilled knowledge in technical skills, especially to create functional clothing made from waste materials. It was a new discovery for the students. It was impactful to develop their understanding related to sustainable innovation in real-world problem. Thus, PBL in fashion design course is effective and give big impact to promote sustainable innovation.

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ID 90: KIT TAM TO

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Highlight: Proses pendidikan perlu mengikut keperluan dan peredaran zaman dalam arus moden pada masa kini. Guru perlu bijak dan kreatif dalam menjalankan kaedah dalam PdPc. Kaedah chalk and talk sudah tidak relevan lagi pada masa kini, Mahasan Mahmood (2003). Justeru, guru perlu kreatif dan inovatif dalam mengaplikasikan PdPc di dalam bilik darjah bagi mengatasi masalah pembelajaran. Penggunaan Kit Tam To yang berkonsepkan berpusatkan bahan dapat membantu murid prasekolah menyelesaikan soalan tambah dan tolak dalam lingkungan 18 dengan betul. Inovasi ini memudahkan murid menyelesaikan masalah operasi tambah dan tolak. Konsep berpusatkan bahan dapat menarik minat murid lebih fokus dan seronok untuk belajar. Kit Tam To merupakan bahan bantu mengajar yang melibatkan Tunjang Sains dan Teknologi iaitu Matematik Awal (MA). Standard Kandungan MA 3.1 Menyelesaikan masalah operasi tambah dalam lingkungan 18 dan MA 3.2 Menyelesaikan masalah operasi tolak dalam lingkungan 18. Terdapat 5 orang murid Prasekolah Gemilang SK Datuk Usman Awang tidak dapat menyelesaikan masalah operasi tambah dan tolak dlam lingkungan 18 dengan betul. Dengan adanya Kit Tam To dapat menyelesaikan masalah tersebut dengan mudah dan cepat.

Kata kunci: *Kit Tam To; murid; operasi*

Objektif inovasi

- Murid dapat menulis nombor dengan betul 1- 20 dengan betul.
- Murid dapat menyelesaikan operasi tambah dalam lingkungan 18 dengan betul.
- Murid dapat menyelesaikan operasi tolak dalam lingkungan 18 dengan betul.
- Murid dapat menulis ayat Matematik dengan betul.

Kumpulan sasaran

- Prasekolah Gemilang
- Murid Pemulihan Khas
- Murid Pendidikan Khas
- Murid Tahap 1

Latar belakang (penjelasan tentang proses penghasilan inovasi mengikut kronologi)

Dengan Kit Tam To ini merupakan bahan yang baharu dalam PdPc. Hal ini kerana bahan yang dihasilkan idea kami dengan menggunakan pengalaman dan pemerhatian di dalam kelas. Kit Tam To juga merupakan bahan yang dapat memberikan sumbangan kepada amalan terkini dalam kemahiran mengenal nombor 1 hingga 20 dan dapat menyelesaikan masalah tambah dan tolak dalam lingkungan 18. Saya menggunakan konsep Multiples Intelgences menurut Howards Gardner iaitu Kecerdasan Logik Matematik contoh aktiviti penggunaan simbol urutan nombor, pengurusan grafik dan pengiraan. Kecerdasan Kinestetik ialah kemampuan dalam menggunakan tubuh badan yang bergerak untuk mengungkapkan idea, pemikiran dan perasaan**.** Bahan yang digunakan ialah magnet, kotak dan pelekat gambar.

Isu/Masalah yang ditangani oleh bahan inovasi

5 orang murid 6 tahun Prasekolah Gemilang SK Datuk Usman Awang tidak dapat mengenal nombor 1-20, tidak dapat membilang nombor 1-20 dan menyelesaikan masalah tambah dan tolak dalam lingkungan 18 dengan betul. Mereka juga sering membuat kesilapan dalam menulis nombor 1-20. Oleh itu, guru cuba mencipta kaedah yang mudah untuk murid cepat ingat dan kenal nombor 1-20 dengan menggunakan bahan terbuang. Satu inovasi baru telah tercipta dengan di namakan Kit Tam To bagi menangani masalah tersebut.

Penjelasan Outcome

- Melahirkan murid celik nombor.
- Membangunkan aktiviti PdPc dalam bilik darjah.
- Menyebar luas bahan bantu mengajar kepada sekolah lain.
- Meningkatkan murid untuk mengenal nombor 1 hingga 20 dengan pantas, mudah dan betul.
- Menyelesaikan masalah operasi tambah dan tolak dalam lingkungan 18 di kalangan murid.

Huraian Inovasi

Inovasi Yang Dilaksanakan

- Murid melihat soalan pada Kit Tam To.
- Murid menyebut soalan yang diberikan.
- Murid akan menarik stik menyelesaikan soalan tambah atau tolak.
- Murid akan mengira objek dan melihat nombor sebagai jawapan .
- Murid akan menulis jawapan pada tempat yang disediakan.

Bahan Inovasi Kit Tam To telah daftarkan myipo/Video penggunaan/Iklan Kit Tam To

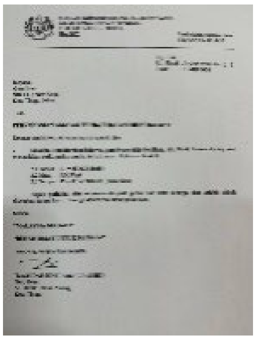
Modul Pentaksiran

https://online.anyflip.com/qdqiy/yxjh/mobile/index.html

Aktiviti Pengayaan

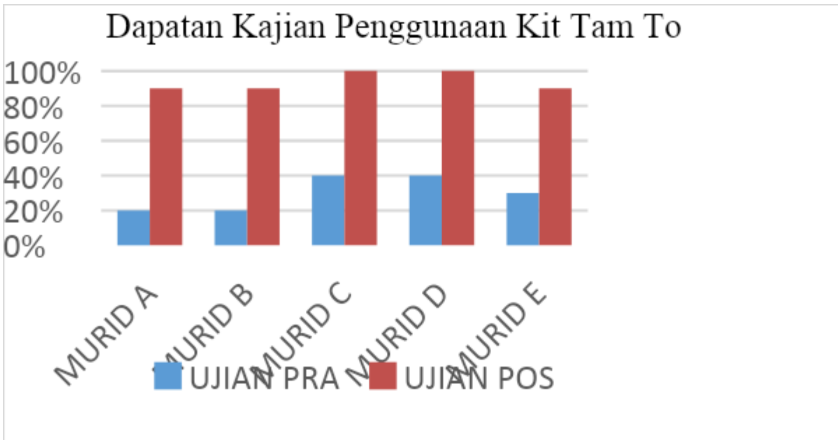
https://docs.google.com/presentation/d/1NdLH8m6uGmNpsZ6xdkffK-G2_R0BI5hJ/mobilepresent?slide=id.p2

Sebar Luas



SJK (C) New Kota, Kota Tinggi
Kos bagi menghasilkan inovasi : RM 30.90 sahaja

Keberkesanan inovasi kepada pengajaran dan pembelajaran



Rajah 1Potensi untuk disebarluaskan kepada pihak lain.

Potensi untuk disebarluaskan kepada pihak lain.
Kelas Prasekolah Daerah Kota Tinggi

Impak Pelaksanaan Kit Tam To

A. Murid

- Mengenal nombor 1-20 dengan betul.
- Menulis nombor 1-20 dengan betul.
- Menyelesaikan operasi tambah dan tolak dalam lingkungan 18 dengan betul.

B. P&P

- Menerapkan nilai pengajaran Pembelajaran Abad Ke 21.
- Pengajaran yang berpusatkan bahan dan murid.

C. C. Bidang Pendidikan

- Peningkatan sokongan ibu bapa dalam pendidikan.
- Mengurangkan murid tidak mengenal nombor.

Potensi Pengembangan Projek
Guru membuat pengayaan dengan menjawab soalan dalam qr code. Dengan ini, mudah untuk murid mengakses seterusnya mengulangkaji dalam operasi tambah dan tolak. Murid juga membuat Latihan Matematik operasi dan tolak bersama ibu bapa di rumah. Teknologi yang di gunakan dapat meningkatkan kemahiran murid dengan mengenal nombor dan menyelesaikan masalah operasi tambah dan tolak dengan cepat dan mudah. Murid tidak bosan malahan mereka akan berasa seronok dan gembira untuk belajar Matematik. Guru akan mengembangkan lagi dengan menambah suara dan animasi dalam perisian soalan qr code dengan pendigitalan yang disarankan oleh KPM 7 Teras Utama yang akan memberi impak yang berkesan kepada murid-murid mengikut trend pada zaman masa kini.

Rumusan

Kami berasa bersyukur dan gembira kerana murid dapat mengenal nombor 1-20 dan membilang nombor 1-20 dengan betul apabila terciptanya inovasi ini. Murid dapat menyelesaikan operasi tambah dan tolak dalam lingkungan 18 dengan betul. Murid-murid menunjukkan keseronokan dalam belajar Matematik dengan pelbagai aktiviti dan kaedah yang saya jalankan. Murid-murid juga menunjukkan minat dan tekun untuk belajar Matematik. Kami berharap inovasi dapat dikembangkan dan diperluaskan kepada sekolah dan murid lain bagi membantu mereka dalam proses pembelajaran Matematik.

Kit Tam To merupakan suatu inovasi PdPc dalam tunjang Awal Matematik terutama murid Prasekolah yang merangkumi kaedah berpusatkan bahan, hands on, interaktif serta mempunyai ciri belajar Pembelajaran Abad Ke 21. PdPc yang kreatif dapat memantapkan guru dalam mengajar murid-murid seterusnya meningkatkan kemahiran belajar murid-murid terutama dalam Tunjang Awal Matematik.

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ID 91: DataPintar: An Interactive App to Aid in Learning Data Measurement Topic Among Secondary School Students.

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Highlights: DataPintar is an innovative app solution designed and developed to potentially enhance teaching and learning outcomes that mainly focus on data measurements concepts within the Fundamental of Computer Science subject. It is an app developed using the current curriculum guidelines and integrates the New Academia Learning Innovation (NALI) framework that promotes student-centered, interactive learning through use of technology-based lessons that makes the understanding of complex issues made easier using visual, audio and tangible teaching methods. This innovation has the potential of providing students with a proper understanding, enhancing interest and hence results in an improvement in the general performance of the students in STEM education.

Keywords: *Interactive App; Data Measurement; Fundamental of Computer Science*

Introduction

The rapid evolution of information technology has influenced the need for updating educational practices and curriculum design. Its influence on the Internet and several technological innovations has caused changes in sectors like social, economic, and educational contexts (Vidal, 2022) and has shifted the educational approach to more interactive technology-integrated teaching methods, with an emphasis on critical thinking and problem-solving skills among students (Nuraeni, 2023). The need to revise the curriculum using digitalization theories has been found to be of great importance in enhancing students' digital competence and practices (Lyngdorf et al., 2022). According to Firdaus & Abdulkarim (2022), the digital age and the rapid growth in information technology called for a transformation of educational content so that it fits the new age.

Technology-based and more interactive methods of teaching and learning are becoming increasingly necessary in this advanced era of secondary education that is concerned with introductory courses such as Fundamentals of Computer Science that form the basis of the advanced information technology concept study for the students. One of the subjects in the Science, Technology, Engineering, and Mathematics (STEM) subjects is Fundamentals of Computer Science which is a very significant tool in making the students assessed as those who have the skills and knowledge necessary to survive in the technology-oriented world. Computer Science is a crucial subject in the senior secondary school curriculum aimed at equipping students with computer knowledge and its applications in today's ICT-driven economy (Ngozi, 2023). The need to introduce and reinforce computer science basics in every grade of elementary, middle school, and high school is underlined to ensure learners are ready for the advanced syllabus (Hurlburt, 2023).

Despite its significance, the effectiveness of the Fundamentals of Computer Science teaching and learning approaches, specifically in data measurement concepts, remains underexplored. Previous research related to the Fundamentals of Computer Science has only concentrated on topics such as algorithms and data representation. Shaharom and Abdul Rahman (2021) pursued the study to teach algorithms through the means of multimedia technology, thus boosting the engagement of learners and increasing their understanding of information technology and multimedia in the computer science course. Putera and Rosli (2021) carried out a study that addressed the student's problem with data representation by using multimedia as the main part of the taught material. This way, students might learn the material more engagingly and effectively via active participation. In this regard, both researchers (Shaharom & Abdul Rahman, 2021; Hashim et al., 2023) highlighted the need for visualizing and using multimedia as the main tactics to guarantee that students are engaged and understand computer science.

Even though a variety of studies have been conducted on fundamental computer science themes such as algorithms and data representation, very few studies have focused issues regarding data measurement concepts and the need to develop innovative tools to aid in this topic. This represents a knowledge gap, hence a need for further research and development of targeted educational tools and approaches to address the challenges and enhance the learning experience related to data measurement concepts. Therefore, this innovation was developed on this basis as follows

The Innovation: DataPintar

DataPintar is an educational tool for secondary school education aimed at improving the learning outcome of data measurements within the Fundamental of Computer Science subject. It is an application created by using Swift and is available in the Apple Store. DataPintar covers the explanation of main topics, including data measurement conversion, calculating the audio and image size, bit rate, the app provides explanations of the terms like resolutions, channels, frequencies, and the files formats. It provides interactive elements where students are allowed to manipulate data and observe the outcome which is in line with the principles of Science, Technology, Engineering and Mathematics (STEM) learning approach, which stand for and stress the application of concepts.

DataPintar enhances the delivery of basic concepts such as computation besides providing students with hands-on experience in actual applications of the theories concerning data measurement within digital media. With the use of the application, students are also able to learn more actively, thus leading to the enhancement of their comprehension on some of the computer science concepts with a view of enhancing the existing STEM education towards enabling students to meet future technological demands.

Innovation Objectives

The main objective of the design and development of DataPintar is to create an innovative and user-friendly mobile application that specifically addresses the challenges faced by secondary school students in understanding and mastering the topic of data measurement.

The application is designed to:

Enhance understanding through a mobile application that can address complex concepts such as data measurement conversion, audio and image size calculations, bit rate, resolutions, channels, frequencies, and file formats by simplifying it through visual, audio and interactive representation

Promote active learning using interactive, hands-on methods to engage students, making learning more effective compared to traditional, passive forms of instruction.

Improve learning outcomes by offering alternative learning tools material that can potentially lead to better academic performance by making abstract concepts more concrete and easier to grasp through practical applications.

Provide educators with alternative tools can potentially supplement their teaching methods that are in line with the latest technology.

NALI Approach Implemented in the Research

DataPintar, an interactive mobile application for the learning data measurement topics in the fundamental of computer science subject, is a mobile application that embodies the framework of The New Academia Learning Innovation (NALI) by offering a student-centered, interactive learning experience. DataPintar complements the hands-on approach by offering an interactive mobile application allows students to manipulate data and information to better understand complex data measurement concepts through practical application, therefore promoting deeper understanding and retention. This aligns with NALI's focus on student-centered learning, where the learner's active participation is central to the educational process.

The decision to use a mobile approach in developing DataPintar was to ensure that this tool can cater to the needs of apps that support blended learning by integrating digital tools into the traditional curriculum. Hence, enabling students to learn both independently and in conjunction with classroom activities. The app's design encourages self-directed learning while also serving as a supplementary resource that teachers can incorporate into their lesson plans, making it a versatile tool that supports multiple learning modes.

Novelty

The uniqueness of DataPintar is that it is among the few applications built specifically focusing on data measurement topic within the Fundamental of Computer Science curriculum in Malaysia for in the secondary schools' students. This application offers comprehensive coverage focusing not only on the simplest measurement of data but also includes such complex topics, as the calculation of the bit rates, audio and image file sizes. Before the design and development phase, the researcher has taken account of its alignment with the current curriculum of Fundamental of Computer Science, thus creating an appropriate app designed to fit seamlessly into the secondary school curriculum, making it an applicable tool for educators to use alongside traditional teaching methods. The deep understanding of the concepts of data measurement allows students to apply the knowledge obtained in real-life situations particularly in the fields of technology and digital media.

Innovativeness

Breaking from the traditional learning approach, DataPintar implies an innovative approach where it is centered around learning with the aid of interactive tools. This app leverages interactive features that allow students to engage in hands-on learning and potentially enhance learning outcomes. Student-centered classrooms and interactive teaching methods are increasingly preferred. Interactive teaching methods not only activate students' activities but also direct them toward communication and discussion, promoting engagement among students and between students and teachers (Rybchynska, 2023).The early stages of the need analysis, the researcher leveraged the use of a nominal group techinique to identify the issues arising regarding the topic, therefore resulting to the creation of a solution that is incorporates a user-centered design to ensure that the needs of the educators and students are met.

Impact

The focus of DataPintar is to provide an alternative in solving issues regarding the process of teaching and learning data measurements topic and improving the learning outcome. This app has the potential to significantly improve students' understanding and retention of complex concepts, leading to better grades and a deeper comprehension of computer science. On a wider point of view, DataPintar has the potential to become an interactive tool that can to not only students and teacher in schools, but also as a learning tool for students outside the traditional classroom setting, such as those in homeschooling or online learning environments.

Research Methodology

A Design and Development Research (DDR) approach was used in this research based on utilizing the concepts proposed by Richey and Klein. This study sheds light to the process of designing and developing an interactive application for learning data measurement concepts. It employs effective research methodologies with a primary focus on product development (Richey & Klein, 2007).

Table 1: Design And Development Research Phases

Phase	Type of Development
Analysis Phase	Literature Review Expert Consensus (Nominal Group Technique)
Design and Development Phase	The development of the DataPintar learning tool in using Swift Programming Expert Consensus (Fuzzy Delphi Method)
Evaluation Phase	Evaluation of the usability of DataPintar (Questionnaire).

Analysis Phase

In the analysis phase, the researcher analysed literature reviews to gather information of what has been studied within the realm of Fundamental of Computer Science subject and issues that had been already addressed. With the assistance of a group of experts in computer science education, was consulted to identify specific challenges in teaching data measurement. Based on structured discussions, these experts helped prioritize the most critical issues, ensuring the app would address the real pain points in the curriculum.

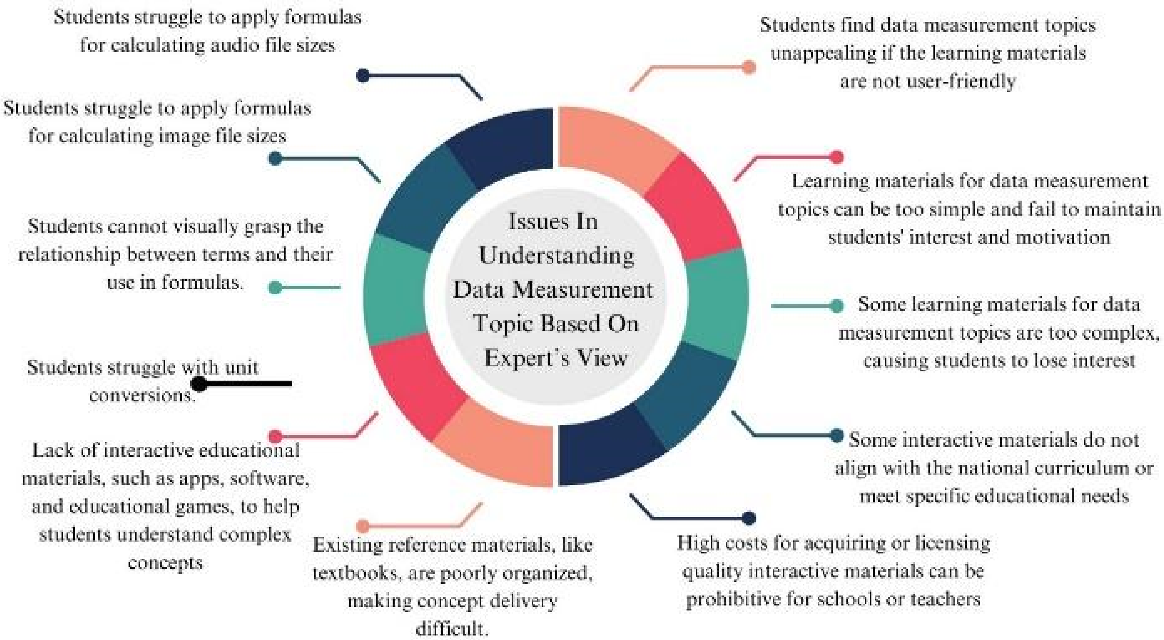

Fig 1: Issues In Understanding Data Measurement Topic

Design and Development Phase.

The design phase focuses on the app's structure, including the layout, user interface, and the types of interactive elements to be included. At this stage, analyses are transformed into a tangible blueprint. The design process of the contents for data measurement topics are aligned with the Fundamental of Computer Science curriculum in Malaysia. In this study, the learning standard used in this content will emphasis on 2.2 and the fourth stage of mastery level. Additionally, to effectively organize and portray the instructional material, a storyboard is indispensable. Leveraging Canva as a sketching tool in this phase, with its user-friendly interface, is a powerful aid in creating a storyboard that can be easily read and managed.

To develop the mobile application, the researcher implemented the use of Swift, a programming platform to create an IOS based mobile application. The researcher took into consideration elements regarding human computer interaction designs to ensure that the app is easy to use for secondary school students. This involves designing an intuitive interface, ensuring that the navigation is clear, providing immediate feedback on user actions, and making the learning process engaging and accessible. Before the Implementation phase can be carried out, the researcher published the app on the Apple Store, making it accessible to students and educators.

Evaluation

Currently, DataPintar is in the process of expert validation through fuzzy delphi methods. In the second phase of the project, this approach will be used to gain consensus from a broader group of experts, ensuring that the app's features and content are both relevant and effective.

Findings and Discussion of the Innovation

The findings from the initial analysis phase of the project indicate that there is a need for the development of DataPintar, a mobile application that provides interactive learning using current technologies. However, the evaluation of this innovation is still ongoing and is hoped to provide effective solutions to enhance the learning outcome.

Relevant Information

Commercialization Potential

There is a growing demand for interactive educational tools, particularly in STEM (Science, Technology, Engineering, and Mathematics) education. This app, focusing on a niche but essential topic within computer science, has significant commercialization potential. Therefore, for future purposes, this app has undergone the process of copyright dan published on Apple App Store.

Future Plans:

DataPintar is developed based on IOS platform and currently is still undergoing the evaluation process. However, the researcher plans to expand the app to other patforms such as android and web based to ensure that it is easily accessible and can be reached to targeted audience other than IOS users. Additionally, further research will be conducted on the effectiveness of the application towards the learning outcomes.

Acknowledgement

The design and development of this mobile application was within the course of Teaching and Learning of Computer Programming (GB6923) and funded by the Faculty of Education Research, Grant "GG-2024-004". On this note, we would like to thank the National University of Malaysia for their support during the process of design and development and copyrighting of the mobile app. We are grateful for the support because this has been useful in safeguarding intellectual property. We are also highly grateful to the subject matter specialists who agreed to be interviewed in the research and shared their opinions and ideas that greatly helped in the creation of the app. We appreciate the cooperation and support from everyone involved, especially guide most of the activities, without which this project could not have been realized.

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ID 92: CukaiPintar: A Modern Solution for Tax Learning, Engaging and Practical

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Highlights: An iOS application called CukaiPintar was designed with the express purpose of assisting pupils in Form 5 in comprehending the idea of income tax in mathematics. The program is intended to make it easier to do precise and speedy computations of income taxes, while also giving step-by-step instructions to guarantee a comprehensive comprehension of the subject matter. Students are able to have a better understanding of and mastery of the subject of income tax, lower the number of calculation mistakes they make, and feel more secure in their preparation for their SPM examinations with the help of CukaiPintar.

Keywords: *Tax Education; Financial Literacy; Curriculum Development*

Introduction

CukaiPintar is an iOS application that aimed to help the improvement of secondary school students' knowledge base in taxation. Due to the difficulties faced by students in their attempts to understand certain complicated tax details, this app includes game element, scenario-based learning and actual SPM trial examination questions, making it innovative and engaging. Developed specifically for the App Store, CukaiPintar is designed for both classroom use and home learning, guarantee that students can grab effective tax knowledge and fun in the same cycle.

Tax education has been recognized as having great significance in the formation of financially literate and responsible citizens and at the same time is considered as one of the difficult subject to teach. Ideally, CukaiPintar solves this problem by providing relevant and real calculative tools that can give an instant result, and support self-assessment among the target users. Another advantage lies in the use of possibilities of interaction and individual learning trails that improve students' interest and effective skills.

Consistent with the New Academia Learning Innovation model, CukaiPintar tries to engage the students actively utilizing appropriate technological interventions in a method that allows the learners to use theoretical knowledge when solving problems. The features also make learning as easy and interesting as possible and this makes it easier for students to understand what was at one time complicated or irrelevant for them. It is through this project that we aim at enabling learners develop personal competencies that will enable them handle their financial lives.

Content

This app is developed with the aim of addressing the challenges faced by secondary school students in understanding taxation by providing interactive tools that simplify calculations, enhance practical application, and enrich the learning experience with relevant and engaging features.

Objectives:

The app aims to simplify complex income calculations to help students build a basic understanding of financial concepts, addressing the challenge of abstract content and lack of basic financial knowledge. It enhances practical application, relevance, and motivation by making tax calculations more relatable to real-world scenarios and incorporating gamification elements to boost student engagement. Additionally, the app provides detailed solutions and automatic corrections to tackle the lack of interactive teaching materials and unengaging methods, offering a more interactive and engaging learning experience.

NALI approach implemented in the research:

The app emphasizes interactive and student-centered learning, aligning with NALI's focus on active learning by engaging students through interactive features. By incorporating real SPM trial exam questions and providing instant feedback with complete corrections, the app fosters critical thinking and self-assessment. The inclusion of gamification and scenario-based learning elements makes the learning experience more engaging and relevant, supporting NALI's goal of connecting education to real-world applications. Additionally, the app supports blended learning by being versatile enough for both classroom settings and independent study, enhancing flexibility and accessibility for students. By offering hands-on experience with taxation, the app empowers students with practical skills, contributing to NALI's objective of promoting innovation in education.

Research Methodology

The research began with a needs analysis using the Nominal Group Technique (NGT) to identify the challenges faced by secondary school students in understanding taxation. NGT, a structured method for achieving consensus and gathering data, focuses on idea generation, issue resolution, and prioritization (Khurshid et al., 2023). Five expert mathematics teachers, each with over fifteen years of experience, participated in the NGT sessions to explore these challenges. According to Gibson and Soanes (2000),a typical NGT session lasts 1.5 to 2 hours, and as noted by Andre L Delbecq et al. (1975) and O'Neil and Jackson (1983), it typically involves 5 to 10 participants.

The findings highlighted eight key challenges, including the abstract nature of tax concepts, a lack of basic financial knowledge, and the scarcity of interactive teaching materials. Based on these insights, the researcher designed a storyboard and subsequently developed the app, incorporating interactive elements such as tax calculators and quizzes featuring real SPM trial exam questions. Mathematics, known for its abstract nature, is often perceived as difficult and intimidating by students worldwide, including in Malaysia (Hui & Rosli, 2021). This common perception underscores the need for more effective teaching strategies in both taxation and mathematics education. The app's features are designed to make learning more engaging and practical, addressing these challenges and enhancing students' understanding of taxation.

The design and development phase focused on creating an engaging and interactive learning tool tailored to secondary school students. The app incorporates key features such as tax calculators, quizzes based on real SPM trial exam questions, and detailed solutions for incorrect answers. These elements were designed to make abstract taxation concepts more accessible and practical for students. SwiftUI was selected for the app's development due to its ability to create a clean, responsive, and intuitive user interface. The design prioritized user experience, ensuring that students can easily navigate and interact with the app's features. The app aligns with the national curriculum, reinforcing classroom learning and offering practical applications of mathematical concepts related to taxation.

While the design and development phases have been completed, the final phase—usability assessment—has yet to be conducted. This phase will involve testing the app with actual students and teachers to evaluate its effectiveness in enhancing students' understanding of taxation. The usability assessment will follow the *Design, Develop, Research* (DDR) approach, ensuring that feedback is gathered and analyzed to guide any necessary refinements to the app.

The project has successfully completed the design and development phases, laying a strong foundation for an innovative educational tool that addresses the challenges identified in the needs analysis. The next step, usability assessment, will be crucial in determining the app's impact on students' learning and identifying areas for further improvement. By adopting the *DDR* approach, the project is poised for continuous enhancement based on real-world feedback, ensuring the app remains a relevant and effective educational resource.

Finding and discussion

The initial stages of the project, particularly the needs analysis and design, provided critical insights into the challenges students face with taxation concepts. Feedback from expert mathematics teachers revealed that students struggle with the abstract nature of taxation and lack practical tools to bridge this gap. These findings directly influenced the app's design, which focuses on making complex taxation concepts more accessible through interactive and practical features.

The design phase successfully translated these insights into actionable solutions. The app includes interactive elements such as tax calculators and quizzes that provide instant feedback, addressing the need for more engaging learning methods. Additionally, by incorporating detailed explanations for incorrect answers, the app offers a valuable learning tool that reinforces understanding rather than merely assessing knowledge. While the full impact of the app cannot yet be assessed without the usability assessment, the features developed thus far are poised to address the core challenges identified. The integration of real-world scenarios, such as SPM trial exam questions, aims to make learning more relatable and less intimidating for students.

The app's design suggests that it has strong potential to enhance students' understanding of taxation. Its focus on interactivity and practical application aligns with modern educational strategies that emphasize active learning. Although the usability assessment has not yet been conducted, it is expected that the app will positively impact student engagement and comprehension of taxation topics. The next steps will involve testing these assumptions through a structured usability assessment phase. This will provide empirical data on how effectively the app meets its educational goals and how students interact with the features in a real learning environment. The findings from this assessment will be crucial in refining the app to ensure it delivers maximum educational value.

The findings from the design and development phases suggest that the app is well-positioned to tackle the challenges identified in the initial needs analysis. By focusing on interactivity, practical application, and immediate feedback, the app offers a promising solution for enhancing students' understanding of taxation. The forthcoming usability assessment will provide the necessary data to confirm its effectiveness and guide any further improvements.

Other Relevant Information

Commercialization Potential:

The app is designed with commercialization in mind, with plans to launch on the App Store. It targets secondary school students in Malaysia, addressing a clear need for improved financial literacy education. However, the app's features are adaptable for broader markets, including other countries or educational systems where taxation and financial literacy are part of the curriculum. The app's scalability, coupled with the increasing emphasis on digital education, enhances its potential for commercial success.

Acknowledgement

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ID 94: MAGICIPHER: An Innovation for Computer Science Subject

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Highlights: MagiCipher is an educational application focused on teaching various encryption techniques, such as the Caesar Cipher, Columnar Transposition Cipher, and Reverse Cipher. The application that are design for Sains Komputer Subjects features interactive quizzes with objective questions, allowing students to engage with the material and test their understanding of these ciphers. Additionally, the application includes functionalities like image zoom and drag, enhancing the user experience. The project integrates creative instructional methods with modern technology, making it a valuable tool for teaching cryptography in a more engaging and accessible way.

Keywords: *Cipher; Caesar; Columnar Transposition; Reverse*

Introduction

In the current evolving educational environment, incorporating technology-based learning is essential for maintaining student interest and active participation in the classroom. At its essence, this educational tool offers a novel approach to teaching cryptography through an interactive Swift based application. This tool is specifically designed to facilitate student exploration and comprehension of various encryption techniques, such as the Caesar Cipher, Columnar Transposition ciphers, and Reverse Cipher. One of the primary advantages of the application is its innovative blend of traditional teaching methods with digital interactivity, which effectively enhances students' grasp of complex concepts. MagiCipher has been developed with a highly innovative teaching approach, surpassing traditional methods by offering interactive tools and quizzes that cater to the needs of educators and students. As outlined in the New Academia Learning Innovation (NALI) model, which prioritizes active engagement and student-centered learning, students have the opportunity to interact directly with cryptologic principles, thereby facilitating a deeper understanding of the subject matter and honing their problem-solving skills. Furthermore, the application has extensive ramifications for student learning. In addition to making the study of cryptography more captivating, it also enables students at all educational levels to experiment with encryption algorithms, promoting not only comprehension but also hands-on exploration. It not only facilitates better retention of information by students, but also nurtures independent learning and critical thinking, both of which hold significant importance in modern education.

Content

Project Objectives

The first goal of MagiCipher is to design an engaging, mobile educational application that will help the students better understand and apply cryptology on their own. Focusing on key methods for encrypting the information, namely the Caesar Cipher, Reverse Cipher, and Columnar Transposition Cipher, the application introduces these highly logical concepts in the simple form. MagiCipher has been developed to ensure compatibility of standard learning methodologies and the innovative technology in the current world. This approach forms a colorful interactional type of learning environment that enlightens the students as they learn, besides encouraging participation in solving problems.

The application of MagiCipher will be in the implementation phase which will take it into learning institutions to enable the learners to practice what they learn through quizzes. This application will empower the learners in the extent that they will learn on their own, and their curiosity will be provoked on the subject matter. Such self-directed learning is valuable for enhancing students' conceptual grasp of cryptography as it directly relates them with topics of practical application and re-affirms their learning.

Last of all, in the evaluation phase, it is proposed to determine how far MagiCipher has enhanced the rate of students' learning outcomes. This evaluation will therefore include students and educators feedback, analysis of the assessment results as well as reconsideration of the application on the basis of the recommendations provided. The aim of MagiCipher is to change the current paradigm of cryptographic education to a system that will allow students to face further challenges and become active and demanding members of the digital society.

NALI Approach

The New Academia Learning Innovation (NALI) model is a crucial component of this groundbreaking project, as it guides its concerted efforts to revolutionize and transform educational practices through a comprehensive and multifaceted approach. With a focus on novelty and cutting-edge methodologies, NALI introduces a revolutionary and interactive Swift-based application, which serves as the centerpiece of this initiative. This technological innovation radically transforms the traditional learning experience, making complex cryptographic concepts, like the illustrious Caesar Cipher, Reverse Cipher, and Columnar Transposition Cipher, more accessible, comprehensible, and engaging for students of all levels and backgrounds. What sets this application apart is not only its advanced technological features but also its meticulously crafted and creatively designed interface. By seamlessly combining time-tested educational methods with state-of-the-art digital tools, the application provides a unique and immersive learning environment unlike any other. Students are introduced to a novel and captivating way of learning, creating an unparalleled opportunity for growth and development. Promising a departure from conventional and monotonous teaching practices, this project places a strong emphasis on active engagement and experiential learning.

By offering hands-on experiences and interactive quizzes, students are actively involved in the learning process, enhancing their understanding. Moreover, this pedagogical approach fosters the development of essential problem-solving skills and critical thinking, which are integral to both academic pursuits and real-world applications. The adaptability and flexibility of MagiCipher align seamlessly with the NALI model's core principle of student-centric learning. By empowering students to take charge of their own educational journeys, it ensures that every learner is actively engaged and invested in the process of acquiring knowledge. This alignment with the NALI model results in a highly personalized and effective learning experience that caters to the unique needs and learning styles of each student, fostering a sense of ownership and achievement.

Furthermore, the impact of this application extends far beyond the boundaries of the classroom. By enabling students to independently explore and experiment with various encryption techniques, it significantly enhances their critical thinking and problem-solving abilities. This newfound empowerment not only facilitates improved knowledge retention but also fosters a deeper understanding of cryptographic concepts, positioning the application as an invaluable and indispensable tool in modern education.

In conclusion, this project stands as a testament to the transformative power of innovative technological solutions within the realm of education. Through the implementation of the New Academia Learning Innovation (NALI) model and the revolutionary Swift-based application, educational practices are revolutionized, creating a more engaging, accessible, and effective learning environment. This project serves as a beacon of educational progress, showcasing how the fusion of innovation and technology can pave the way for a brighter future in education, where students are inspired, motivated, and equipped with the necessary skills to navigate an ever-evolving digital landscape.

Research Methodology

The research methodology for this project is structured in several distinct phases, with the current focus on the Development stage. Initially, the methodology involved the design and creation of a cryptography teaching application using Swift, a modern programming language known for its robustness and efficiency. This prototype application integrates various encryption techniques, including the Caesar Cipher, Reverse Cipher and Columnar Transposition Cipher, into a user-friendly and visually captivating digital format. The development phase has successfully produced a highly functional prototype that allows for interactive learning and engagement. The prototype incorporates features designed to facilitate hands-on exercises, such as interactive quizzes, practical examples, and dynamic learning tools. The user interface of the application has been carefully crafted to provide a seamless and intuitive experience, enabling students to easily navigate through various concepts and practice cryptographic operations in a stimulating environment (Bhagat et al.2023) (Khan et al., 2021).

During the upcoming stages, the Implementation phase will encompass the deployment of the prototype in an educational environment. This thorough deployment strategy entails working in cooperation with schools and universities to incorporate the application into their current curriculum. This will enable a more profound comprehension of how the app can improve the learning experience and encourage active engagement among students. Within these educational settings, students will utilize the application to delve into cryptographic concepts, tackle puzzles and challenges, and complete related exercises (Rayavaram et al.2024). Through active utilization of the app, students will acquire a hands-on understanding of different cryptographic techniques and cultivate crucial problem-solving abilities.

Upon completion of the implementation, the Evaluation phase will be carried out to gauge the effectiveness of the application. This comprehensive assessment will entail gathering and analyzing user feedback from both students and educators in order to determine the app's impact on learning outcomes. The evaluations will focus on a range of measures, such as levels of engagement, understanding of cryptographic principles, and the ability to apply these concepts in real-world situations (Liu & Panagiotakos, 2022). Furthermore, the assessment will take into consideration the overall user-friendliness of the app and its role in improving problem-solving skills and independent learning among students. It will also delve into the degree of motivation and excitement generated by the application, with the aim of identifying areas for improvement and enhancement.

The findings from these assessments will provide important information to guide any needed changes and enhancements to the application. Through thorough analysis of the feedback and integration of helpful suggestions, the team will guarantee that the app is in line with educational goals and effectively aids in student learning. Additionally, these ongoing improvements will allow the application to adjust to the constantly changing landscape of cryptographic knowledge and teaching methods. The commitment to continual enhancement ensures that the app continues to be a beneficial education tool that empowers students to establish a strong understanding of cryptography and nurtures their interest in this fascinating field.

Finding and discussion of the project or innovation.

The first results from the analysis of teachers' views of the usefulness of the MagiCipher application show that this is an innovative approach to learning cryptography. Some of the teachers said that it helped to close the divide between conventional pedagogy and contemporary technology by making concepts in Cryptography easy and fascinating to the learners. The features which enhance interactivity, together with the more proactive approach invoked by the application, was flagged as a major improvement relative to traditional instruction aids.

The teachers also reiterated the benefits that the application has on enabling the students engage in self-directed learning and be creative. They also observed that it might be useful to incorporate quizzes and practical exercises into the app to build up the students' knowledge of cryptographical concepts. Additionally, the introduction of gamification and extensive use of digital elements was considered as innovation which could help attract students' attention and interest to the topics discussed.

However, the reader must be advised that despite the above results, the overall assessment of the notebooks from the students' viewpoint is yet to be conducted but only being planned for. This second stage of the project will consist in collecting precise feedback from the students involved in order to analyze the full extent of the learning application for learners. This future evaluation will be important in the overall determination of the MagiCipher efficiency and in turning of new directions that it needs to take.

Commercialization Potential

Although the project has not yet garnered formal awards or public recognition, it has been acknowledged for its groundbreaking approach to teaching cryptography. This recognition highlights the MagiCipher alignment with contemporary educational models, such as the New Academia Learning Innovation (NALI) framework. The application's integration of interactive elements, such as quizzes and practical exercises, showcases its potential to enhance educational practices by making complex concepts more accessible and engaging. MagiCipher potential for broader adoption is promising. As educational institutions increasingly seek innovative solutions to improve student engagement and learning outcomes, this application offers a compelling case for integration into secondary education curricula. Its ability to provide a hands-on, interactive learning experience could be particularly appealing to educators and institutions looking to modernize their teaching methods.

Another measure is proposed to safeguard the MagiCipher contents is by applying for a copyright with a view to protecting its work from distortion. Also, for the app which is to be launched on apple App Store, it will be able to reach people from different parts of the world. Aside from the commercial purposes, the project will also request approval and publish the work through the authority of the Kementerian Pendidikan Malaysia (KPM) making the product as a valuable tool for the education system in Malaysia. But what serves as a major advantage of this strategic approach for boosting the visibility of the app at the same time contributes to advancing the achievement of national education goals, which makes it a high possibility to quickly gain popularity and receive further recognition in the sphere of education and innovations.

Future development and refinement of the application could further bolster its appeal and effectiveness. Continued improvements and enhancements are expected to increase its efficacy as an educational tool, potentially leading to recognition and accolades in educational innovation exhibitions and conferences.

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ID 95: Enhancing Experimental Accuracy and Learning Outcomes with CLApS: The Integrated Data Sheet and Digital Enhancements

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Highlights: CLApS (Charles's Law Apparatus Set) revolutionizes the study of Charles's Law in Chemistry education with its integrated data sheet and digital enhancements. Traditionally, verifying Charles's Law using separate, conventional apparatus has been prone to errors and inefficiencies. CLApS integrates a user-friendly digital interface that simplifies temperature and gas volume measurements, significantly reducing experimental errors to an impressive 0.36%. It also streamlines data collection and analysis, optimizing student learning experiences. The incorporation of digital enhancements in CLApS not only enhances experimental accuracy but also reduces equipment costs by 67.6% and shortens experiment duration by 53.1%. Student feedback underscores its effectiveness, with an average survey score of 4.73, indicating substantial improvements in learning outcomes and preparedness for STEM fields. This innovation emphasizes how CLApS, through its integrated data sheet and digital features, enhances experimental accuracy, facilitates efficient data management, and fosters enhanced learning experiences in STEM education.

Keywords: *Charles's Law; Experiment Accuracy; Data sheet; reading error*

Introduction

Chemistry is a compulsory subject for all students of the science program at the Matriculation College. To prepare students for life at the university; science process skills, manipulative skills, self -learning and learning using technology towards industry 4.0 are introduced to students. Experiment in verifying Charles's Law is conducted in Semester 1 for the Chemistry subject SK015 of the Science Matriculation Program. This experiment is conducted to discuss the topic of gas laws. The implementation of this experiment can improve students' understanding of the theories learned during lectures and tutorials. This study focuses on enhancing students' scientific process skills and empowering their manipulative abilities in recording temperature and air column height readings during the Charles's Law experiment. Through this experiment, students are provided with the opportunity to plot graphs to accurately verify Charles's Law. Previous research has shown that experiments in Chemistry are essential activities not only for deepening students' understanding of chemical concepts but also for aiding in the development of scientific skills (Apparatus, n.d.; Blanco & Romero, 1995; Bopegedera, 2007; Campbell et al., 2011; Dietrich et al., 2019; Limpanuparb et al., 2019; R. F. Muldiani et al., 2020; Ratu Fenny Muldiani & Hadiningrum, 2019).

Furthermore, Chemistry experiments play a crucial role in fostering creative thinking and encouraging the development of a scientific attitude among students. A student-centered teaching approach that involves activities, investigations, and experiments is instrumental in nurturing and sharpening their scientific process skills. This study also highlights that such structured and effective experiments can significantly enhance students' thinking skills (Irwandi & Chanunan, 2018). Moreover, additional research is necessary to examine the Charles's Law experiment, particularly in terms of improving and modifying the experimental apparatus used, to ensure that the experimental data obtained is more accurate and reliable (Muldiani R F and Hadiningrum K, 2018). This study also aims to assist lecturers in conducting more effective teaching and learning sessions, with experimental data that is rationally accepted and can be explained through direct observation of existing phenomena or based on theoretical references (Kerlinger F N, 2000).

Therefore, this study is expected to make a significant contribution to improving the quality of teaching and learning in Chemistry at the matriculation level, particularly in the implementation of experiments involving Charles's Law.

The conventional apparatus was used to conduct the Charles Law experiment at the matriculation colleges throughout Malaysia consists of 5 units of separate apparatus and devices; namely 250 milliliters (mL) measuring cylinder, clinical thermometer, glass tube, plastic ruler and rubber. Several problems have been identified while conducting experiments using this existing conventional apparatus. It was found that they were difficult to operate and produced inconsistent readings. Damage to the apparatus and tools used such as bent plastic rulers, broken glass tubes and thermometers, loose and broken binder rubber caused it to need to be replaced frequently. This has contributed to wastage and environmental pollution. Apart from that, its structure consists of several separate apparatus units causing it to require a lot of space to be stored. All of this has a negative impact on the teaching and learning (T&L) process in the laboratory and contributes to a relatively high percentage of errors when students plot graphs to verify Charles's Law.

Recognizing these limitations, our group has developed the Charles's Law Apparatus Set (CLApS). CLApS is designed to be simpler, more compact, economical, and user-friendly compared to traditional apparatus. It aims to achieve significant improvements in experimental outcomes: reducing error percentages to 5.00%, cutting equipment costs by 40%, and decreasing experimental operation time by 50%. Central to CLApS is the integration of a digital data sheet, pivotal in revolutionizing the experimental process by addressing these challenges. The digital data sheet enhances the experiment in several critical ways. It automates data collection, minimizing human error in recording measurements and ensuring more precise and consistent experimental results. Real-time data analysis capabilities enable students to instantly visualize trends and relationships between variables, facilitating deeper insights and informed decision-making during experiments. Digital formats facilitate graphical representation and numerical analysis, aiding students in constructing graphs, identifying patterns, and drawing effective conclusions. The integration of digital data sheets aligns with Industry 4.0 educational technology trends, equipping students with essential digital literacy skills for future academic and professional environments.

Analysis of the study demonstrates significant improvements: the experimental error rate reduced to just 0.36%, equipment costs slashed by 67.6%, and experimental operation time shortened by 53.1%. The adoption of CLApS in Teaching and Learning (TnL) environments produces graduates from the Matriculation Program who are knowledgeable, creative, innovative, and competitive in STEM fields through enhanced manipulative and scientific skills. This is evidenced by a mean score of 4.73 in student questionnaires, indicating that CLApS substantially enhances experiment performance and provides more accurate data.

Project Objectives

The **CLApS (Charles's Law Apparatus Set)** project aims to enhance the teaching and learning process in the topic of Charles's Law within the Matriculation Science Program by achieving several key objectives. These objectives include minimizing the percentage of errors in experimental data to below 5.00%, thereby improving the accuracy of results, reducing the overall cost of equipment required for the experiment by 40%, and cutting the experimental operation time by 50%. Additionally, the project seeks to integrate digital tools, such as a digital data sheet, to foster students' digital literacy and data-handling skills, while also promoting the development of scientific process skills, manipulative abilities, and critical thinking among students.

Research Methodology

The research methodology employed in this project follows the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), a systematic approach to instructional design. The project began with the **Analysis** phase, where the limitations of the conventional apparatus used for the Charles's Law experiment in Matriculation colleges were identified. This phase involved gathering feedback from educators and students about the challenges they encountered, such as operational difficulties, high error rates, and significant costs. These findings informed the objectives of the CLApS project, which aimed to address these specific issues.

In the **Design** phase, the focus was on conceptualizing a compact, user-friendly apparatus that integrated digital tools to simplify the experimental process, enhance accuracy, and reduce costs. Detailed plans were developed for CLApS, incorporating features like automated data collection and real-time analysis via a digital data sheet. Following the design, the **Development** phase involved creating the CLApS prototype, conducting iterative testing, and making refinements based on feedback to optimize its functionality and usability.

By incorporating a digital data sheet into CLApS, we not only aim to optimize the educational experience in the laboratory but also empower students with practical skills and knowledge crucial for their academic and professional success in STEM disciplines as in Figure 1.

Pictures/ Schematic diagrams/ Flow Charts

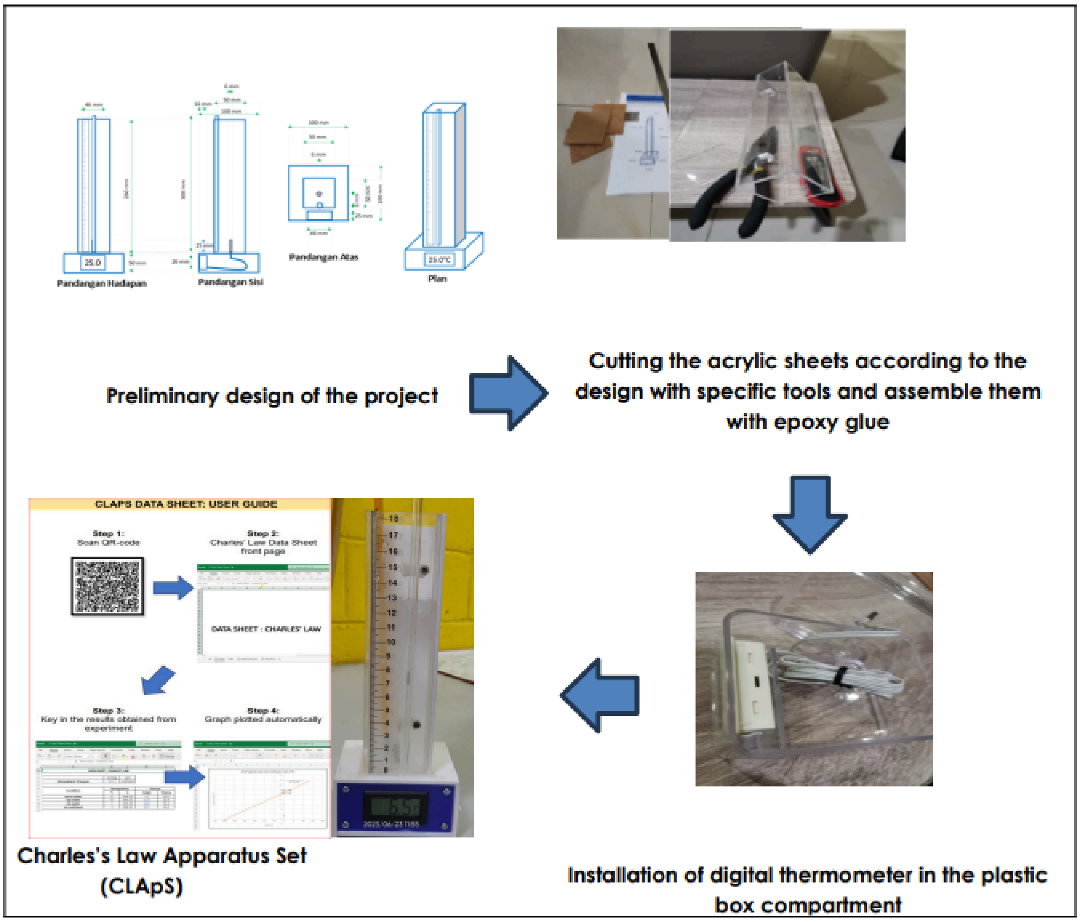

Figure 1: Flow chart the making of CLApS

The **Implementation** phase saw the deployment of CLApS in selected Matriculation colleges, accompanied by training sessions for lecturers to ensure they were familiar with the new apparatus. This phase also included using CLApS in actual student experiments, allowing for real-time data collection and analysis to assess its impact on the learning process.

Finally, in the **Evaluation** phase, both quantitative and qualitative data were collected to evaluate CLApS's effectiveness. Metrics such as error rates, operation time, and cost savings were quantitatively analyzed, while qualitative feedback on ease of use, accuracy, and satisfaction was gathered through questionnaires. A comparative analysis was conducted to assess CLApS's performance against traditional setups, leading to further refinements to maximize its impact on student learning outcomes. Through the structured application of the ADDIE model, the research ensured a systematic and effective development and implementation of CLApS, resulting in a more efficient and impactful teaching tool for the Chemistry curriculum.

Finding And Discussion of The Project Innovation

Objective 1: Reduce the error percentage to 5%
The data obtained from the experiment proves that CLApS can help students to collect data consistently as evidenced through the R^2 value for CLApS which is 99.64% of the theoretical value, equivalent to 0.36% in terms of percentage of error. This value indicates that the use of CLApS has produced a very small error. The first objective, which is to reduce the error percentage to less than 5%, has been successfully achieved.

Objective 2: Reduce equipment costs by 40%
Apart from conventional apparatus, commercial apparatus has also been used as an alternative in the chemistry laboratory of the Malacca Matriculation College. However, its use has been discontinued as the apparatus requires the use of more chemicals than conventional apparatus resulting in increased operating costs in the laboratory. Table 1 displays the cost comparison between conventional apparatus, commercial apparatus and CLApS. CLApS saved the cost by 67.6% which is equivalent to RM125. Therefore, the second objective of reducing equipment costs by 40% has been successfully achieved.

Objective 3: Reduce handling time to 50%
Observations were also made on the experimental operation time using conventional apparatus and CLApS. The data in Table 2 show that the experimental operation time can be reduced by 53.1% which is equivalent to 19 minutes when students use CLApS. This reduction in time will provide more opportunities for students to analyze their findings

and have discussions with the lecturers. This is a very encouraging added value. Thus, the third objective of reducing the experimental operation time to 50% was successfully achieved.

TABLE 1: Comparison of equipment costs

	Convensional apparatus	Commercial apparatus	CLApS 3.0
COST	RM125	RM185	RM60
SAVING	RM65	RM125	-
% SAVING	52%	67.6%	-

TABLE 2: Comparison of operating time

Student	Convensional apparatus (minute)	CLApS (minute)
1	39	20
2	35	16
3	38	16
4	31	15
Average	35.8	16.8
Time saving (minute)	19.0	
% Time saving	53.1%	

All the evidence above shows that CLApS has succeeded in achieving its objective which is to reduce the percentage of errors to 5%, thus showing that CLApS innovation reliable and commercially ready. The time savings of 53.1% and cost savings of 67.6% also show that CLApS have great potential to be marketted commercially. By incorporating a digital data sheet into CLApS, we not only aim to optimize the educational experience in the laboratory but also empower students with practical skills and knowledge crucial for their academic and professional success in STEM disciplines as in Figure 1.

Impact Of Innovation

Short Term Impact of Innovation

CLApS has created a conducive environment for students to conduct experiments. Students become more enthusiastic and passionate because they now have apparatus that are easier to use and give better experimental results than before. Indirectly, CLApS is capable of preparing students for institutions of higher learning in science, technology and professional fields by 2050. This is in line with Melaka Matriculation College's aspiration which is to produce outstanding human capital. In addition, the laboratory assistants were more contented and less stressed because the broken and damaged apparatus has been reduced with the use of CLApS in the laboratory.

Long Term Impact of Innovation

The long-term impact of our innovation, CLApS (Charles's Law Apparatus Set), has been significant. Firstly, it has contributed to substantial financial savings, with a reduction in government expenditure on equipment for Charles's Law experiments by RM125 per model, translating to a 67.6% cost reduction. Preparation and maintenance time for laboratory assistants has also been optimized; where previously five separate apparatuses were needed, CLApS consolidates them into one, simplifying the setup process. Additionally, the time required for students to complete the experiment has been halved, from 36 minutes to just 17 minutes, thanks to its user-friendly design. The durability of CLApS eliminates the issue of broken apparatus, especially thermometers, achieving a 0% breakage rate. The teaching and learning process has been greatly enhanced, with the experimentation objectives and learning goals being fully met due to accurate data and efficient use of resources. Furthermore, the project aligns with national goals by fostering innovation in education and advancing the teaching profession, meeting the aspiration of producing at least one innovation project per educator.

Novelty/Creativity/Innovativeness/Applicability

From five individual and separated items as in the conventional apparatus, CLApS has it all in one simple and compact model. CLApS is a 9 cm x 7 cm x 33 cm cuboid container, constructed using 3 mm A Grade acrylic sheets. It is equipped with a digital thermometer with temperature range of -20^{o}C to 70^{o}C, a glass tube containing mercury plug at the inner wall of the container and has engraved scale (in centimeters unit) on its surface. CLApS comes with CLApS Data Sheet, an apps created to generate a straight line graph from the tabulated volume and temperature data in order to verify Charles's law.

It has become the first innovation product of its kind in Malaysia and has been registered for intellectual property protection under MyIPO number CRLY00026913 with the aim of being commercialized and marketed to matriculation colleges, form six colleges, pre-university centres and secondary schools.

he project adopts the NALI (Novelty, Applicability, Innovativeness, and Learning Impact) approach in several key ways. **Novelty** is achieved by integrating traditional apparatus into a single, compact unit that incorporates digital technology to automate and streamline data collection. The **Creativity** of CLApS is evident in its design, which overcomes the limitations of conventional setups by providing a more efficient and user-friendly solution. **Innovativeness** is highlighted through the integration of digital technology, aligning with Industry 4.0 educational goals and equipping students with essential digital skills. The **applicability** of CLApS is demonstrated by its potential for widespread use in various educational settings due to its cost-effectiveness and ease of use. The project's **impact** is significant, with notable reductions in error rates, equipment costs, and operation time, thereby enhancing the quality of student learning and optimizing resource use.

Achievement

In recent years, our work in science education has garnered significant recognition. In 2021, we received the Gold Award at the International Invention, Innovation and Design Expo (INoDEx 2021) and the Platinum Award at the Seminar Penyelidikan dan Pertandingan Inovasi IPG Kampus Dato' Razali Ismail. Additionally, the High Impact Innovation Award at the Karnival Kumpulan Inovatif dan Kreatif Profesionalisme Keguruan 2021 underscored our innovative contributions. In 2022, our achievements continued with the Science Education Award (Consolation Prize) from the Malaysia Toray Science Foundation, alongside multiple accolades at Kimia Invensi dan Inovasi Malaysia 2022 (KI2M 2022), including the Diamond Award, Gold Award, and Best Video Award. Our success was further highlighted by receiving the 2nd Best Innovation and Gold Award at the Pre-University Matriculation Innovation Competition (PIITRAM2022).

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ID 96: LeMoSHyP Module

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Highlights: The LeMoSHyP Module combines interactive digital and hands-on activity to draw the orbitals overlapped among 25 students of the 2023/2024 session. Analysis of end-of-term exam work reports, quizzes and literature reviews, revealed a significant problem in drawing the orbitals overlapped. The LeMoSHyP Module was designed based on Scaffolding Theory through mastery and self-learning. The document analysis (pre-test and post-tests) and non-structured interviews exhibit 91.7% of students failed the pre-test, while in the post-test 91. 91.7% were excellent and 8.3% gained honours which shows that LeMoSHyP Module boosted students' confidence, enthusiasm, and accuracy in drawing orbitals overlapped which implemented visual, auditory, read & write and kinesthetics (VARK) learning styles. Its vibrant colours stimulated students' memory, understanding, and skills in which prepares students for the 4.0 Industrial Revolution by encouraging the 4C skills: creativity, collaboration, critical thinking, and communication.

Keywords: *LeMoSHyP; orbitals overlapped; Scaffolding Theory; mastery and self-learning*

Introduction

LeMoSHyP Module is a *hands-on* learning tools across the digital world. This can be seen in the application of the acronym as a strengthening of remembering the sequence of steps as well as the use of models in coaxing abstract as *hands-on* learning. Both are intertwined in digital form to make learning more engaging, more understandable, and more student-friendly, and most importantly, it is self-learning that can take place anywhere, at any time, according to the student's suitability for face-to-face learning or online learning. The failure of students to draw Lewis's structure leads to misconceptions and affects their mastery of the subtopics of molecular geometry, polarity, orbital overlap, and hybridization. Drawing Lewis's structure is the basis for students to master the title of orbital hybridization. Lewis's correct structure will allow students to follow, understand, and subsequently master any subtopics related to his structure. This innovation aims to make abstract learning related to Lewis's structure feasible as self-learning in a more student-friendly, engaging, easy to understand, remember, and master way.

A preliminary review was conducted to identify the difficulties faced by students in drawing Lewis structures, employing document analysis and structured interviews. The document analysis involved evaluating students' work reports and quiz results. From the Student's Work Report (LKC) of the PSPM Semester 1 session 2019/2020, it was found that 30% (378 out of 1259 students) failed to draw Lewis structures correctly. Additionally, 20% of the students incorrectly drew hydrogen atoms attached to carbon atoms, and 30% of the 113 students depicted a double bond between an oxygen atom (bound to a hydrogen atom) and a carbon atom. Quiz 4 analysis further revealed significant inaccuracies in students' ability to draw Lewis structures. Common errors included incorrect summation of valence electrons, failure to draw structures adhering to the octet rule, and omission of double bonds in molecules requiring them. 8 out of 12 students struggled with the sequence of steps, 9 out of 12 could not draw structures without a double bond, and 11 out of 12 failed to properly include double bonds. Besides, structured interviews provided additional insights, twelve students were interviewed, only three expressed interests in chemistry. Eleven students reported difficulty in recalling the steps to draw Lewis structures, with an equal number unable to draw them correctly or incorporate double bonds.

Literature underscores the importance of mastering Lewis structure drawing for understanding the physical properties, reactions, spatial structure, and geometry of covalent compounds. Wan (2014) highlights the importance of writing Lewis's structure for students to understand the physical properties and reactions of chemicals and predict the structure of space and geometry of covalent compounds. Although Lewis's structural drawing skills are important in learning molecular geometry, it is also a matter that often causes problems for most students, particularly Matriculation College students. According to Wan (2014), the problem may be because the description of drawing Lewis's structure for compounds in textbooks at the high school and pre-university level is difficult, and this is less helpful for students in remembering the step sequence of drawing Lewis's structure. The description includes six steps to paint the Lewis structure, including the need to comply with the octet rules of each atom. This leaves the student unable to paint it well. The steps in conventional teaching to paint Lewis's structure are quite long and hard to remember (Aminah & Noor, 2014).

Terhune and Kari (2016) highlight the difficulty students face in translating macroscopic information into symbolic language. To address these issues, the LeMoSHyP Module, incorporating the SToVaDiM acronym in kit form, learning videos, and 2D-MoS kit has been introduced. This module offers a step-by-step guide, facilitating easier recall of the sequence, and integrates hands-on learning with digitized, systematic, and student-friendly resources. A preliminary review of the problem was conducted to confirm the difficulties faced by students in drawing Lewis's structure and others subtopic related in Chemical Bond.

Project or Innovation Objectives

The objectives of this study are:

- Students should correctly draw the Lewis structure of covalent molecules using the LeMoSHyP Module.
- Students should correctly draw the molecular geometry, orbital hybridisation, and orbital overlap using the LeMoSHyP Module.
- Students remember the sequence of steps in determining formal charge correctly
- Students can determine the polarity of the molecule.

Research Methodology

The ADDIE model was employed to implement the LeMoSHyP Module. During the Analysis phase, the difficulties faced by students in drawing Lewis structures were identified, focusing on K2T1 and H6T2 students and assessing their prior knowledge and learning preferences. In the Design phase, the instructional design of the LeMoSHyP Module was created with a focus on VARK learning styles, developing tasks, activities, and assessments to reinforce learning. The Development phase involved creating the LeMoSHyP PowerPoints, user manuals, and video tutorials, along with preparing tool kits and the LeMoSHyP Board for hands-on activities. Implementation involved sharing instructional materials and links with students, setting up Google Meet breakout rooms, and guiding students through the process. Students watched user guide videos in a flipped classroom approach, worked in groups to complete tasks using the provided materials, and revisited the videos for reinforcement. In the Evaluation phase, formative feedback was collected to make real-time adjustments and summative evaluation assessed student performance through completed tasks and submitted photos, evaluating the module's effectiveness based on learning outcomes and feedback.

By following these steps and utilizing the ADDIE model, the LeMoSHyP Module effectively integrates into the learning process, ensuring a comprehensive approach to teaching Lewis structures. This innovative approach in a digital ecosystem promotes self-regulated learning, which can be revisited multiple times for reinforcement, making the teaching process more dynamic and engaging. The integration of VARK learning styles, the use of the SToVaDiM acronym, and the blend of hands-on and digital learning tools represent significant advancements in the pedagogical approach to teaching chemistry, offering students a novel and effective way to master complex concepts.

In line with the transformation towards the "fourth industrial revolution," the use of online applications has become essential. Online video tutorials, while effective, need to be supplemented with additional tools to enhance learning. The LeMoSHyP Module combines various learning styles—visual, auditory, read-and-write, and kinesthetics VARK—to ensure effective and meaningful learning. The module includes tool kits, a user manual, learning videos, the LeMoSHyP Board, and the LeMoSHyP Module itself. The innovative aspect of the LeMoSHyP Module lies in its comprehensive and integrated approach to teaching Lewis structures. By combining traditional hands-on learning with modern digital tools, it addresses multiple learning styles and preferences. The novelty of the LeMoSHyP Module is evident in its use of the SToVaDiM acronym and kit form, making it easier for students to remember and apply the steps. Additionally, the digitization of the module allows for interactive and self-paced learning, which is particularly suited to the needs of contemporary students

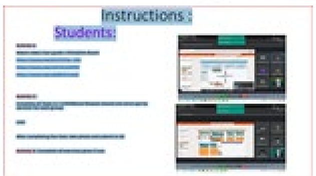
Finding And Discussion of The Project or Innovation

Innovation Documentation

LeMoSHyP Module consists of:

Tool kits

User Manual



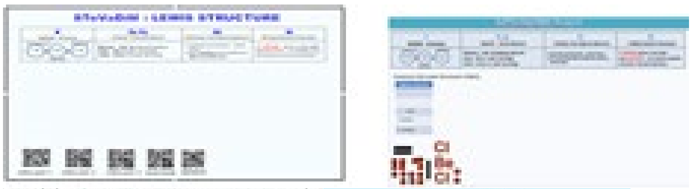
Learning Video

Part 1

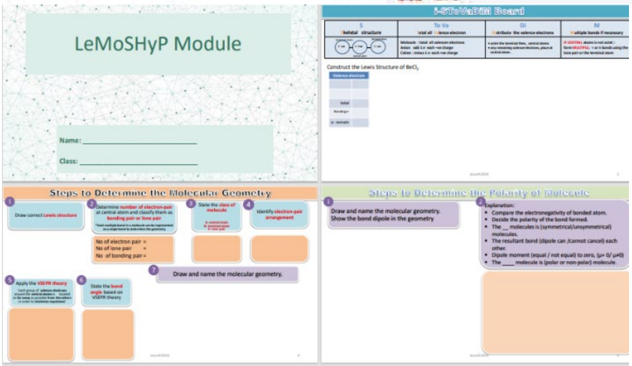
Part 2

Part 3

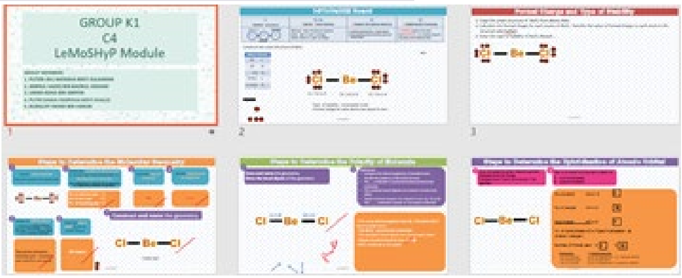
LeMoSHyP Board



LeMoSHyP Module (hardcopy)



LeMoSHyP Module (Online)



The teaching approach in the digital ecosystem is an alternative to in-class learning: it is self-regulating, can be reviewed repeatedly, and serves as a strengthening after hands-on learning. Repetition can improve students' memory and understanding. Students can study individually or in groups without lecturers at any time. Digital video is dynamic and capable of stimulating various senses, such as hearing and vision. The process of teaching in the classroom is also made easier without repeated explanations by lecturers, as video screenings can be accompanied by elements of images, music, and voiceovers to attract attention and brief the students.

Results & Discussion

Document analysis, Pre-Test and Post Test were used for the collection of study findings. The analysis of the documents that have been carried out are as follows.

Students can draw Lewis's structure, molecular geometry, orbital hybridisation and orbital overlap using the LeMoSHyP Module

Table 1: Score Range by % Student Score and Status

Score Range	Lewis's structure				Draw molecular geometry, polarity, orbital hybridization, and Orbital Overlap				Remember the sequence				Status
	Pre-Test		Post Test		Pre-Test		Post Test		Pre-Test		Post Test		
	Number of Students	% Number of Student	Number of Students	% Number of Student	Number of Students	% Number of Student	Number of Students	% Number of Student	Number of Students	% Number of Student	Number of Students	% Number of Student	
80-100	-	-	9	75	-	-	11	91.7	-	-	12	100	Excellent
75-79	-	-	-	-	-	-	-	-	-	-	-	-	
70-74	-	-	-	-	-	-	-	-	-	-	-	-	
65-69	1	8.3	3	25	-	-	1	8.3	-	-	-	-	Honours
60-64	-	-	-	0	-	-	-	-	-	-	-	-	
55-59	-	-	-	0	-	-	-	-	-	-	-	-	Pass
50-54	-	-	-	0	1	8.3	-	-	-	-	-	-	
45-49	-	-	-	0	-	-	-	-	-	-	-	-	Failed
40-44	-	-	-	0	-	-	-	-	-	-	-	-	
35-39	-	-	-	0	-	-	-	-	-	-	-	-	
0-34	11	91.7	-	0	11	91.7	-	-	12	100	-	-	

(Range and Status are referred to from the Two-Year Matriculation Programmed (PDT) Handbook for the 2021/2022 session. 2022 Putrajaya: BMKPM)

Referring to Table 1, For item 'Draw Lewis's structure, 91.7% of students failed in the pre-test, and only 8.3% of the students had achieved honours while in the post-test, 75% of students had excelled and 25% of students received honours. These findings show that most students were able to draw Lewis's structure. Thus, the first objective of the study is achieved.

For item 'Draw molecular geometry, polarity, orbital hybridization, and orbital overlap' the pre-test shows 91.7% of students had failed to draw molecular geometry, orbital hybridization and orbital overlap' for covalent molecules while only 8.3% of the students had passed while the post-test shows, 91.7% of students excelled and 8.3% of students received honours. to 'draw molecular geometry, orbital hybridization, and orbital overlap' This shows that the majority of students can draw to draw molecular geometry, orbital hybridization, and orbital overlap' and this objective has been achieved

For item "remember the sequence of steps in drawing Lewis's structure, molecular geometry, hybridisation, orbital overlap and determine formal charge', the pre-test shows 100% of students have failed to remember the sequence of steps in drawing Lewis's structure, molecular geometry, hybridisation, orbital overlap and determine formal charge correctly. However, the post test revealed 100% of the students excelled in remembering the sequence of steps to determine the structures correctly. Thus, this objective has been achieved.

Publication, Award, and Intellectual Property

Awards

1. Gold Award in IICE2024- International Innovation Competition in Education 2024
2. Silver Medal in ICoMSLIi2023- International Competition on Mathematics and Science Learning Innovation-2023
3. Gold Award in International Innovation Competition, ICSME 2022.
4. Gold Award in International Summit of Innovation and Design Exposition 2020 (InSIDE)
5. Gold Award as Presenter in Webinar Professional Learning Communities (PLC) Program Matrikulasi KPM 2020
6. Bronze award in Pertandingan PdP Inovatif Kolej Matrikulasi Selangor Peringkat Kebangsaan 2020
7. Platinum award in Professional Learning Communities (PLC) Kolej Matrikulasi Melaka 2019
8. Platinum award in Pertandingan Inovasi Unit Kimia KMM

Dissemination

1. Webinar Professional Learning Communities (PLC) Program Matrikulasi KPM 2020
2. International Summit of Innovation and Design Exposition 2020 (InSIDE)
3. Pertandingan PdP Inovatif Kolej Matrikulasi Selangor Peringkat Kebangsaan 2020
4. Professional Learning Communities (PLC) Kolej Matrikulasi Melaka 2019
5. Kolej Matrikulasi Melaka
6. Kolej Matrikulasi Kelantan
7. Kolej Matrikulasi Kejuruteraan Johor
8. Kolej Matrikulasi Johor
9. Kolej Matrikulasi Pulau Pinang
10. Kolej Matriulasi Negeri Sembilan

Intellectual Property

Notification number of Intellectual Property: CRLY00023999 certified by Intellectual Property Corporation of Malaysia (MyIPO)

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ID 97: Inovasi Aplikasi Pembelajaran Asas Sains Komputer (NumFlex) secara dalam talian

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Sorotan: Aplikasi NumFlex direka untuk meningkatkan pemahaman pelajar Tingkatan 2 mengenai penukaran sistem nombor, seperti sistem binari, oktal, desimal, dan heksadesimal. Alat interaktif ini disepadukan dengan prinsip Interaksi Manusia-Komputer dan nilai estetik untuk mencipta pengalaman pembelajaran yang menarik. Selari dengan Dokumen Standard Kurikulum dan Pentaksiran (DSKP), NumFlex menyokong pedagogi berkesan dan memperkasa kualiti pendidikan Malaysia, menyediakan pelajar dengan kemahiran penting untuk menghadapi dunia digital.

Keywords: *Pembelajaran Interaktif; Penukaran Sistem Nombor; Teknologi Pendidikan.*

Pengenalan

Dalam era digital yang pesat berkembang, literasi digital dan pemahaman asas sains komputer menjadi kemahiran kritikal untuk setiap pelajar. Salah satu komponen penting dalam literasi digital ialah pemahaman tentang penukaran sistem nombor, termasuk desimal, binari, oktal, dan heksadesimal. Namun, ramai pelajar menghadapi kesukaran untuk memahami konsep ini kerana sifatnya yang abstrak. Mata pelajaran Asas Sains Komputer (ASK) yang diperkenalkan dalam Kurikulum Standard Sekolah Menengah (KSSM) bertujuan untuk mendidik pelajar tentang asas sains komputer, tetapi kaedah pengajaran tradisional sering kali tidak mencukupi dalam membantu pelajar memahami penukaran sistem nombor ini (Quraishi et al., 2024; Arissaputra et al., 2023).

Aplikasi NumFlex telah dibangunkan untuk mengatasi cabaran ini dengan menyediakan alat pembelajaran interaktif yang lebih menarik. Aplikasi ini menawarkan pendekatan kreatif dengan menggunakan teknologi imersif untuk membantu pelajar memahami penukaran sistem nombor melalui visual dan modul interaktif. NumFlex memperkenalkan perubahan dalam pedagogi yang menggalakkan pelajar berinteraksi secara aktif dengan kandungan pembelajaran, memperkukuh kefahaman mereka tentang konsep ini (Reddy et al., 2020; Hamid et al., 2022).

Tambahan pula, literasi digital bukan sahaja penting dalam meningkatkan kefahaman konsep tetapi juga dalam memperbaiki pengurusan bilik darjah dan menjadikan proses pembelajaran lebih diperibadikan serta interaktif. Penggunaan teknologi digital yang berkesan seperti NumFlex dapat meningkatkan kemahiran kognitif pelajar dan memudahkan penyampaian kandungan yang lebih jelas dan mudah difahami (Jia & Huang, 2023; Sangaji & Pribadi, 2023). Kajian menunjukkan bahawa integrasi literasi digital dalam kurikulum pendidikan mampu meningkatkan prestasi akademik dan kolaborasi pelajar (Lela Susanty, 2024).

Dengan memberi tumpuan kepada penukaran sistem nombor, NumFlex bukan sahaja menyokong pembelajaran sains komputer tetapi juga menyumbang kepada peningkatan literasi digital pelajar. Aplikasi ini menyediakan platform pembelajaran berpusatkan pelajar yang fleksibel dan mesra pengguna, sekaligus mempersiapkan pelajar untuk menghadapi cabaran dunia digital yang semakin berkembang (Quraishi et al., 2024; Arissaputra et al., 2023; Hamid et al., 2022).

Kandungan

Objektif projek atau inovasi

Aplikasi NumFlex bertujuan untuk meningkatkan pemahaman dan penggunaan pelajar Tingkatan 2 dalam penukaran sistem nombor, terutamanya melibatkan sistem binari, oktal, desimal, dan heksadesimal. Walaupun sistem nombor ini adalah asas dalam bidang sains komputer, pelajar sering kali menganggapnya sukar dan abstrak. NumFlex menyediakan pendekatan langkah demi langkah yang tersusun untuk memudahkan pemahaman konsep ini dengan memecahkannya kepada bahagian yang lebih kecil dan mudah difahami. Dengan cara ini, aplikasi ini membantu pelajar menguasai konsep penukaran sistem nombor yang penting, sekali gus membolehkan mereka mengaplikasikan peraturan penukaran nombor dengan lebih yakin.

Untuk mencapai objektif ini, aplikasi NumFlex menyediakan persekitaran pembelajaran yang dinamik dan interaktif bagi menggantikan kaedah pengajaran tradisional dalam matematik dan Asas Sains Komputer. Kaedah lama yang bergantung pada bahan pembelajaran statik dan hafalan sering menyebabkan pelajar kehilangan minat dan kekeliruan. Sebaliknya, NumFlex menggunakan elemen gamifikasi, rangsangan visual, dan maklum balas masa nyata untuk menarik minat pelajar dan menjadikan pembelajaran lebih interaktif. Ciri-ciri interaktif ini bukan sahaja menarik perhatian pelajar tetapi juga membolehkan mereka mengesahkan pemahaman mereka secara masa nyata, memperbaiki kesilapan dengan serta-merta dan meningkatkan daya ingatan.

Selain meningkatkan keterlibatan pelajar, NumFlex juga direka untuk menambah baik hasil pembelajaran. Aplikasi ini membekalkan alat yang direka khusus untuk memudahkan pemahaman konsep penukaran sistem nombor, seterusnya meningkatkan prestasi pelajar dalam penilaian akademik. Pendekatan yang disesuaikan dalam NumFlex membolehkan pelajar belajar mengikut kadar mereka sendiri, menjadikan proses pembelajaran lebih fleksibel dan berkesan.

Satu lagi objektif penting aplikasi ini adalah untuk mempertingkatkan daya ingatan pelajar terhadap konsep yang dipelajari. Dengan pendekatan pembelajaran aktif yang melibatkan simulasi dan latihan berulang, aplikasi ini memastikan pelajar dapat mengekalkan pengetahuan mereka dalam jangka masa panjang. Simulasi interaktif ini berfungsi untuk memperkukuh konsep yang telah dipelajari dan membantu pelajar mengaplikasikan pengetahuan mereka dalam situasi sebenar.

Akhir sekali, NumFlex juga berfungsi untuk membangunkan kemahiran pengaturcaraan dan pemikiran komputasi dalam kalangan pelajar. Selain daripada mengajar penukaran sistem nombor, aplikasi ini turut memperkenalkan pelajar kepada asas-asas pengaturcaraan dan logik komputer. Dengan cara ini, pelajar dapat mengasah kemahiran penyelesaian masalah dan kreativiti mereka, menyediakan mereka dengan asas yang kukuh untuk membangunkan aplikasi atau perisian mudah di masa hadapan. Ini bertepatan dengan keperluan global untuk kemahiran digital dan literasi komputer yang semakin meningkat dalam abad ke-21, menyediakan pelajar untuk cabaran teknologi masa hadapan.

Pendekatan NALI dilaksanakan dalam penyelidikan

- **(Novelty)**: Kebaharuan NumFlex terletak pada pendekatan yang berbeza dan lebih berkesan dalam mengajar penukaran sistem nombor melalui alat interaktif berasaskan teknologi digital. Aplikasi ini menyokong kepelbagaian gaya pembelajaran, menggabungkan pembelajaran berasaskan permainan, serta memanfaatkan pembelajaran dalam talian untuk meningkatkan akses kendiri pelajar. NumFlex juga fleksibel, membolehkan pelajar belajar mengikut keselesaan dan tahap pemahaman masing-masing, berbeza dengan pendekatan tradisional yang lebih statik dan bergantung kepada hafalan semata-mata.
- **(Creativity):** NumFlex memperlihatkan kreativiti yang tinggi dengan menggabungkan elemen gamifikasi, animasi visual, dan simulasi interaktif untuk membantu pelajar memahami konsep matematik yang abstrak seperti penukaran sistem nombor. Aplikasi ini memanfaatkan antara muka pengguna yang intuitif, menjadikannya mudah digunakan oleh pelajar dan guru dengan navigasi yang jelas dan ikon yang mudah dikenali. Selain itu, maklum balas masa nyata melalui mesej pop-up, panduan, dan pembetulan segera membolehkan pelajar memperbaiki kesilapan mereka dengan serta-merta.Aplikasi ini juga mempunyai elemen visual yang menarik, di mana grafik dan skema warna yang berfungsi membezakan antara sistem nombor yang berbeza, seperti binari, oktal, desimal, dan heksadesimal. Elemen interaktif seperti ciri seret dan lepas, slider, dan kuiz membolehkan pelajar melibatkan diri secara aktif dalam bahan pembelajaran dan mengamalkan penukaran sistem nombor. Gabungan elemen-elemen ini menjadikan pembelajaran lebih menyeronokkan dan efektif. Tambahan lagi, aplikasi ini direka dengan reka bentuk responsif yang membolehkannya berfungsi dengan lancar merentasi pelbagai peranti seperti tablet, telefon pintar, dan komputer meja. Fleksibiliti ini membolehkan pelajar belajar dalam pelbagai persekitaran pembelajaran. Kombinasi inovatif ini memastikan NumFlex bukan sahaja menarik perhatian pelajar tetapi juga meningkatkan keberkesanan proses pembelajaran
- **(Innovativeness)**: Inovasi melibatkan pengenalan kepada idea atau teknologi baru yang belum pernah digunakan secara meluas, atau penambahbaikan kepada kaedah yang sedia ada. NumFlex memperkenalkan inovasi dalam pendidikan sains komputer dengan mengintegrasikan teknologi terkini, khususnya pada platform iOS, melalui pendekatan pembelajaran berasaskan aplikasi yang mesra pengguna dan interaktif, memecahkan halangan tradisional dalam pengajaran penukaran sistem nombor.
- **(Applicability)**: NumFlex mempunyai kebolehgunaan yang luas, sesuai digunakan dalam bilik darjah untuk mata pelajaran Asas Sains Komputer Tingkatan 1 dan 2, serta Matematik Tingkatan 4 di sekolah kerajaan dan swasta. Aplikasi ini juga relevan untuk pendidikan global dengan pendekatan 3 dalam 1 yang merangkumi nota, pencapaian prestasi, dan latihan. Mobiliti aplikasi ini membolehkan ia digunakan di mana-mana sahaja, sesuai untuk pelajar belajar secara kendiri di luar waktu kelas, dengan fleksibiliti yang menyokong pelbagai gaya pembelajaran dan tahap kefahaman.
- **(Impact):** NumFlex memberikan impak yang besar dalam meningkatkan kefahaman pelajar terhadap konsep penukaran sistem nombor, seterusnya meningkatkan motivasi mereka dalam mempelajari sains komputer. Aplikasi ini memperkasakan kemahiran digital pelajar yang penting untuk masa depan mereka dalam dunia teknologi yang semakin berkembang. Dengan kerjasama Kementerian Pendidikan Malaysia (KPM), aplikasi ini diselaraskan dengan kurikulum kebangsaan, meningkatkan kebolehgunaan di sekolah kerajaan dan swasta. Pengiktirafan hak cipta dan pelancaran di Apple App Store juga meningkatkan kredibiliti aplikasi ini. Melalui strategi jualan yang dirancang, termasuk seminar pendidikan dan kolaborasi dengan KPM, NumFlex dijangka memperluas penggunaan dan keberkesanannya, bukan sahaja di peringkat nasional tetapi juga berpotensi di pasaran antarabangsa.

Metodologi Penyelidikan

Penghasilan Aplikasi NumFlex menggunakan model m-ADDIE (Modified ADDIE Model), yang merupakan model reka bentuk instruksional yang komprehensif dan sistematik. Penggunaan Nominal Group Technique (NGT) dan Fuzzy Delphi Method (FDM) turut menyokong proses reka bentuk dan pembangunan aplikasi ini. Model m-ADDIE terdiri daripada lima fasa: Analisis, Reka Bentuk, Pembangunan, Pelaksanaan, dan Penilaian, dengan pengubahsuaian yang sesuai untuk memastikan aplikasi ini memenuhi keperluan pendidikan sains komputer.

Fasa 1: Analisis Keperluan

Fasa Analisis dalam model m-ADDIE memfokuskan kepada mengenal pasti keperluan pembelajaran dan cabaran pelajar Tingkatan 2 dalam penukaran sistem nombor seperti binari, oktal, desimal, dan heksadesimal. Kajian ini menggunakan NGT untuk mengumpul pandangan daripada pakar pendidikan bagi mengenal pasti cabaran utama yang dihadapi oleh pelajar dalam pembelajaran konsep asas ini melalui kaedah tradisional. Melalui NGT, para pakar menegaskan perlunya alat pembelajaran interaktif tambahan untuk meningkatkan pemahaman dan penglibatan pelajar dalam proses pembelajaran. Hasil analisis menunjukkan skor konsensus yang tinggi terhadap keperluan aplikasi interaktif ini, yang menekankan potensinya dalam menangani kekurangan pendidikan sedia ada. Teknik NGT yang dimodifikasi ini terbukti berkesan dalam mengumpulkan pandangan yang sahih, mengesahkan praktikaliti dan penerimaan aplikasi ini di kalangan pengguna sasarannya

Fasa 2: Reka Bentuk

Berdasarkan hasil analisis, fasa Reka Bentuk melibatkan penciptaan reka bentuk aplikasi yang komprehensif menggunakan kaedah Fuzzy Delphi Method (FDM) untuk mencapai konsensus pakar. FDM digunakan untuk mendapatkan pandangan terperinci daripada pakar-pakar mengenai ciri-ciri yang perlu ada dalam aplikasi NumFlex. Pandangan pakar ini membantu dalam merancang antara muka pengguna yang interaktif dan elemen-elemen gamifikasi seperti maklum balas masa nyata dan visualisasi konsep untuk menjadikan pembelajaran lebih menarik dan mudah difahami. Fasa ini juga menggabungkan prinsip Interaksi Manusia-Komputer (HCI) untuk memastikan aplikasi mudah digunakan oleh pelajar. Storyboards, wireframes, dan prototaip digunakan untuk menggambarkan bagaimana pelajar akan berinteraksi dengan aplikasi tersebut.

Fasa 3: Pembangunan

Fasa Pembangunan dalam model m-ADDIE melibatkan pelaksanaan reka bentuk yang telah disepakati menggunakan bahasa pengaturcaraan Swift, yang dipilih kerana keserasian tinggi dengan peranti iOS serta sokongan ciri interaktif. Fasa ini membolehkan penciptaan modul-modul pembelajaran yang memfokuskan pada penukaran sistem nombor seperti binari, oktal, desimal, dan heksadesimal. Sepanjang fasa ini, proses pembangunan dijalankan secara iteratif dengan maklum balas daripada pakar yang dikumpulkan melalui FDM untuk memperbaiki dan meningkatkan ciri-ciri aplikasi. Penekanan diberikan kepada pembangunan modul interaktif yang dapat membantu pelajar memahami dan mengingati konsep dengan lebih baik.

Fasa 4: Pelaksanaan

Fasa Pelaksanaan melibatkan pengujian aplikasi NumFlex oleh guru-guru pakar Asas Sains Komputer (ASK) di Malaysia, dengan fokus pada pengajaran Tingkatan 2 berkenaan penukaran sistem nombor. Guru-guru ini dilatih untuk menggunakan aplikasi ini dalam pengajaran mereka. Penggunaan FDM dalam fasa ini membantu mendapatkan maklum balas langsung daripada guru-guru mengenai keberkesanan aplikasi dalam meningkatkan pemahaman pelajar. Guru-guru juga diminta mengintegrasikan aplikasi ini ke dalam pengajaran harian mereka, dengan pemantauan rapi dijalankan untuk menilai bagaimana aplikasi ini membantu meningkatkan penglibatan pelajar, memperbaiki kefahaman konsep, dan menjadikan pembelajaran lebih menyeronokkan.

Fasa 5: Penilaian

Fasa terakhir dalam model m-ADDIE adalah Penilaian. Ini melibatkan pengumpulan data melalui soal selidik, kuiz, dan perbincangan kumpulan fokus untuk menilai keberkesanan aplikasi dalam memenuhi objektif pendidikan. Fokus utama penilaian adalah untuk mengukur sejauh mana aplikasi ini berjaya meningkatkan pemahaman pelajar terhadap penukaran sistem nombor dan meningkatkan keterlibatan mereka dalam proses pembelajaran. Hasil penilaian ini memberikan pandangan berharga mengenai kekuatan dan kelemahan aplikasi serta cadangan penambahbaikan yang boleh dilakukan pada masa hadapan.

Perbincangan projek atau inovasi

Dalam dunia pendidikan yang semakin berkembang pesat, keperluan untuk pendekatan inovatif menjadi semakin mendesak. Cabaran masa depan menuntut sistem pendidikan untuk terus menyesuaikan diri bagi mempersiapkan pelajar dengan kemahiran yang diperlukan dalam dunia yang pantas berubah. Dunia digital yang semakin kompleks memerlukan penekanan terhadap literasi digital, penyelesaian masalah, dan kebolehsuaian bagi membantu pelajar menangani situasi yang tidak dijangka dan cabaran baharu. Pendekatan tradisional dalam pengajaran tidak lagi mencukupi, dan perubahan teknologi yang pesat memerlukan kaedah pembelajaran yang lebih dinamik untuk memastikan pelajar dapat berkembang dan bersedia menghadapi kerjaya masa depan.

Di era digital ini, sistem pendidikan mesti mengintegrasikan teknologi secara menyeluruh untuk memastikan pelajar dapat menggunakan, memahami, dan mencipta dengan alat digital. Pendidikan yang bertumpukan teknologi harus menyediakan alat dan platform digital yang sesuai untuk pengajaran dan pembelajaran. Ini termasuk penggunaan aplikasi pembelajaran interaktif, simulasi, serta maklum balas masa nyata yang dapat membantu pelajar menguasai teori sambil menerapkannya dalam situasi dunia sebenar. Dengan memanfaatkan alat-alat ini, pelajar bukan sahaja membangunkan pemikiran kritikal dan kreativiti, tetapi juga kemahiran menyelesaikan masalah yang sangat diperlukan dalam dunia pekerjaan yang semakin dipengaruhi oleh teknologi.

Generasi baharu seperti Gen Z dan Alpha, yang dibesarkan dalam dunia digital, memerlukan pengalaman pembelajaran yang menarik, interaktif, dan diperibadikan. Mereka lebih cenderung kepada pembelajaran yang menggunakan kandungan visual, maklum balas segera, dan pengalaman pembelajaran langsung (hands-on). Oleh itu, pendekatan pendidikan untuk generasi ini harus disesuaikan dengan penggunaan teknologi seperti gamifikasi dan alat pembelajaran yang responsif terhadap gaya pembelajaran individu. Ini penting untuk meningkatkan penglibatan mereka dalam proses pembelajaran dan memastikan mereka lebih bermotivasi dan bersedia untuk belajar secara bebas.

Kesimpulannya, pendidikan masa kini mesti berkembang seiring dengan perubahan teknologi dan keperluan pelajar yang semakin kompleks. Penggunaan pendekatan inovatif yang memanfaatkan teknologi digital, menyediakan pembelajaran yang diperibadikan, dan meningkatkan literasi digital adalah kritikal untuk memastikan pelajar bersedia menghadapi cabaran masa depan. Inisiatif seperti NumFlex adalah contoh yang baik bagaimana teknologi dapat digunakan untuk memenuhi keperluan ini, dengan menawarkan pembelajaran yang fleksibel, menarik, dan sesuai dengan gaya pembelajaran generasi digital yang moden.

Maklumat tambahan

Aspek	Penerangan
Pendaftaran Hak Cipta dan Pengiktirafan	Aplikasi NumFlex telah berjaya didaftarkan di bawah hak cipta, memastikan perlindungan harta intelek dan memudahkan pengkomersialan yang lebih luas. Pendaftaran ini menubuhkan pengiktirafan pasaran dan kredibiliti aplikasi. Selain itu, NumFlex telah menerima anugerah daripada sekolah, menunjukkan keberkesanannya dan meningkatkan statusnya sebagai alat pembelajaran yang inovatif.
Kerjasama dengan Kementerian Pendidikan Malaysia (KPM)	Kerjasama dengan KPM membolehkan Aplikasi NumFlex diintegrasikan ke dalam sistem pendidikan kebangsaan, selaras dengan Dokumen Standard Kurikulum dan Pentaksiran (DSKP) serta Kurikulum Standard Sekolah Menengah (KSSM). Penyelarasan ini menyokong pengajaran penukaran sistem nombor dalam Asas Sains Komputer dan Matematik, memastikan kaitan dan kebolehgunaan aplikasi kepada sukatan pelajaran Malaysia. Pengiktirafan dari KPM meningkatkan penerimaan dan potensi jualan di institusi pendidikan awam dan swasta.
Bahan Pembelajaran Tambahan Diterbitkan di Apple App Store	Aplikasi NumFlex merancang untuk menambah bahan pembelajaran tambahan bagi meningkatkan nilai pendidikannya. Sumber-sumber ini akan memenuhi gaya dan keutamaan pembelajaran yang berbeza, menawarkan pengalaman pembelajaran yang lebih komprehensif. Penambahbaikan ini menjadikan NumFlex lebih menarik bagi guru dan pelajar, sekali gus memperluas penggunaannya dan potensi jualan.
Strategi Jualan dan Prospek Masa Depan	Strategi jualan jangka pendek hingga sederhana menumpukan pada memperkenalkan NumFlex di sekolah-sekolah Malaysia melalui kerjasama dengan KPM, seminar pendidikan, dan pameran teknologi. Strategi jangka panjang mungkin melibatkan pengembangan ke pasaran antarabangsa, terutamanya di negara-negara dengan kurikulum yang serupa atau penekanan kuat pada pendidikan sains komputer dan matematik.

Pengakuan

Projek inovatif ini dibiayai oleh Fakulti Pendidikan dan Universiti Kebangsaan Malaysia (UKM) di bawah projek GGGE6923 Pengajaran dan Pembelajaran Pengaturcaraan Komputer. penyelidik mengucapkan terima kasih yang setinggi-tingginya kepada Dr. Nor Hafizah Adnan, pengarang sepadan kami, atas sokongan teguh, bimbingan yang berwawasan, dan kepakaran yang tidak ternilai. Penyelidik mengucapkan terima kasih yang tulus kepada Ts. Dr. M. Khalid M. Nasir atas galakan dan kesabaran beliau yang berterusan, yang memainkan peranan penting dalam menjayakan projek ini.

Rujukan

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ID 98: Mat Metro: Innovative Skill-Based TVET Solution Beyond Classroom

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Highlights: The Mat Metro project leverages Augmented Reality (AR) and Virtual Reality (VR) technologies to revolutionize skill-based TVET education. Developed as a mobile application, it provides immersive, interactive learning experiences to learn and practice mechanical and electrical skills. By incorporating real-world modules from Institut Kemahiran MARA Johor Bahru, Mat Metro enhances accessibility, safety, and engagement in education. The project, initially tackling the problems arose during Covid-19 pandemic, exemplifies innovative approaches in New Academia Learning Innovation (NALI), making advanced technology-driven skill-based learning more inclusive and effective to a wider audience.

Keywords: *Augmented Reality (AR) & Virtual Reality (VR); Skill-based Learning; Mobile Application; Innovative Teaching & Learning; TVET*

Introduction

Traditional skill-based education often faces several challenges that hinder effective learning and skill acquisition. These challenges include limited access to hands-on training, high costs associated with physical resources and equipment, safety concerns in practical environments, and the difficulty of providing personalized feedback to learners. Additionally, the COVID-19 pandemic has further exacerbated these issues by restricting access to physical learning spaces and resources.

The Mat Metro application addresses these challenges by leveraging Augmented Reality (AR) and Virtual Reality (VR) technologies to create an immersive, interactive, and engaging learning experience. Mat Metro, where "Metro" stands for **Me**chanical and Elec**tro**nics, was designed as a mobile application to ensure it is accessible to a wider audience, including the general public. By utilizing mobile devices such as smartphones and tablets, Mat Metro makes advanced skill-based STEM education more inclusive and scalable, allowing learners to benefit from cutting-edge educational technologies regardless of their location or access to traditional educational resources.

The application incorporates real-world case studies and modules from Institut Kemahiran MARA (IKM) Johor Bahru, focusing on teaching basic mechanical and electrical skills using mobile-based extended reality technologies – namely augmented reality (AR) and virtual reality (VR). These modules include handling tools, circuit analysis, and assembly, providing learners with practical, hands-on experience in a safe and controlled virtual environment. By integrating gamification elements and real-time feedback, Mat Metro enhances learner engagement and motivation, ultimately improving the understanding and retention of skills.

Content

Project or innovation objectives:

The Mat Metro project aims to revolutionize skill-based TVET (also applicable to STEM) education by leveraging Augmented Reality (AR) and Virtual Reality (VR) technologies for wider audience. The key objectives of the Mat Metro project are:

- Enhance Accessibility: Provide learners with access to realistic simulations of practical skills from anywhere, reducing dependency on physical resources and enabling remote learning.
- Ensure Safety: Offer a safe environment for learners to practice and master skills without the risks associated with real-world training scenarios.
- Personalized Learning: Incorporate gamification elements and real-time feedback to provide immediate, personalized guidance and motivation to learners.
- Increase Engagement and Retention: Utilize the immersive nature of AR and VR to enhance learner engagement and improve the retention of skills and knowledge.
- Wider Audience Reach: Develop the application for mobile devices such as smartphones and tablets to ensure it is accessible to a broader audience, including the general public.

NALI approach implemented in the research

The Mat Metro project introduces several novel aspects that align with the principles of New Academia Learning Innovation (NALI), which emphasizes the integration of technology, creativity, and practical skills in education. Here are the key novel contributions of the Mat Metro project:

1. <u>Integration of AR and VR in Skill-Based Learning:</u>

Unlike traditional educational methods, Mat Metro leverages Augmented Reality (AR) and Virtual Reality (VR) technologies to create immersive and interactive learning experiences. This integration allows learners to engage with complex mechanical and electrical concepts in a simulated environment, enhancing their understanding and retention of skills.

2. Mobile Accessibility:
By developing the application for mobile devices such as smartphones and tablets, Mat Metro ensures that advanced skill-based STEM education is accessible to a wider audience. The AR and VR educational content were properly designed for mobile devices that do not require special equipments as in the laboratory settings. This approach democratizes education, making it possible for learners from diverse backgrounds and locations to benefit from cutting-edge educational technologies.

3. Real-World Case Studies and Modules:
The project incorporates real-world case studies and modules from Institut Kemahiran MARA (IKM) Johor Bahru, focusing on practical mechanical and electrical skills. These modules are also in-line with the Malaysian Skill Certificate (Sijil Kemahiran Malaysia – SKM).This real-world application ensures that the learning content is relevant and directly applicable to industry needs, bridging the gap between theoretical knowledge and practical skills.

4. Gamification and Personalized Learning:
Mat Metro employs gamification elements such as timer, rewards and missions to enhance learner engagement and motivation. Additionally, the application provides real-time feedback, allowing for personalized learning experiences that cater to individual learner needs and progress.

5. Safety and Risk Management:
The use of AR and VR technologies provides a safe environment for learners to practice and master skills without the risks associated with real-world training scenarios. This aspect is particularly important for skill-based learning in fields such as mechanical and electrical engineering, where safety is a critical concern.

By incorporating these innovative elements, the Mat Metro project exemplifies the principles of New Academia Learning Innovation (NALI), offering a forward-thinking approach to skill-based TVET and STEM education that is both effective and inclusive.

Research Methodology

The research methodology for the Mat Metro project involved several key stages to develop and implement an AR and VR platform for teaching basic mechanical and electrical skills. Here is a detailed explanation of each stage:

1. Identifying and Understanding Learning Objectives:

In the initial stage, researchers collaborated closely with instructors from Institut Kemahiran MARA (IKM) Johor Bahru to identify the specific skills and learning objectives required for teaching basic mechanical and electrical skills. This collaboration ensured that the AR and VR content was tailored to meet the educational needs of the students. By understanding the precise requirements and goals, the researchers could design content that was both relevant and effective.

2. Storyboarding and Design:

Once the learning objectives were clearly defined, the researchers proceeded to storyboard and design the AR and VR content. This involved creating visual representations of the virtual environment and planning the learner's journey within it. The design phase was crucial for mapping out the interactive elements and ensuring a seamless learning experience. Additionally, gamification elements such as points, rewards, and missions were incorporated to enhance learner engagement and motivation, making the learning process more enjoyable and effective.

3. Development:

The development stage focused on creating realistic virtual simulations of mechanical and electrical modules. Emphasis was placed on interactive elements that allowed learners to practice their skills in a simulated environment. The AR and VR content was developed for mobile devices, such as smartphones and tablets, to ensure accessibility to a wider audience. The researchers utilized software development tools like Unity3D and programming languages such as C# to create immersive and interactive experiences that could be easily accessed by learners.

4. Integration of Educational Content:

In this stage, the educational content was integrated into the AR and VR experiences. This included creating interactive tasks and challenges that aligned with the learning objectives identified earlier. The researchers continued to use gamification strategies by designing the tasks as 'missions' or 'quests' that learners had to complete. A comprehensive handbook outlining the modules and required markers for AR and VR was produced to guide learners through the content, ensuring they had all the necessary information to effectively engage with the learning material.

5. Testing and Iteration:

A series of testing sessions were conducted with instructors and learners from IKM Johor Bahru to gather feedback on the AR and VR content. Four IKM instructors, including the Head of the Department, were involved in verifying the content, and 26 students participated in user acceptance testing. Feedback from these sessions provided valuable insights into the user experience and highlighted areas for improvement. The iterative process of refining the content based on this feedback ensured that the final product was both effective and user-friendly.

6. Application Deployment:

After iterating and improving the AR and VR content based on the feedback received, the final step was to deploy the application to the general public. The application was made available via Google Playstore, allowing users to download it to their own devices. This deployment phase ensured that the AR and VR technology was accessible to a wide range of users, making advanced skill-based STEM education more inclusive and scalable.

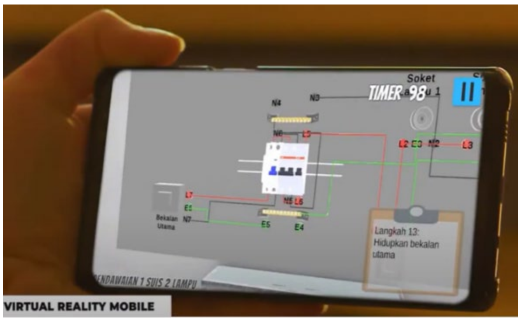
By following these stages, the Mat Metro project successfully developed an immersive and interactive learning platform that enhances skill-based TVET education through the use of AR and VR technologies. This approach is not only limited to TVET domain, but has the potential to be replicated for STEM education.

Finding and discussion of the project or innovation

The findings from the Mat Metro project demonstrate that the implementation of AR and VR technologies significantly enhances skill-based learning. Both instructors and students reported positive outcomes, with the immersive nature of these technologies making the learning process more engaging and interactive. Instructors noted that AR and VR allowed for real-time feedback, improving the overall teaching process and student understanding. Students found the learning experience enjoyable and reported better retention of skills due to the interactive and immersive elements. The use of gamification increased student participation and motivation, adding an element of competition and fun. Despite initial challenges, careful planning and continuous iteration led to the successful creation of an effective and engaging learning platform. Overall, the project highlighted the potential of using extended reality technologies such as AR and VR to transform skill-based education by providing a safe, cost-effective, and accessible learning environment. Figure 1 shows the Mat Metro application and some images of the sample modules.

(a)

(b)



(c)

Fig 1: (a) Mat Metro application, (b)Sample AR module, (c) Sample VR module

Other relevant information

As one of the MyHackhaton 2020 winners, the Mat Metro project received significant funding support from CradleFund through MyHackathon 2020 initiative, that also involves the Ministry of Science, Technology and Innovations (MOSTI). This financial backing was crucial in the development and implementation of the AR and VR technologies used in the project. The funding enabled the research team to collaborate with experts, develop the mobile application, and conduct extensive testing and iteration to ensure the effectiveness and accessibility of the learning platform. The support from CradleFund and MyHackathon 2020 played a pivotal role in realizing the project's objectives and contributing to the advancement of skill-based TVET and STEM education. The success of Mat Metro, showcased at the MyHackathon 2020 ceremony on 1st December 2021, underscored the transformative potential of these technologies in enhancing skill-based TVET education that is crucial to the future of our nation.

Acknowledgement

We express our profound gratitude to CradleFund and the Ministry of Science, Technology and Innovations (MOSTI) for the funding and invaluable support through the MyHackathon2020 initiative, which played a pivotal role in the realization of this work. Not to mention heartfelt thanks to the dedicated team that combines ThinkersLab Sdn. Bhd., UTM ViCubeLab, Institut Kemahiran MARA Johor Bahru, and Virtual Space Center to work together as a team, whose expertise and collaboration were instrumental in implementing the Augmented Reality and Virtual Reality technologies in skill-based learning, and everyone involved in every stage of this project. Your contributions have been essential to the success of the Mat Metro project.

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ID 99: UTM DIANA Intelligence Avatar as Educator Towards Safer Society in the Digital World

Ajune Wanis Ismail[1], Anazida Zainal[2], Zakiah Mohamad Ashari[3], Fadzliaty Edora Fadzli[4], Norhaida Mohd Suaib[5], Sarina Sulaiman[6]

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Highlights: This project develops DIANA, an advanced digital assistant and educator, using real-time holographic technology and AI. DIANA offers life-sized, interactive holographic experiences that simulate human behavior to enhance learning. By integrating Natural Language Processing (NLP) and AI, DIANA provides personalized and immersive educational interactions. The initiative aims to revolutionize education by merging cutting-edge digital interfaces with advanced educational technology. The project evaluates DIANA's impact on student learning time and outcomes, seeking to make education more accessible, engaging, and effective in a technology-driven society.

Keywords: *Hologram; Natural Language Processing (NLP); Artificial Intelligence (AI); Cyber Threat*

Introduction

With the pervasive influence of digital technologies in our daily lives, societies are increasingly dependent on these innovations. People now have immediate and boundless access to digital content, resources, and databases, leading to the emergence of digital societies where technology plays a central role from start to finish of each day. This project aims to enhance interactions within AI and our education societies through innovative approaches, including a real-time intelligent avatar, Natural Language Processing (NLP), Artificial Intelligence (AI), and cutting-edge hologram technology.

The project focuses on developing DIANA, an advanced digital assistant designed to function as an educator. Utilizing state-of-the-art holographic technology, DIANA will offer real-time, life-sized holographic experiences that simulate human behavior with high fidelity. This system aims to create an interactive learning environment where DIANA not only imparts knowledge but also engages users through dynamic, human-like conversation.

Central to this initiative is the integration of new-generation AI to enhance DIANA's educational capabilities. By overlaying holographic elements onto real-world environments, DIANA will provide immersive and personalized educational experiences. By merging cutting-edge digital interfaces with educational technology, this project seeks to revolutionize the learning experience, making education more accessible, engaging, and effective in the digital age. The project explores the impact of an intelligent avatar, DIANA, on student learning time and educational outcomes. With technology increasingly embedded in our daily lives, there is a growing need to leverage these advancements to enhance learning experiences. DIANA, an advanced digital assistant and educator, utilizes state-of-the-art holographic technology to create real-time, life-sized interactions that simulate human behaviour with remarkable accuracy.

Content

Project or innovation objectives

1. Design DIANA as an iconic in the form of Avatar as a 'living' assistant that is able to interact with people in the form of human-like conversation
2. Develop DIANA hologram form based on the interference of light waves to record and reconstruct three-dimensional images. This principle allows for the creation of high-resolution, 3D visualisations that can be viewed from multiple angles. This technology can attract Gen Z to interact with DIANA
3. Implement DIANA dialogue system and intuitive interaction space for students to interact and learn from DIANA on various topics, unlike AI systems out there DIANA is equipped with a security brain where cybersecurity breaches, incidents, and threats negatively impact our students can be secured and protected by DIANA.

NALI approach implemented in the research

The core objective of this project is to assess how DIANA, as an intelligent avatar, influences the efficiency and effectiveness of student learning. By integrating new-generation AI, DIANA is designed to offer personalized and engaging educational experiences. This includes adapting to individual learning styles, providing instant feedback, and facilitating interactive lessons through human-like conversation.

The novelty in this project is the use of life-sized, real-time holographic avatars for educational purposes is a groundbreaking approach. DIANA is also equipped with a security brain, to protect our youth from cybersecurity breaches, incidents, and threats that negatively impact our students. Most existing AI tools did not consider cyber threats like DIANA did. DIANA's holographic presence offers a level of immersion and realism that traditional educational tools cannot match. DIANA integrates cutting-edge artificial intelligence to provide highly personalized educational experiences. This includes adaptive learning paths and real-time feedback tailored to each student's needs, which is a significant advancement over static educational materials.

The creativity is when DIANA's design emphasizes human-like conversation and interaction, making learning more engaging and relatable. This creative approach aims to mimic real-world teaching dynamics in a digital format. The project explores creative ways to overlay holographic elements onto real-world environments, creating immersive simulations that can enhance understanding and retention of complex subjects.

The innovation of AI-Powered Educator, DIANA's use of advanced AI to simulate human behavior and adapt educational content in real-time demonstrates a novel application of artificial intelligence in education, offering new possibilities for interactive learning. Security brain to protect our students. The innovative use of holographic technology allows for real-time, interactive communication that can adapt to students' responses. This innovation represents a significant leap forward from traditional digital or text-based learning tools.

DIANA tailors educational content to each student's needs, potentially reducing learning time by addressing specific gaps in knowledge and adapting instruction in real time. Through holographic and conversational interfaces, DIANA aims to increase student engagement, which can lead to more efficient learning and better retention of information. By streamlining access to information and providing immediate support, DIANA could help students optimize their study time and focus on areas that require the most attention.

The impact of the project is, it will evaluate DIANA's impact on student learning time by comparing traditional educational methods with those involving the intelligent avatar. Metrics will include time spent on learning tasks, retention rates, and overall academic performance. By integrating advanced digital interfaces with educational strategies, this project aims to enhance the efficiency of learning processes and contribute to more effective educational practices in the digital age.

Research Methodology

Figure 1 shows the methodology of the project which consists of four subprojects named Project 1, Project 2, Project 3 and Project 4. Figure 2 presents the framework where the data lake will be crawling and profiling started with the assessment. Later the content generation and the framework eventually produced an application called DIANA.

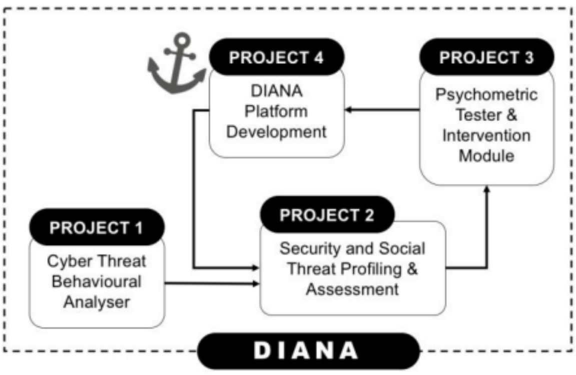

Figure 1: DIANA methodology

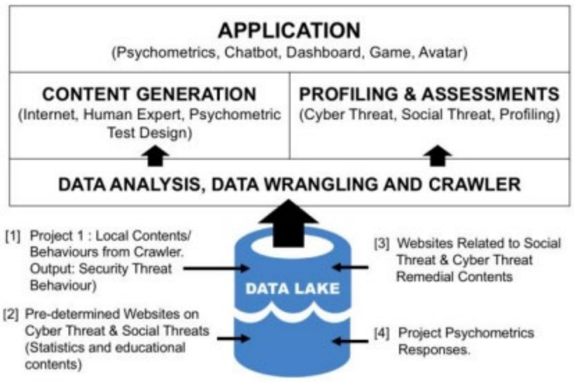

Figure 2: DIANA framework

Project 1 shows the development of Security Brain Intelligence (SBI) for Cyber Threat Behavioural Analysis. This project study aims at designing and developing an intelligent learning model called security brain intelligence (sbi) for cyber threat behavioral analysis using artificial intelligence techniques. In Project 2, the development of an Intelligence Brain (Engine) to perform security and social threat profiling and assessments. Security Threat Behavioural Profiling will be generated from analysis of browsing behavioural pattern (output from Project 1); which includes browsing time, URLs and content of the websites. Behavioural profiles will be created based on several attributes gathered from this processed traffic data. Such attributes are; types of websites visited (Gambling, illicit, shopping, news, social media, banking, malicious websites, arts, games, sports, health etc.), amount of time browsing, browsing time (midnight, early morning etc.) Besides, the 9 elements of Digital Citizenship will be used to enrich the user's profiles. Similar behaviours will be grouped into one category of profile using clustering technique.

Project 3 initiates the development of Intervention Content and Well-Being Psychometric Tests for Measuring the Severity of Security and Social Threat. The users' responses to the psychometric tests will determine the stage of seriousness of their mental health. Based on their mental health stage, the users then will be channeled to the appropriate predetermined intervention programs. Once completed, they will be asked to complete the diagnostic tests (in the forms of games or brief questionnaires) to determine the changes in their state of mental health. While Project 4 runs the development of a Platform for DIANA as a Protector and Educator. This project designs and develops a platform for DIANA that consists of an AR/VR/hologram application, DIANA Avatar as a 'living' assistant that can interact with people in the form of human-like conversation.

Finding and discussion of the project or innovation

Figure 3: DIANA is first showcased at UTM Research Day

DIANA is first showcased at UTM Research Day - D.I.A.N.A stands for Digital Security and Social Intelligent Assistant. She is a virtual female human-like avatar with our local Malaysian identity appearance. Furthermore, she can promote our unique Malaysian culture and have the potential to become our digital ambassador. DIANA is a hologram assistant that can be programmed to know whatever we intend her to have. Equipped with the AI brain and human-like speech with the help of the Natural Language Processing technique, the first version D.I.A.N.A (D.I.A.N.A 1.0) can interact and answer questions related to UTM.

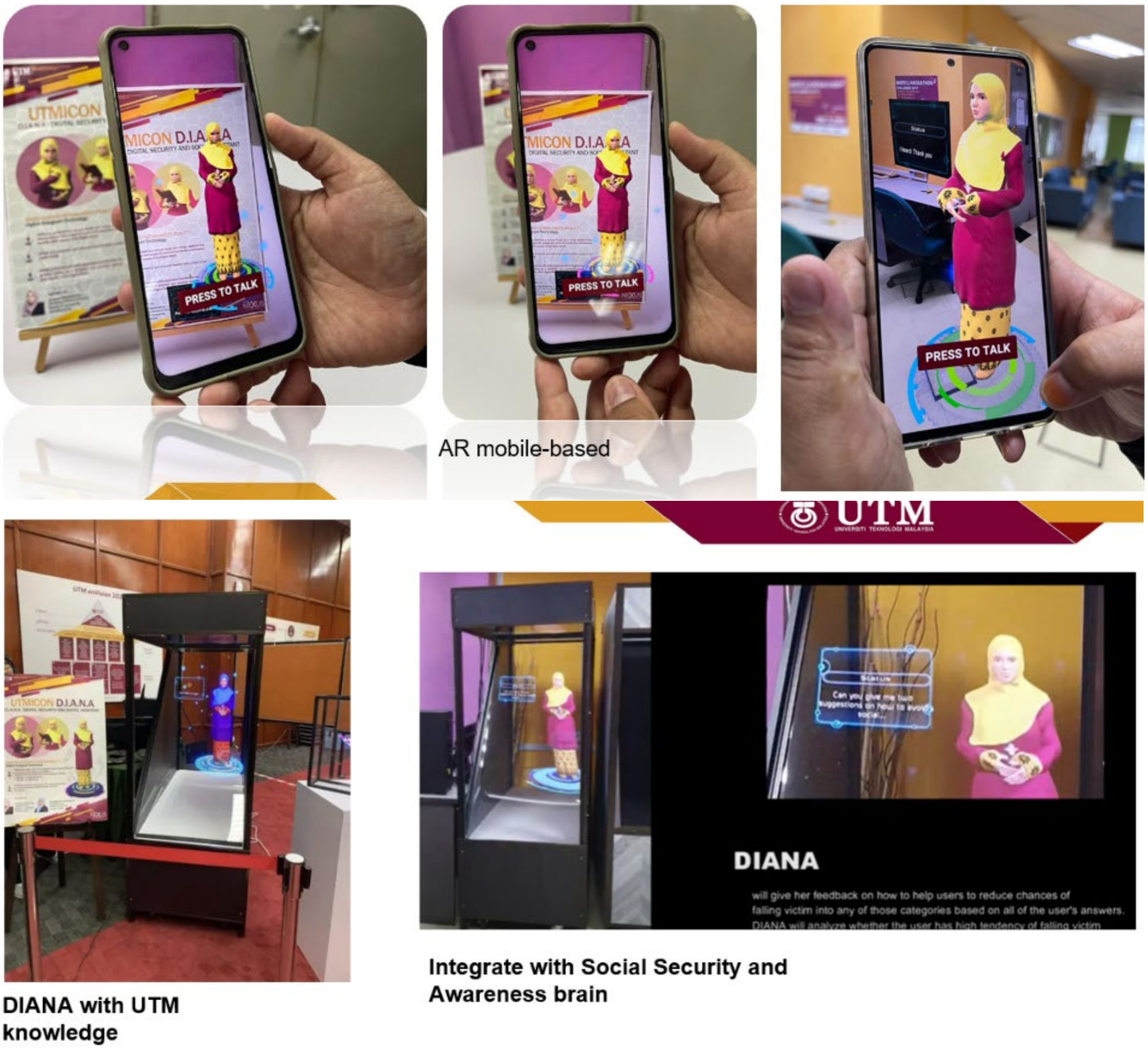

Figure 4: DIANA is available in multiple platforms, not just hologram but also mixed reality, and augmented reality.

Other relevant information

Premier Infinitum Sdn. Bhd.
202301021963 (1158460-A)
17-2 Suite,
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40100 Shah Alam. Selangor.
Tel: +603 5526 7718

Date: 29 January 2024

DR. AJUNE WANIS ISMAIL
UTM VICUBELAB
School of Computing,
Faculty of Engineering,
Universiti Teknologi Malaysia (UTM)

RE: LETTER OF INTENT: COLLABORATION FOR FURTHER DEVELOPMENT OF PROTO HOLOGRAM APPLICATION BETWEEN INFINITUM AND UTM.

Dear DR. AJUNE WANIS ISMAIL

1. We agreed to become a collaborating member of the research to be carried out with the UTM researcher for future improvement of DIANA's enclosure. Our company requires facilitation from UTM to conduct experiments with DIANA by leveraging Proto Hologram.

2. Our teams are conducting a project in the areas of augmented reality and improvement of Malay Natural Language processing which fit the aim of developing a digital twin with artificial intelligent of a particular topic and the advance holographic solutions in Malaysia.

3. This collaboration intends to explore potential commercial outcome between **Premier Infinitum Sdn Bhd** and **UTM VICUBELAB, School of Computing, Faculty of Engineering,**

Figure 5: Commercialization plan with Premier Infinitum Sdn Bhd

Figure 6: Exhibition MRANTI Supercharger 21 Aug 2024

Figure 7: Exhibition MRANTI Supercharger 06 June 2024

Figure 8: New UTMHUB [Link-1]

D.I.A.N.A pembantu maya berkebolehan berfikir, bertindak seperti manusia

Omar Ahmad · Februari 14, 2023 @ 11:49pm
bhnews@bh.com.my

D.I.A.N.A, avatar hologram pintar beroperasi dengan masa nyata (real-time), diprogram dan dilatih sebagai pembantu

BH BeritaHarian

JOHOR BAHRU: Universiti Teknologi Malaysia (UTM) membangunkan pembantu maya dalam bentuk avatar hologram pintar yang beroperasi dalam masa nyata (real time) dikenali sebagai D.I.A.N.A.

Ketua Projek D.I.A.N.A, Dr Ajune Wanis Ismail, berkata D.I.A.N.A berkeupayaan berinteraksi dengan manusia menerusi gaya percakapan semula jadi, memahami apa yang diperkatakan serta memberi maklum balas yang sesuai.

Katanya, D.I.A.N.A bermaksud 'Digital Security and Social Intelligent Assistant' (Pembantu Pintar Sosial dan Keselamatan Digital).

"Ia dibangunkan sebagai avatar maya mirip wanita beridentitikan Malaysia. Bahkan, kepintaran yang dimilikinya membolehkan avatar ini mempromosi warisan dan kebudayaan kebangsaan, sekali gus berpotensi untuk diangkat sebagai duta digital kita.

"Sebagai hologram pintar, D.I.A.N.A mampu diprogram untuk menyimpan apa jua maklumat dan data yang diperlukan.

"Pembantu maya ini juga dilengkapi dengan minda kecerdasan buatan (AI) dan berupaya bertutur seperti manusia dengan bantuan teknik Pemprosesan Bahasa Semula jadi (NLP). Versi pertama D.I.A.N.A (D.I.A.N.A 1.0) boleh berinteraksi dan menjawab apa jua soalan berkaitan UTM," katanya.

Menjelaskan demikian dalam satu kenyataan hari ini, Ajune Wanis berkata, D.I.A.N.A pertama kali dipamerkan semasa Hari Terbuka Penyelidikan UTM 2023 pada 6 Februari lalu bersempena lawatan kerja Menteri Pendidikan Tinggi, Datuk Seri Mohamed Khaled Nordin ke UTM.

Katanya, hasil maklumat dan data berkaitan UTM yang disimpan D.I.A.N.A, menjadikannya ikon digital UTM.

"Kebolehan untuk berfikir dan bertindak seperti manusia membolehkannya ditugaskan sebagai pembantu maya dan mungkin menjadi sahabat maya suatu hari nanti.

"Dalam bentuk aplikasi telefon pintar pula, D.I.A.N.A mampu memberi manfaat kepada pengguna sebagai pendidik dan pelindung, dalam usaha mewujudkan masyarakat sejahtera dalam dunia digital.

D.I.A.N.A pembantu maya berkebolehan berfikir, bertindak seperti manusia

"Bagi memastikan D.I.A.N.A mampu diakses pelbagai lapisan masyarakat, selain teknologi hologram, UTM turut menyepadukan teknologi realiti terimbuh (AR) dalam pembangunan D.I.A.N.A.

"Ia bagi membolehkannya muncul pada skrin telefon pintar pengguna. Keupayaan D.I.A.N.A versi AR setara dengan versi hologram," katanya.

Katanya, versi pertama D.I.A.N.A dibangunkan bersama pasukannya dari 'Mixed and Virtual Environment Research Lab' (Mivielab) yang juga sebahagian daripada entiti UTM ViCubeLab Research Group, di bawah Fakulti Komputeran UTM.

"Saya turut dibantu Dr Norhaida Mohd Suaib dan Dr Md Sah Salam, yang juga penyelidik UTM ViCubeLab Research Group. Projek D.I.A.N.A menerima pendanaan daripada Program UTMICONIC, diketuai Prof. Madya Dr Anazida Zainal.

"Saya salah seorang ketua projek yang terlibat dalam penyelidikan dan pembangunan komponen sistem hologram avatar maya ini. Ketua projek lain seperti Dr Fo'ad Rohani dan Prof Dr Hamdan Said turut terlibat secara langsung dalam sumbang saran teknikal bagi menjayakan projek ini," katanya.

D.I.A.N.A, avatar hologram pintar beroperasi dengan masa nyata (real-time), diprogram dan dilatih sebagai pembantu maya. - Foto ihsan UTM

https://www.bharian.com.my/berita/nasional/2023/02/1064391/diana-pembantu-maya-berkebolehan-berfikir-bertindak-seperti-manusia

Figure 9: Berita Harian [Link-2]

Acknowledgement

We are grateful for the funding - UTM ICONIC GRANT - DIANA.

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ID 100: UTM Edu-Metaverse Immersive Learning with AI Assistant

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Highlights: Edu-Metaverse Immersive Learning with AI Assistant leverages advanced virtual reality and artificial intelligence to create a dynamic educational environment. By integrating immersive metaverse experiences with AI-powered assistants, this innovation offers personalized, interactive learning opportunities. Students engage in collaborative problem-solving within virtual worlds, receiving real-time feedback and support tailored to their needs. This approach enhances engagement, supports critical thinking and creativity, and fosters 21st-century skills, transforming traditional education into a more immersive and effective learning journey.

Keywords: *Metaverse; Virtual Reality; Artificial Intelligence; Virtual Assistant; Immersive Learning*

Introduction

Resilience Education for Future-Oriented Quality Graduates is a pioneering initiative that redefines resilience training by integrating cutting-edge technologies such as the Edu-Metaverse Immersive Learning with AI Assistant. This project leverages the immersive potential of the metaverse and the personalized support of AI avatars to foster resilience and adaptability in students. Novelty is demonstrated through the unique combination of the metaverse and AI avatars to deliver resilience education. Unlike traditional methods, this approach introduces innovative ways to engage students in virtual environments where they face and overcome simulated challenges, thereby enhancing their capacity to handle real-world adversities. Creativity shines in the design of these virtual learning experiences. The metaverse provides a vast, interactive space where students encounter dynamic scenarios that test and build their resilience. AI avatars act as mentors within this environment, offering tailored guidance and support that adapts to each student's unique needs, making the resilience training both creative and effective. Innovativeness is reflected in the use of AI avatars for real-time, adaptive feedback. This represents a significant advancement from conventional educational practices, ensuring that resilience training is personalized and continuously evolving.

The ability of AI to analyze student interactions and provide immediate, actionable insights enhances the effectiveness of the resilience education program. Applicability is aligned with the New Academia Learning Innovation (NALI) model by integrating immersive, technology-driven learning solutions. The combination of the metaverse and AI avatars fits seamlessly within this model, addressing contemporary educational needs and preparing students for future challenges with a forward-thinking approach. The impact on Students' Learning is profound as this integrated approach significantly boosts engagement and empowerment. The immersive nature of the metaverse and the supportive role of AI avatars create a compelling learning experience that not only improves students' resilience but also enhances their overall academic performance and readiness for future challenges. In summary, the Resilience Education for Future-Oriented Quality Graduates initiative, in conjunction with the Edu-Metaverse Immersive Learning with AI Assistant, represents a transformative advancement in educational practices. By merging novel technological innovations with creative design, it offers a powerful and impactful way to develop essential resilience skills in students, ensuring they are well-equipped for the complexities of the future.

Content

Project or innovation objectives

Traditional classroom settings can sometimes be static and disengaging for students, particularly for those who are visual or kinesthetic learners. This can lead to reduced motivation and interest in the subject matter. Standardized teaching methods often fail to address individual learning needs and preferences, leading to varying levels of understanding and retention among students. Traditional learning methods can fail to capture the attention of students who are more accustomed to interactive and immersive digital experiences. Conventional classroom settings often lack the interactive and experiential elements that can make learning more engaging and effective. Maintaining student engagement and collaboration in virtual or hybrid learning environments can be challenging without interactive and immersive tools.

Here are **three innovation objectives** for the Resilience Education for Future-Oriented Quality Graduates project, which **integrates the Edu-Metaverse Immersive Learning with AI Assistant**

1) Study the existing user interaction in the metaverse. Create a comprehensive and interactive virtual learning environment within the metaverse that supports educational activities, including virtual classrooms, simulations, and collaborative projects.
2) Implement AI assistants that provide real-time, personalized support and feedback to students, adapting to their individual learning needs and progress.
3) Integration AI-based virtual Avatar Assistant in Metaverse Classroom and evaluate the user experiences

NALI approach implemented in the research (e.g., novelty, creativity, innovativeness, applicability and

impact)

The **novelty** is the project introduces a groundbreaking approach by integrating immersive metaverse environments with AI-powered virtual assistants for education. Unlike traditional learning methods, it offers a novel educational experience where students interact in a fully virtual, 3D space, allowing for real-time, experiential learning. This innovative blend of technologies represents a significant departure from conventional classroom settings and digital learning tools. The project showcases **creativity** through the design of immersive virtual learning environments and interactive scenarios. Students can explore richly detailed virtual worlds, participate in engaging simulations, and solve problems within these environments. The use of AI avatars as interactive mentors adds a layer of imaginative engagement, providing dynamic and responsive educational support that adapts to students' needs and encourages creative problem-solving. The integration of AI assistants within a metaverse platform represents a **major innovation** in educational technology. AI avatars offer personalized, real-time feedback and guidance, adapting to each student's learning style and progress. This innovative approach enhances traditional learning methods by providing adaptive, interactive, and immersive educational experiences, significantly improving how educational content is delivered and engaged. The project is highly **applicable** to the New Academia Learning Innovation (NALI) model by aligning with contemporary educational trends that emphasize immersive, technology-driven learning. It addresses the need for modern educational solutions that prepare students for a digital and interconnected world. By integrating virtual environments and AI into the curriculum, the project supports the development of essential 21st-century skills, making it relevant to current and future educational needs. The **impact** of the project on students' learning is profound. The immersive metaverse environment enhances engagement by offering interactive and engaging learning experiences that capture students' interest and motivate active participation. AI assistants provide personalized support, boosting individual learning outcomes and fostering a deeper understanding of the material. This approach empowers students by developing critical skills such as collaboration, communication, and problem-solving, ultimately preparing them for success in a rapidly evolving world. AI assistants can adapt to individual learning styles and needs, providing tailored content and feedback that helps students grasp concepts more effectively. This personalization can lead to better understanding and retention of material. Real-Time Feedback - Instant, actionable feedback from AI can help students quickly identify and address gaps in their knowledge, leading to improved performance and quicker mastery of subjects.

Research Methodology

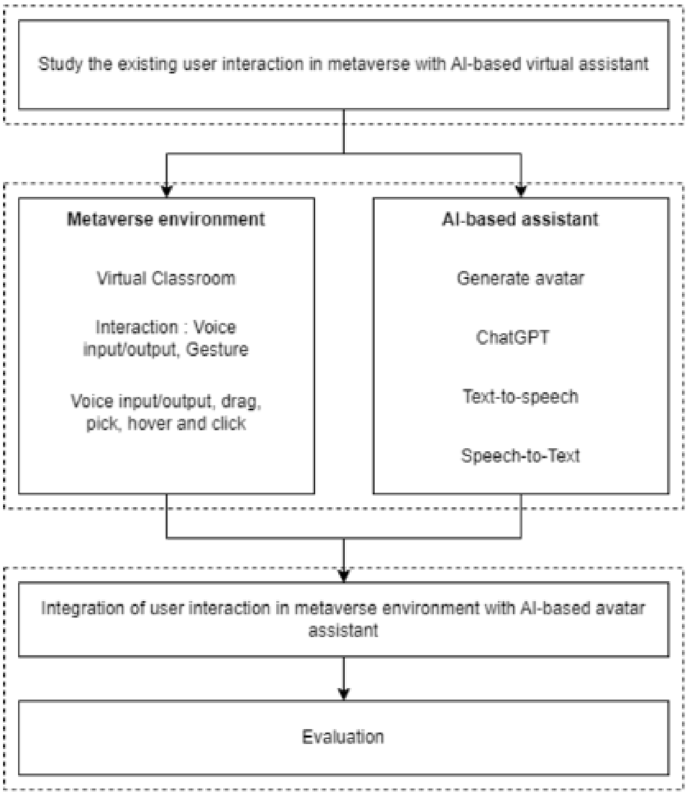

Figure 1 Methodology Flowchart

Phase 1 : Study the existing user interaction in the metaverse. Create a comprehensive and interactive virtual learning environment within the metaverse that supports various educational activities, including virtual classrooms, simulations, and collaborative projects. This first phase is important and has been done clearly to discover and explore further information and issues related to user interaction in the metaverse as well as the AI virtual assistant. The appropriate method and tools can be applied to develop user interaction in the metaverse and the AI virtual assistant by gathering all the information gained. Design and build virtual spaces tailored to different subjects and learning styles, integrate interactive tools and resources, and ensure that the environment is user-friendly and accessible to all students.

Phase 2 : Implement AI assistants that provide real-time, personalized support and feedback to students, adapting to their individual learning needs and progress. This phase had been a development phase for the metaverse classroom. Develop AI algorithms capable of assessing student performance and learning preferences, create mechanisms for personalized content delivery and feedback, and ensure seamless interaction between AI assistants and the virtual learning environment. The requirements and information obtained in the preceding chapter served as the foundation for the requirements and findings. In this phase, building the metaverse classroom was crucial while allowing user interaction with the aid of an AI-based virtual avatar assistant. User interaction in the metaverse classroom had been expected to increase efficiency during the learning process, with the AI-virtual avatar assistant responding to voice commands and guiding the user throughout the tasks. In developing the interaction in the metaverse, the software did not require any payment as it was free to use and had a variety of features for developing the metaverse component. For the AI-based virtual avatar assistant, a cutting-edge AI tool had been used to integrate with the virtual avatar. In this development, ChatGPT had been used to generate a script based on a given prompt.

Phase 3 : Integration AI Assistant in Metaverse Classroom and evaluate the user experiences. This phase proceeds with the integration of user experience with an AI-based virtual avatar assistant in a metaverse classroom after the development process is successfully done. To let users, connect with the metaverse, users can join a specific metaverse room using a specific ID and allow the user to interact with the AI-based virtual avatar assistant using voice commands. Last but not least, the user evaluation was carried out for the user interaction in the metaverse environment with the AI-based virtual assistant.

Finding and discussion of the project or innovation

In response to the evolving demands of modern education, this project explores the integration of the metaverse and artificial intelligence (AI) assistants to enhance collaborative learning experiences. Traditional educational methods often struggle to engage diverse learning styles, address educational inequalities, and scale effectively across varied contexts. The proposed solution leverages immersive virtual environments within the metaverse, coupled with adaptive AI assistants, to create a dynamic, interactive, and personalized learning experience. The metaverse offers an engaging platform for virtual classrooms, simulations, and collaborative projects, while AI assistants provide real-time, customized support and feedback to meet individual student needs. This approach aims to bridge geographic and resource disparities, foster deeper engagement and motivation, and prepare students for the complexities of the 21st-century job market. By addressing key issues such as lack of engagement, accessibility challenges, and the need for scalable quality education, this project seeks to revolutionize educational practices and outcomes, ensuring a more inclusive, effective, and future-ready learning environment.

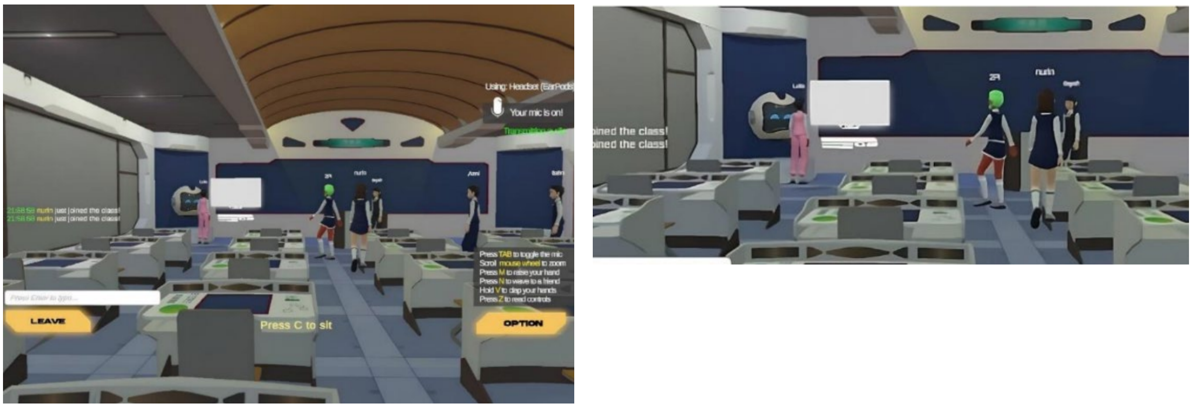

Figure 2 Findings of metaverse interface and application with users enter the classroom

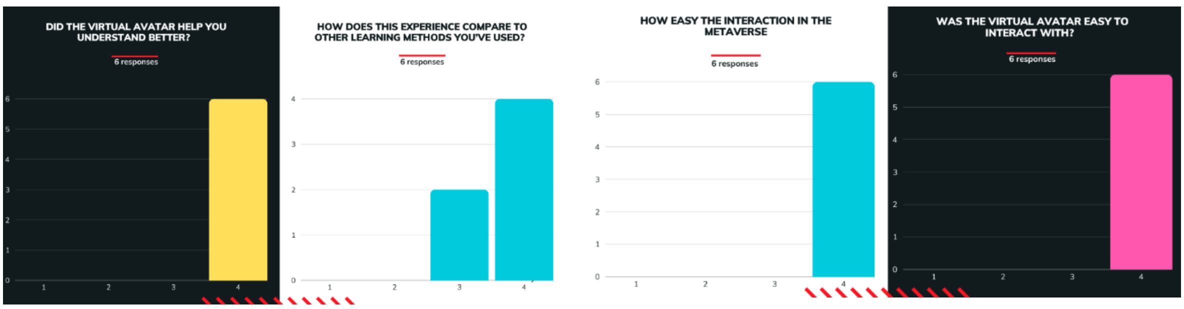

Figure 3 Surveys and testing carried out, the graph shows user experience

Findings improved learning outcomes. AI assistants can adapt to individual learning styles and needs, providing tailored content and feedback that helps students grasp concepts more effectively. This personalization can lead to better understanding and retention of material. Instant, actionable feedback from AI can help students quickly identify and address gaps in their knowledge, leading to improved performance and quicker mastery of subjects.

Findings enhanced assessment, AI and metaverse technologies enable detailed tracking of student progress and performance. Educators can use this data to identify trends, measure effectiveness, and make informed decisions about instructional strategies. The ability to assess various aspects of student performance, including collaboration, problem-solving, and critical thinking, provides a more holistic view of student capabilities.

Other relevant information (e.g., commercialization potential, awards received (title of project, exhibition and year))

Potential to be commercialized to educational institutions, we will be partnering with schools, universities, and educational organizations to integrate metaverse and AI technologies into their curricula can lead to commercial contracts and long-term collaborations.

Technology Providers: Collaborating with hardware and software providers for VR/AR equipment, AI tools, and cloud services can open up joint ventures and revenue-sharing opportunities.

Figure 4 **Exhibition**: Demo and presenter at National Event STEM/AI Booth - Madani Zone Selatan, JOHOR BAHRU, 17 Ogos

Figure 5 Potential Commercial **partnership**: Premier Infinitum Sdn Bhd (Malaysia) & Kumon Education (2024)

Acknowledgement

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ID 102: Mastery Integration Techniques in Engineering Subject: A practical approach

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Highlights: Nowadays, many students need a stronger understanding in the topic of integration due to having weak fundamentals of integration. This happens especially to the subject of Differential Equations (DE) which requires a great basis of integration. Therefore, techniques of integration (TOI) are developed and implemented in class to enhance students' understanding. A comprehensive analysis will be conducted based on students' performance in Test 1 and Final Examination. The results show that the implementation of TOI had a generally positive impact on the students' performances where their results increased greatly. This novelty innovation could be potentially commercialized to other subjects too.

Keywords: *Fundamentals; Integration; Techniques of Integration (TOI).*

Introduction

Mathematics and engineering are interrelated since many applications in engineering need mathematics to solve them. According to Fajrina *et. al* (2020), teaching and learning content of interdisciplinary knowledge cover science and mathematics through integrating engineering and design practices using relevant technology engineering. As mentioned by Gold *et. al* (2023) engineering is related to mathematics and spatial development that can support children's cognitive skills.

STEM known as science (S), technology (T), engineering (E), and mathematics (M) is relevant because in the nature of the world, each discipline in STEM is interconnected to encounter many problems (Hafni et. al, 2020). One way to overcome students' critical thinking skills is by applying the STEM approach where students can explore the problem effectively and efficiently. Also, this approach can improve students' learning quality (Minarti *et. al,* 2023). Hence, it is accurate to state that mathematics and engineering are correlated.

In Universiti Teknologi Malaysia, all engineering students are required to take differential equation (DE) subjects in year one and semester two. This subject is the continuation from the engineering mathematics 1 subject that they have taken in year one semester 1. One of the topics in DE that is important for them to excel in this subject is integration. Integration is the reverse process of differentiation to calculate an integral (Stroud *et. al,* 2020). Integrals in mathematics are used to find areas, volumes, displacement, etc. Integration is essential because it comprises many applications in engineering problems.

According to the data of the test and final examination, students tend to not answer the questions that involve integration, and this is due to their lack of understanding of that topic. The students have a problem identifying the accurate techniques to solve the problem. Hence, to increase their understanding, especially the integration topic, this project is introduced specially to help them master the technique of integration. This approach is a flowchart-based approach that guides students step by step. Therefore, using this approach, students may take it as a tool to test their understanding of the technique of integration (TOI).

Project Objectives

The following objectives outline our key goals and targets for these innovations

1) To ensure students develop a deep understanding of various integration techniques beyond rote memorization.
2) To improve students' ability to tackle complex integration problems independently.
3) To continuously evaluate students' understanding and skills in applying integration techniques.

NALI Implementation in Problem-Based Learning for Techniques of Integration (TOI)

A novel, systematically designed learning approach has been developed for Techniques of Integration (TOI) within the mathematics subject, Differential Equations (DE) SSCE1793, aimed at addressing the specific educational needs of engineering students. Mainly, this innovation is considered as problem-based learning (PBL), where students are able to answer the given question based on the instructional video that is provided by lecturers. According to Lazim et al. (2023), PBL differs from the traditional problem-solving techniques which requires the students to apply existing knowledge to solve a certain question where in this case involving integration. PBL enhances students for critical thinking as well as enhances the students to analyze the problem critically. This innovative framework is designed to support students for various engineering areas, including civil, mechanical, and electrical engineering. The approach integrates an instructional resource which is a video involving beginner, intermediate, and high-level examples to overcome the unique challenges associated with mastering integration techniques. By employing a structured, methodical teaching strategy involving a user-friendly flowchart, provided for students, the framework seeks to enhance students' understanding and application of complex integration concepts.

To evaluate the effectiveness of this approach, a comprehensive analysis will be conducted based on students' performance in Test 1 and the Final Examination. This assessment will provide insights into how well the framework improves students' understanding and application of the subject. It is anticipated that by addressing the specific learning needs of engineering students and employing targeted instructional strategies, this approach will result in significant improvements in academic performance. Consequently, it is expected to enhance the overall educational outcomes for students within these engineering disciplines, thereby contributing to their academic success.

Research Methodology

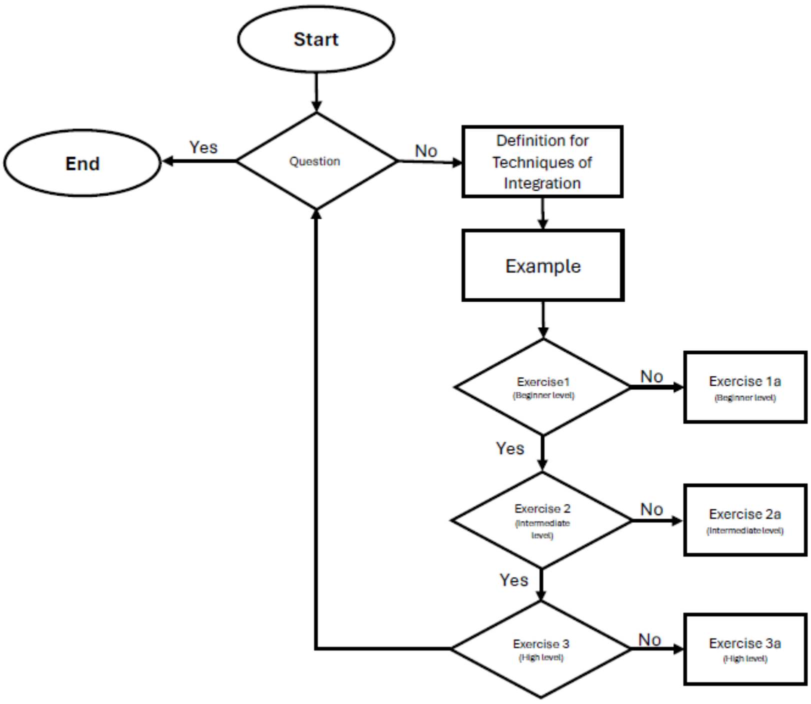

Figure 1: Flowchart of the process for answering integration questions using instructional interphase

A flowchart guides them through solving problems, with definitions and exercises designed to improve their comprehension and ability to apply what they've learned. The goal of this project is to facilitate students' understanding of integration techniques using a step-by-step tutorial.

Initial Question Attempt:
Students begin by attempting a given question related to techniques of integration. This step assesses their initial understanding of the topic.

Decision Point:
If students are unable to answer the question, they are prompted to revisit the foundational concepts. This involves clicking on a link that directs them to a definition of the techniques of integration.

Review of Techniques:
Students review the definitions and examples provided for the techniques of integration. This step ensures that they have the necessary theoretical knowledge before proceeding.

Exercise Sequence:
After reviewing the definitions, students proceed to a series of exercises designed to reinforce their understanding:

a. Exercise 1 (Beginner Level): Students start with beginner-level exercises. If they struggle, an alternative beginner-level exercise (Exercise 1a) is provided to reinforce their understanding. If they successfully complete these exercises, they move on to the next level.

b. Exercise 2 (Intermediate Level): Upon completing the beginner exercises, students are directed to intermediate-level exercises. They continue to build on their knowledge and skills. If they face difficulties, a secondary intermediate-level exercise (Exercise 2a) is given to provide additional practice

c. Exercise 3 (High Level): The final set of exercises is at a high difficulty level, challenging students to apply their understanding comprehensively. If they encounter difficulties, they are given another high-level exercise (Exercise 3a) to ensure thorough understanding.

Feedback Loop:
After completing the high-level exercises, students are prompted to revisit the original question. This step is crucial as it allows students to apply the knowledge and skills they have gained through the exercises. It also serves as a self-assessment to determine if they can now answer the question correctly.

Final Assessment:
If students are able to answer the question after completing the exercises, they proceed to the next tutorial or problem. If not, they are encouraged to repeat the process, focusing on areas where they struggled, until they achieve a satisfactory level of understanding.

This methodology ensures that students are not just passively learning but actively engaging with the material through a cycle of learning, practice, and application. The flowchart serves as a visual guide, making the learning process intuitive and systematic.

Findings and Discussions

The scores of five engineering students with poor performance are recorded in Table 1. Test 1 indicates the scores before the implementation of TOI while the final examination reflects the scores after its implementation. A bar chart in Figure 2 is provided as visual support for a clearer comparison.

Table 1: Students' Scores

Name	Test 1	Final Examination
Student 1	23	57
Student 2	15	32
Student 3	31	46
Student 4	38	54
Student 5	38	79

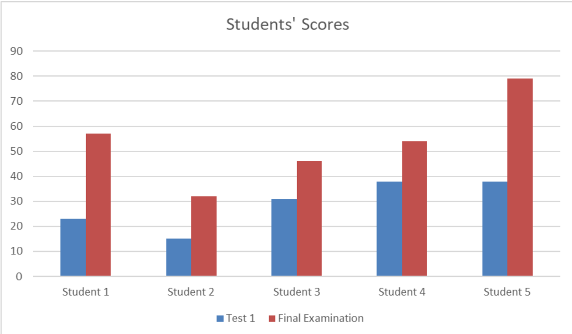

Figure 2: Students' Scores in Test 1 and Final Examination

Based on Table 1 and Figure 2, all students improved their scores from test 1 to the final examination. This shows that the implementation of TOI had a generally positive impact on the students' performances although the magnitude of improvement varied. This indicates that while the implementation of TOI was very helpful, the extent of improvement might also be influenced by individual factors like prior knowledge, effort, or learning style. In summary, the TOI approach improves the fundamental knowledge of mathematics (integration topic) as the students' scores demonstrated a consistent improvement.

Commercialization Potential

The system demonstrates significant potential for commercialization within the educational sector. The structured, interactive approach to learning techniques of integration could be adapted for use in various educational settings, including schools, universities, and online learning platforms. Its adaptability allows it to serve as a valuable tool for students at different educational levels, enhancing their understanding and problem-solving skills in mathematics.

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ID 104: Implementation of A Dual-Course Integrated Project using Cooperative Engineering Design Approach

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Highlights: The innovation in this work centres around the integration of two separate courses - Medical Instrumentation and Physiology & Intro to Medicine - through a single cooperative engineering design project. The approach incorporates engineering design process and the principles of cooperative learning to promote knowledge construction and application in a social setting. This is to provide students with a holistic view of a real-world problem by establishing interconnections between courses. Students were challenged to link technological solutions to solve human physiology issues. Students worked together on the integrated project that serves as part of the assessment for both courses. The integrated project promoted interdisciplinary learning, reduced redundancy in assignments, and encouraged teamwork. This innovative approach also saved time and provided a broader perspective for problem-solving.

Keywords: *Cooperative Learning; Integrated Project; Engineering Design; Interdisciplinary Learning.*

Introduction

One approach to teaching and learning that intentionally connects the views, knowledge, and abilities from other disciplines is curriculum integration (Mora & Coto, 2014). According to proponents of curricular integration, the finest teaching and learning approaches should be all-encompassing and non-fragmented to provide a more comprehensive grasp of a subject. Unfortunately, the way many higher education institutions currently structure their curricula, the way traditional teaching methods are used, and the trend toward individualism have led to a fragmented delivery of knowledge, with courses repeating themes, students having to work twice as hard to complete assignments, and little opportunity for students to connect and construct knowledge from different courses to solve problems. Building connections between information from other fields of study or courses may give students access to a greater variety of experiences, facilitate a less fragmented approach to learning, and improve their connections to the outside world.

Furthermore, to improve comprehension and retention of a subject, more recent pedagogical approaches to teaching and learning encourage students to actively engage and cooperate in class discussion and participation. To maximize the amount of cooperative and active engagement and participation from the students, jigsaw technique, think-pair-share, gallery walk, discussion forums, and design projects are used to develop hands-on projects, group work, brainstorming, and presentations (Patton, 2015; Keyser, 2000; Paulson, 1999). Some classrooms will provide points for participation in these activities to incentivize students. To receive a decent score for the course, students must both perform well on their written exam and actively participate in these activities. While it is admirable to try to engage students through learning activities, there is a chance that students may become overworked due to deadlines, extracurricular activities, and project demands if they are overburdened with assignments or major projects from several courses in a single semester.

This study explores the concept of integrated curriculum through a cooperative engineering design project involving two distinct courses: Physiology & Intro to Medicine and Medical Instrumentation from the Medical Electronics specialization program. The integrated project was developed to meet the learning outcomes of both courses: students had to work on a medical-related program or gadget and then connect its use to the human body. The two courses would use different assessment rubrics to evaluate this same design assignment. The objective was to support students connect the dots of the knowledge content between two distinct courses, allows them to think more broadly while completing a project, and cut down on the total number of projects that each student must complete for the semester. This paper also discusses the students' experience while completing this cooperative engineering design project.

Innovative Design of Cooperative Engineering Design Approach

The primary objective of the innovation is to develop a project of two distinct courses, Medical Instrumentation and Physiology & Intro to Medicine, into a single interdisciplinary design project. This innovation aimed to streamline the student workload, reducing the number of assignments while fostering the application of knowledge from multiple fields. The project also sought to prepare students for real-world challenges in healthcare technology by requiring them to design medical-related devices or software to solve human physiology issues that aligns with the United Nations Sustainable Development Goals (SDGs). The students were tasked with connecting the functional principles of their systems with the human physiological system, thereby encouraging holistic problem-solving and global citizenship.

The integrated project described in this work incorporates engineering design process and the principles of cooperative learning to promote knowledge construction and application in a social setting. This is to provide students with a holistic view of a real-world problem by establishing interconnections between course. . The project required students to integrate knowledge from both Medical Instrumentation and Physiology & Into to Medicine, encouraging them to build upon existing knowledge to solve complex problems. The project emphasized active participation through hands-on tasks and cooperation in problem-solving which supports the idea that students learn more effectively when they engage in meaningful activities rather than passively receiving information. The team-based structure of the project promoted cooperative learning, where students worked in diverse groups to share knowledge and perspectives. Group interactions is essential in developing critical thinking and problem-solving skills. Students are also exposed to The project follows the engineering design process, where students identify and addressed real-world problems related to healthcare and medical-related issues, fostering critical thinking, self-directed learning, and interdisciplinary integration. Through each process in the engineering design process, students learned by doing. The development of medical devices or software allowed them to apply their theoretical understanding in a tangible, real-world context, enhancing the retention of knowledge. The incorporation of engineering design process and the principles of cooperative learning is hoped to foster deeper learning and skill development among students.

The integrated project is proposed to replace traditional, fragmented assignments with a single interdisciplinary task assessed by both courses. It is innovative in fostering collaboration across medical and engineering disciplines, an approach not commonly implemented in engineering curriculums. The implementation of the project follows an innovative approach - Cooperative Engineering Design Project (CEDP), where the design process follows each stage of the engineering design phase . embraced with the principles of cooperative learning to support students working in team. The process flow of the integrated project is shown in Figure 1, with the CEDP approach shown in the implementation stage:

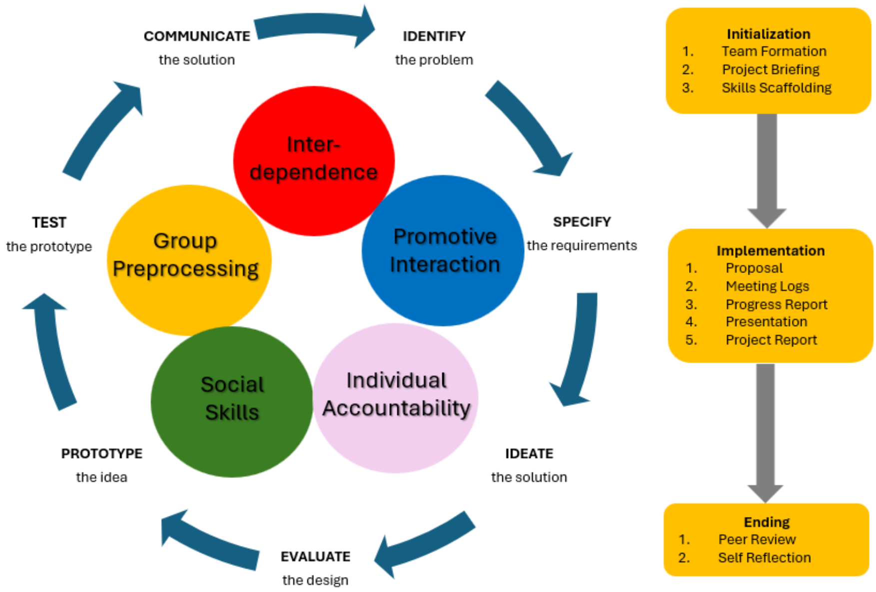

Figure 1: Process Flow of the Cooperative Engineering Design Project

Students were encouraged to propose improvements to current healthcare systems, allowing for creative thinking in both software or hardware development. The flexibility to select project topics based on real-world medical needs promoted innovative ideas. The project was aligned with societal needs, especially in the healthcare domain, ensuring students' work was grounded in practical, applicable solutions. The focus on the UN's SDGs further ensured the social relevance of the student projects. By integrating interdisciplinary knowledge and fostering teamwork among students of diverse academic backgrounds, the project helped to enhance their collaborative and problem-solving skills. This method of assessment also promoted time efficiency, creativity, and in-depth knowledge retention.

The integrated design project involved third and fourth-year students who were enrolled in the Medical Electronics major from the Faculty of Electrical Engineering at Universiti Teknologi Malaysia. Utilizing CL principles for both classes, 3 to 4 students were grouped into heterogeneous teams, considering various factors including race, gender, cultural background, and academic achievement to promote diversity in thinking and opportunities to adapt with others on mutual concerns (Valls & Kyriakides, 2013). Each group was tasked with developing a project that proposed improvements to a healthcare-related system, linking its operation to human physiology.

The project deliverables were structured to ensure steady progress throughout the semester, with weekly submissions and continuous feedback from instructors. Assessments were conducted using rubrics specific to both Medical Instrumentation and Physiology & Intro to Medicine courses. Table 1 displays the schedule of when project deliverables are expected be completed. The project schedule was designed to have specific weekly deliverables to prevent students from procrastinating and avoiding a rush of work at the end of the semester. Ongoing evaluation and feedback were given in conjunction with the submitted tasks.

To assess the students' perception of the integrated project, anonymous feedback was collected towards the end of the semester through four questions focusing on the concept, experience, challenges, and preferences regarding group or individual work.

Table 1. Schedule of Project Execution

Task / Deliverables	Week												
	3	4	5	6	7	8	9	10	11	12	13	14	15
Team Formation													
Project Briefing													
Skill Scaffolding							B						
Proposal							R						
Progress Report (Individual)													
Prototype Presentation							E						
Project Report													
Minutes of Meeting							A						
Self & Peer Assessment							K						
Self-Reflection													

Research Methodology

Learners' feedback on the implementation of the integrated project were collected towards the end of the project and were conducted anonymously and voluntarily. A total of 25 respondents out of 32 students submitted their feedback to the following open-ended questions and data was analyzed using thematic analysis.

- Question 1: What is your feedback about the concept of integrated project?
- Question 2: What do you like best about the project?
- Question 3: Do you prefer to work on a project on your own or as a group? Why so?
- Question 4: What do you think can be improved about the integrated project

Findings and Discussion

Results from the students' feedback revealed that their perception of the integrated project were mostly positive, with 64% stating that the integrated project was a valuable learning experience. The combination of knowledge from different disciplines was mentioned, as was the opportunity to save time by merging assignments from two different courses. For Question 2, students found the teamwork aspect especially rewarding, with 44% indicating that collaboration, knowledge sharing, communication and unity with their peers were among the most enjoyable part of the project. The integrated project allows them to interact more as a team member. 16% of the respondents mentioned that the opportunity to apply their knowledge in the medical field and making something useful were what they liked best about the project. Some also mentioned that they appreciated the freedom to work on any title and opportunity to learn deeply about a particular case

When asked whether students would rather work alone or in a group, majority of the respondents (72%) felt that working in a group was preferable, while only 20% desired working alone because they felt that their teammates were not putting in enough effort. A minority of 8 % said they had no preference since they thought both options were good.

However, there were challenges, particularly regarding the execution of hardware-based projects. The bulk of responsibility for hardware-related tasks was primarily on certain team members who had the hardware components in hand. . For some students, it was challenging to engage in discussions and encourage some team members to distribute their fair portion of work. Some sstudents found the project requirements to be complex and recommended clearer guidelines for future iterations. There were also suggestion to make the progress reports and reflections to be simpler and structured to assist students in finishing their tasks, instead of increasing their workload.

Despite these challenges, the integrated project successfully promoted interdisciplinary learning, problem-solving, and time management. Students were able to apply theoretical knowledge in a practical setting, which they found to be both challenging and rewarding.

In the execution of the integrated project, the focus was on the diversity of team members to enhance creativity and enhance teamwork skills (Theobald *et al.*, 2020). Nevertheless, a team with excessive diversity may result in communication problems if there is a significant difference in skills among its members. This was addressed by mixing the team members with high, average and low achievers to minimize the disparities. In general, the majority of students were satisfied with their assigned team, with only a few mentioning a lack of dedication from their teammates. There did not appear to be any knowledge or skill gaps, as members of the cooperative were able to assist each other.

Springer et al. (1999) researched how including varying levels of group work impacts outcomes, determining that the most advantageous results were achieved with an intermediate amount of time spent in groups. Other researchers observed a slight detrimental impact linked to both self-paced and self-directed learning as seven out of ten instances of students in problem-based learning (PBL) curriculums performed worse than students in traditional programs on basic science assessments (Prince, 2004; Norman & Schmidt, 2003; Albanese & Mitchell, 1993). On the other hand, recent research indicated that PBL could contribute to cultivating favorable student attitudes, promoting a more profound learning style, and enhancing long-term knowledge retention compared to conventional teaching methods (Freitas et al., 2016). Hence, careful planning is necessary when assigning group projects in class to ensure it is not overwhelming for students yet still promotes meaningful learning. Students should be allotted time for both individual and group study.

It is important to carefully plan the implementation of allowing students to work on integrated projects that can be graded across multiple courses to best fit the students' learning situation. Future integration may involve incorporating purely software-focused projects in online education, while reserving hardware-focused projects for in-person instruction. A class should have the right number of activities planned - enough to keep students engaged but not so many that discourage learning.

Conclusion

This integrated cooperative engineering design project represents an innovative approach to engineering education, combining interdisciplinary knowledge and promoting real-world problem-solving skills. The positive student feedback and the project's potential for real-world application demonstrate its success and promise for future iterations. Future improvements could include clearer guidelines and considerations for online or hybrid learning environments to ensure more effective project delivery. It is hoped that the proposed approach can also be adapted by other courses to promote meaningful learning experience for students by providing students with a holistic view of a real-world problem by establishing interconnections between multiple courses.

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ID 105: MindSprint: Spin & Write – A Creative and Interactive Writing Game for Low-Proficiency Learners

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Abstract: This study investigates the effectiveness of MindSprint Spin & Write, an innovative educational game designed to enhance the writing skills of low-proficiency English language learners. The game integrates elements from the Process Approach (Hyland, 2003) and Edward de Bono's Six Thinking Hats framework (de Bono, 1985) to address challenges in complex sentence construction and idea organization. Using a mixed-methods approach, the study examines the game's impact on students' writing performance, confidence, and engagement. Results indicate significant improvements in participants' ability to construct complex sentences, increased confidence in writing, and high levels of satisfaction with the game. The findings suggest that MindSprint Spin & Write offers an effective, engaging method for teaching writing skills to low-proficiency ESL learners.

***Keywords**: Process Approach;Writing Proficiency; Low Proficiency Learners;Writing Confidence; Game-based learning*

1.0 Introduction

Writing proficiency is a critical skill for academic success and professional development in English as a Second Language (ESL) contexts. However, low-proficiency learners often struggle with complex sentence construction and idea organization, hindering their overall writing performance. Traditional writing instruction methods may not adequately address these challenges, necessitating innovative approaches that engage learners and provide structured support.

MindSprint Spin & Write is a novel educational game developed to address these issues. It incorporates key components of the Process Approach (Hyland, 2003) and Edward de Bono's Six Thinking Hats framework (de Bono, 1985) to guide learners through the stages of writing: Mindmapping, Planning, Drafting, and Revision (Flower & Hayes, 1981; Graham & Perin, 2007). The game aims to enhance learners' communicative achievement performance (Weigle, 2002) while fostering creativity, engagement, and collaboration (Bachman & Palmer, 1996).

Recent research has demonstrated the effectiveness of the Process Approach in improving both accuracy and fluency in learners' writing (Graham & Harris, 2018; Ferris, 2021). Additionally, Faraliza Ahmed Shukri's (2024) research in Malaysia emphasizes the importance of prioritizing sentence structure and communicative success for low-proficiency ESL learners through scaffolded support and guidance.

The integration of gamification in educational settings has shown promise in increasing student engagement and retention of complex linguistic skills (Hung, Hwang, & Lin, 2020). Game-based approaches, particularly those involving collaborative tasks, have been found to boost motivation and reduce writing anxiety, common barriers for low-proficiency learners (Dicheva & Dichev, 2017).

This study seeks to evaluate the effectiveness of MindSprint Spin & Write in improving low-proficiency ESL learners' writing skills, focusing on complex sentence construction, idea generation, and overall writing confidence.

2.0 Objective

The primary goal of MindSprint Spin & Write is to enhance the sentence construction skills of Low Proficiency Learners by employing the Process Approach.

The objective of the game is to:

1) Enhance learners' proficiency in utilising Linking Words and Cohesive Devices to construct intricate sentences (Li & Cummins, 2019).
2) Involve students in the writing process by assigning collaborative activities that enhance their self-assurance and alleviate their nervousness (Horwitz, 2010).
3) Enhance the development of critical thinking and creativity by allocating distinct roles and viewpoints according to de Bono's Six Thinking Hats framework (de Bono, 1985).

3.0 Methodology

3.1 Research Design

This study employed a mixed-methods approach, combining quantitative data from pre- and post-tests and a Google Form questionnaire with qualitative data from students' responses. This design allowed for a comprehensive assessment of the game's impact on students' sentence production abilities, engagement levels, and confidence in writing (Creswell & Creswell, 2018).

3.2 Participants
The study involved 53 students selected from three low-proficiency classes: Form 4 Aspirasi, Form 4 Adil, and Form 4 Azam. Participants were chosen based on their English writing exam scores, targeting those who struggled with generating cohesive and complex sentences, as well as organizing thoughts effectively.

3.3 Procedure
Participants engaged in four rounds of the MindSprint Spin & Write game over four weeks, with each iteration representing a distinct phase of the Process Approach. The game utilized color-coded cards and a spin wheel to randomly assign writing tasks related to various aspects of sentence building and cohesion.

3.4 Data Collection and Analysis
Data was collected through pre- and post-tests, a Google Form questionnaire using Likert-scale questions, and open-ended responses. Quantitative data was analyzed using descriptive statistics, while qualitative data underwent thematic analysis to identify recurring patterns and themes in students' responses.

4.0 Results and Discussion

Analysis of the pre- and post-test evaluations revealed significant improvements in students' writing performance, particularly in their ability to construct complex sentences. Key findings include:

1) 80% of students reported MindSprint: Spin & Write as "very helpful" in improving their writing skills, especially in enhancing speed and clarity in sentence construction.
2) 75% of students reported increased confidence in writing.
3) 70% claimed the game improved their cognitive abilities and idea generation.
4) 65% found the use of colorful cards made learning easier and more enjoyable.
5) 60% believed the game helped them organize their time and improve writing outcomes, particularly during exams.
6) Overall satisfaction level increased by 49.1%.
7) 85% of students recommended MindSprint for low-proficiency learners in writing.

These results align with recent research on the effectiveness of gamification in enhancing engagement and motivation in learning environments (Zhao & Huang, 2021). The game's structured activities and collaborative nature support a successful competitive and supportive learning environment, consistent with Shukri's (2024) findings on the effectiveness of collaborative, process-approach learning for low-proficiency learners.

5.0 Conclusion

MindSprint Spin & Write demonstrates significant potential as an effective and engaging tool for teaching sentence construction skills to low-proficiency ESL learners. By integrating the Process Approach with a game-based structure, learners experienced improvements in both writing proficiency and confidence. The incorporation of a spin wheel and color-coded cards made the learning process more enjoyable and unpredictable, reducing anxiety and promoting creativity.

Future research could extend this model by conducting experiments with students of varying proficiency levels or by incorporating digital components to further enhance the interactivity of the learning experience. The results support Faraliza Binti Ahmed Shukri's (2024) proposal for implementing collaborative learning models focused on the learning process in Malaysian ESL contexts, further validating the efficacy of innovative educational tools like MindSprint.

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ID 106: Synergizing Research and Teaching in Real-Time Software Engineering Course with Enquiry-Based Learning Approach

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Highlights: Integrating research into teaching activities in higher education remains a challenge, particularly in practice-oriented fields like Software Engineering. This study shares our continuous effort to improvise the Collaborative Assignments and Projects (CAP) framework in a Real-Time Software Engineering (RTSE) course, emphasizing student collaboration and problem-solving through practical applications of real-time concepts. The course design incorporates research-driven learning using an Enquiry-Based Learning (EBL) approach alongside Competition-Based Learning (CBL) to promote active student engagement. By embedding research elements throughout the course lifecycle and focusing on real-time software development with mobile robots, the approach equips both technical proficiency and research-oriented thinking. To validate the effectiveness of this approach, a survey was conducted among course participants, and the findings offer preliminary evidence supporting the integration of research into the CAP framework, providing insights for future research and a foundation for developing research-driven software engineering courses.

Keywords: *Enquiry-Based Learning; Collaborative Assignments and Projects; Mobile Robots; Competition-Based Learning; Research and Teaching.*

Introduction

Collaborative Assignment and Project (CAP) involves students working in groups to complete projects, emphasizing teamwork and shared learning. Enquiry-based learning (EBL) focuses on student-led investigation and problem-solving, fostering critical thinking and research skills, whereas Competition-Based Learning (CBL) incorporates competitive elements to enhance motivation and learning through gamification and competition. EBL represents a pedagogical approach that bridges the gap between teaching and research by engaging students in inquiry and investigation. This educational strategy emphasizes learning through active engagement and reflection, as articulated in foundational works exploring its implementation across various disciplines (Spronken-Smith & Walker, R. (2010) Levy, P., & Petrulis, R. (2012)). EBL has been adopted in the context of integrating research-oriented teaching at multiple educational levels, ranging from undergraduate to doctoral programs (Archer-Kuhn et. Al, 2020). To integrate between research and teaching, the integration of CAP, EBL, and CBL will represents a multifaceted approach to enhancing educational outcomes.

Several studies have proposed integration frameworks that combine the CAP, EBL, and CBL. Silva, B., & Madeira, R. N. (2010) presented a mixed collaborative-competitive framework for programming courses that integrated automated support for collaborative and competitive activities. Similarly, Regueras et al. (2010) introduced a model in a communication network course employing Moodle and a custom tool, QUESTOURnament, to enhance inquiry and critical analysis in collaborative and competitive phases. Another notable work that emphasized the implementation of these combined methodologies was presented by Awasekar and Nirgude (2018), who focused on a cooperation-competition strategy in computer graphics education by demonstrating higher student performance compared to traditional lectures. The e-Yantra Robotics Competition serves as another example, integrating extensive project-based learning with competitive elements assessed over four months with measurable curriculum impacts on students' technical and creative skills (Krithivasan et al., 2014).

Despite a good progress in CAP and CBL integration, the comprehensive adoption of all three methodologies–CAP, EBL, and CBL—remains less widespread. The existing body of work primarily addresses combinations of competitive and project-based elements, with EBL integration being explored to a lesser extent. Hans, S. & Chakraverty, S. (2017). offers insights into skills-oriented collaboration, while Mebert et al. (2020) apply collaborative projects across disciplines, indicating breadth in application, but a need for deeper, cohesive blending of all three methodologies.

Content

1. Objectives

The aim of this project is to present an enhancement of the CAP framework (Jawawi et al., 2022), which implements the EBL and CBL using mobile robots as methodologies for the RTSE course.

i. To assess the integration of research-focused content and activities in the RTSE course, specifically examining its alignment with Research-Led, Research-Oriented, Research-Based, and Research-Tutored approaches.

ii. To evaluate the course's impact on student engagement with research in RTSE focusing on their participation in independent research, critical analysis, and knowledge creation across different research approaches.

2. NALI Approach Implementation

a) Novelty

The enhancement of the CAP framework (Jawawi et al., 2022) begins with the integration of Enquiry-Based Learning (EBL) to emphasize research-driven content, followed by the incorporation of Challenge-Based Learning (CBL) using mobile robots, as methodologies. This combination addresses the limitations of traditional learning methods, such as low motivation, poor self-esteem, and a lack of practical, real-world experience. Through EBL, the framework cultivates critical thinking and research skills by encouraging students to explore and apply theoretical knowledge in real-world contexts. The addition of CBL further engages students in hands-on, problem-based activities focused on real-time software engineering, enhancing their practical skills and deepening their understanding through active inquiry and competition.

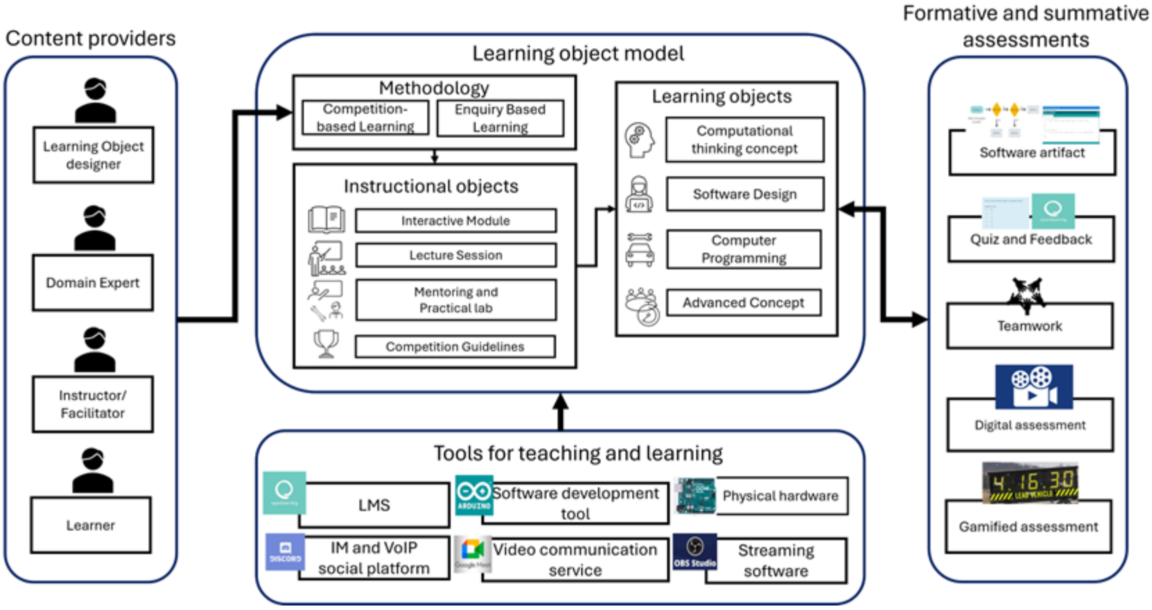

Figure 1: The enhancement of Collaborative Assignment and Project (CAP) framework

The CAP framework comprises three key components: 1) the learning object model, 2) content providers, and 3) formative and summative assessments. The learning object model integrates methodologies like Enquiry-Based Learning (EBL), Challenge-Based Learning (CBL), and Problem-Based Learning, with a focus on concurrency in timing analysis for mobile robots in a competitive setting. This approach emphasizes EBL by engaging students in research-driven tasks that explore the complexities of timing analysis and concurrency in robot software, critical for real-time performance. Instructional objects are enriched by field experts, including robotics lecturer and postgraduate students, who provide guidance during practical labs and lecture sessions, sharpening students' programming skills and preparing them for the challenges of the competition. The learning objects, based on the software development lifecycle, require students to perform detailed timing analysis on robot software and implement these solutions on physical hardware. Content providers, including designers, experts, instructors, and learners, play pivotal roles in shaping the educational processes and pedagogical strategies. These assessments involve the creation of software artifact, teamwork, quiz and real-time feedback through digital tools and gamified experiences through CBL to enhance student learning and engagement. Digital assessments include technical reports and presentations on timing analysis and concurrency aimed at deepening their research capabilities and practical application of learned concepts.

b) Creativity

The competition effectively integrates all aspects of the learning object model, leveraging mobile robots as a dynamic tool for both formative and summative assessments, as illustrated in the CAP framework (see Figure 1). By incorporating mobile robots into the educational process, this approach significantly enhances student engagement in both individual lessons and collaborative projects. The use of these robots not only drives innovation in tackling complex problem-solving tasks but also aligns with Enquiry-Based Learning (EBL) by promoting deep research and exploration of advanced concepts. Simultaneously, Competition-Based Learning (CBL) is reinforced as students participate in competitive challenges, which naturally ignite their motivation and active involvement. This method fosters a collaborative learning environment where students interact, share creative solutions, and exchange knowledge, ultimately enriching their educational experience.

c) Innovativeness

The methodologies of the learning object model in the CAP framework incorporate the following innovative components:

- **Enquiry-Based Learning (EBL):** EBL emphasizes critical thinking and research-driven exploration, engaging students in activities that require them to investigate complex programming challenges, particularly those related to concurrency in timing analysis within real-time software engineering. By focusing on problem-based learning, EBL encourages students to explore theoretical concepts and apply them in real-world scenarios, such as timing and concurrency issues in mobile robots. This approach not only enhances students' understanding but also promotes active inquiry, problem-solving, and the ability to critically evaluate information, which are essential for developing strong programming skills and adapting to new challenges.

- **Competition-Based Learning (CBL):** CBL integrates research-based activities into competitive environments, allowing students to apply their knowledge in practical scenarios, such as real-time software engineering tasks. The competition provides opportunities for students to test their skills in areas like timing analysis and concurrency management. The assessments and feedback from the event offer valuable insights into students' strengths and areas for improvement, enabling educators to adjust their teaching strategies and provide targeted support. Through CBL, students gain comprehensive learning experience that effectively bridges the gap between theoretical knowledge and practical application.

d) Applicability

In the RTSE course, students participate in a series of practical lab sessions where they collaboratively develop code for mobile robots and engage in problem-based tasks as a team. These tasks culminate in a competition where the robots must navigate a line-following track and complete specific challenges within a set timeframe. The CAP framework, as applied here, provides guidance in the design of the learning object model, thereby reinforcing the effectiveness of research-oriented and competition-based learning. This approach not only enhances students' technical skills but also integrates research-driven problem-solving and real-time engineering challenges, ensuring that students can confidently apply their knowledge in practical, competitive scenarios, building both resilience and a strong foundation in theoretical and applied research.

e) Impact

- **Enhanced Knowledge Retention and Real-World Readiness**: The framework promotes vibrant engagement through competition and research-oriented learning, resulting in improved knowledge retention and practical application while effectively preparing students for real-world challenges.
- **Development of Resilience and Adaptability**: By integrating research-driven problem-solving with competition-based activities, the framework equips students with the resilience and adaptability necessary to confidently tackle complex programming challenges and excel as software engineers.

f) Commercialization Potential

- This approach holds significant commercial potential for adoption in similar programming embedded systems courses, offering a scalable model for integrating research-oriented and competition-based learning.
- This approach could be leveraged to develop lab modules for the RTSE course, providing a commercially viable framework that enhances both educational outcomes and marketable skills in real-time software engineering

Research Methodology

The research methodology is structured into four distinct phases: Participatory Pre-Survey, Mobile Robots Introduction and Training, Problem-Solving Tasks with Robotic Programming, and Post-Survey Questionnaires. The approach integrates ongoing research into the teaching process, enabling students to engage directly with current academic and practical advancements.

1. **Participatory Pre-Survey:** In this phase, students participate in surveys that assess their initial programming knowledge and attitudes towards robotics. The survey, which includes Likert-scale questions, open-ended prompts, and demographic inquiries, is designed based on the latest educational research. The data collected serves as a baseline for evaluating the impact of the subsequent phases, ensuring that the teaching methods align with current academic insights.

2. **Mobile Robots Introduction and Training:** Students are introduced to mobile robots, covering the basics of components, sensors, and programming within Integrated Development Environments (IDEs). This phase is conducted through lectures, hands-on lab sessions, and practical demonstrations. The content is guided by the most recent research in mobile robots and students are mentored by postgraduate student, diving into current research and case studies. This approach ease student to connect theoretical concepts with real-world applications, reflecting the dynamic nature of research-led teaching.

3. **Problem-Solving Tasks with Robotic Programming:** During this phase, students participate in practical lab sessions where they program mobile robots to do certain problem-solving tasks. These activities are meant to get more challenging and are based on current robotics research topics. Students are encouraged to incorporate the most recent research findings into their programming efforts, promoting creativity and better knowledge. The phase concludes with a robotic competition, when students evaluate their knowledge and abilities in a real-world situation.

4. **Post-Survey Questionnaires:** In the final phase, students answer post-survey questionnaires to measure their programming abilities, research abilities and knowledge on mobile robots. The research was carried out to determine the importance of deviations within different criteria. This phase not only assesses the effectiveness of the instruction, but also engages students in data analysis and interpretation, connecting individual learning results to effective research-led teaching.

Finding and Discussions

Participants

To validate the effectiveness of research and teaching integration in the Real-Time Software Engineering course, we chose to conduct a survey among students that had enrolled in the course. The participants in this survey were from undergraduate students from Faculty of Computing, UTM that registered in software engineering program. There are 2 types of survey that are entry and exit. 173 participants answered entry survey (29 female, 144 male), 97 participants answered exit survey (24 female, 73 male), and 76 participants answered both surveys (19 female, 57 male). All the participants are volunteered to complete the survey.

Research-Led Analysis

The survey comprises of eight questions that asked participants to indicate their level of agreement to each statement independently. Table 1 shows the analysis result of survey questions and average response (including standard deviation) for each question.

Table 1: Analysis Result of Survey Questions and Average Response (Including Standard Deviation).

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
0.68	0.55	0.48	0.77	0.61	0.59	0.55	0.56
Research-Led		Research-Oriented		Research-Based		Research-Tutored	
0.61 (0.07)		0.83 (0.14)		0.60 (0.01)		0.55 (0.01)	

The survey results indicate a strong emphasis on research-oriented approach within the RTSE course, with the highest average score of 0.83 (Q4) reflecting students' engagement in learning how to conduct research as part of the curriculum. This suggests that the course effectively incorporates research activities into its structure. Conversely, lower scores on research-led questions (Q1-Q3) and research-tutored activities (Q7, Q8) imply that while the course introduces students to research methods and scientific publications, there may be room for improvement in fostering deeper engagement with these materials. The moderate scores for research-based components (Q5, Q6) indicate that independent research and the creation of new knowledge are present but could be further emphasized. Overall, the results suggest that the course is well-structured to encourage research, particularly in teaching students how to conduct research, but additional focus on integrating and critically engaging with scientific publications could enhance the research-led and research-tutored aspects of the course.

On the other hands, the survey also included a question to assess students' self-perceived research skills using a Likert scale. Before enrolling in the course, 10% of participants considered themselves highly competent in research skills, 53% moderately competent, and 33% had low or no competency. After completing the course, the percentage of participants with high competency increased to 32%, while those with low or no competency decreased to 11%. The proportion of participants with moderate competency remained at 53%. This significant improvement in research skills among participants demonstrates that the course effectively met its objective of enhancing research competency.

Conclusion

In conclusion, this paper proposes a course design that seamlessly incorporates research elements throughout the course lifecycle, employing various techniques to promote active student engagement with research content and activities in Real-Time Software Engineering course. Based on survey response by the participants, our course design able to achieve the objective in developing a comprehensive framework on research-driven courses especially in Software Engineering program.

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ID 107: ReflecExCycle: Learn and Experience by using Reflective Cycle and Experiential Learning to Enhance Students Reflection and Observation Skills

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Highlights: ReflecExCycle is an innovative approach designed to enhance students' reflection and observation skills in basic behavior modification courses. The combination of Kolb's Experiential Learning Model and Gibb's Reflective Cycle, ReflecExCycle aims to improve students' research skills, particularly in observing behavior and critically reflecting on their experiences. In this course, students are asked to conduct observations on selected behaviors and reflect on their findings. By implementing the experiential learning and structured reflection, students engage in active learning and progressing from basic observation to in-depth analysis of real-world behaviors. This approach promotes deeper learning, allowing students to transfer their insights to future situations while shaping reflective practitioners.

Keywords: *experiential learning; reflective learning; behavior modification; observation*

Introduction

In today's dynamic educational landscape, the development of critical observation and reflection skills is essential for fostering deeper learning and enhancing students' ability to connect theory with practice. ReflecExCycle is an innovative project designed to integrate Kolb's Experiential Learning Model and Gibbs' Reflective Cycle to enhance students' reflection and observation capabilities. Through these two approaches, the project seeks to promote an active participation of students, where they not only observe and record behaviors in real-world contexts but also critically reflect on their experiences. The integration of reflective and experiential learning helps students to analyze their observations, make informed decisions and apply their insights to similar situations in the future.

This project encourages students to move beyond surface-level observation, helping them develop a structured approach to reflection. Students gain a deeper understanding of their learning processes through repeated cycles of observation, reflection, and application which promotes growth in both academic and real-life contexts. ReflecExCycle is designed to practice reflective practitioners who are capable of learning throughout their careers, which are indispensable in both education and professional environments.

Content

Innovation Objective

The objective of ReflecExCycle is:

- To enhance student reflective practice by using ReflecExCycle in basic behavior modification courses.
- To improve student observation skills and research by using ReflecExCycle in basic behavior modification courses.

NALI approach

There has been a shift towards more dynamic and experiential approaches in modern education that actively engage students in the learning process. Therefore, we introduce an innovative framework that integrates Kolb's Experiential Learning Theory as a teaching method with Gibbs' Reflective Cycle as a tool for student reflection and learning outcomes. This framework attempts to make the classroom a more interactive and effective environment for both academic and personal growth by blending the two approaches in order to promote deeper learning, critical thinking, and self-awareness among students.

By integrating Kolb's Experiential Learning Theory (1984) along with Gibbs' Reflective Cycle (1988), a fresh perspective is brought to the field of teaching and learning. Although both ideas have been widely used independently, their combination offers an additional perspective. The four stages of Kolb's theory highlight the importance of experiential learning. These stages include Concrete Experience, Reflective Observation, Abstract Conceptualisation, and Active Experimentation. The six steps of Gibbs' Reflective Cycle consist of Description, Feelings, Evaluation, Analysis, Conclusion, and Action Plan; are designed to help students think reflectively after an experience. The combination of Gibbs' reflective model with Kolb's experiential cycle provides a double loop learning strategy whereby students engage in both reflecting and experienced processes. Looking into it, students are able to successfully implement their insights in future situations, understand their learning, and learn the emotional and cognitive aspects of their experience.

ReflecExCycle introduces novel opportunities for actively involving students in their own learning through creative methods. The integrated approach promotes educators to create interactive classroom activities that also demand students to engage in critical reflection on those activities. For example, a project-based activity in the classroom can be organised according to Kolb's cycle of Concrete Experience, in which students are instructed to engage actively, think about their experience, generate new ideas, and assess their understanding. At the same time, Gibbs' Reflection

Cycle enables the students to examine the emotional aspects of their learning, therefore improving the student's metacognitive abilities and promoting self-awareness.

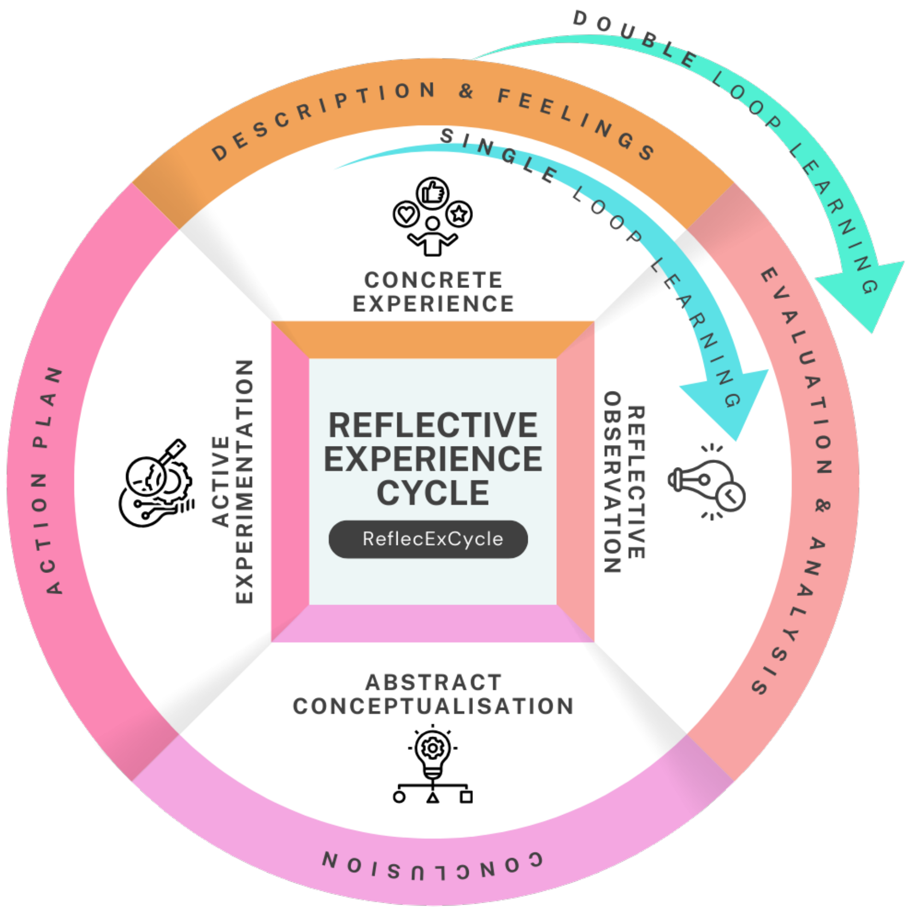

Figure 1: ReflecExCycle: The Reflective Experience Cycle, The Integration of Kolb's Experiential Learning Theory + Gibb's Reflective Cycle

Students in the class of Basic Behaviour Modification are impacted through the learning process by applying ReflecExCycle new framework. They are able to critically reflect on their actions and experience which helps them to develop awareness of their learning process, decision making and emotional responses. Instead of passively receiving information through lectures, the students are given the opportunity to actively present their reflection on how they can apply the knowledge gained in the real-world context. We look forward to preparing the students not only to succeed academically but also excel in their everyday life.

Research Methodology

In Basic Behaviour Modification class, one of the critical skills to be possessed by students is the ability to observe, record, and graph the data in order to analyse the behaviour pattern before choosing the appropriate intervention or techniques to change specific behaviour. In this ReflecExCycle, the Kolb's Experiential Learning model consists of four stages which each stage will be explained below:

Concrete Experience: Instructor encourages students to engage directly in the experience. The instructor assigns students to observe peer interactions in class such as participation, collaboration or disruptive behaviours.

Reflective Observation: Instructor guides students to reflect on their observations by providing questions like, "What patterns did you notice?" The facilitation starts by encouraging students to relate the frequency of certain behaviours with the factors that might influence the occurrence of behaviours such as environmental or social factors.

Abstract Conceptualization: After gaining general understanding from the observation, the instructor teaches students to connect them to relevant theories to explain why specific behaviors occurred and how they might be modified. For example, concepts like reinforcement in operant conditioning theory explain why students participate more when there are marks given than when the participation is voluntary.

Active Experimentation: This stage portrays the application of the conceptual understanding to influence future behavior in similar situations. Students can apply positive reinforcement techniques such as giving rewards or praising and observing if this leads to an increase or decrease in that behavior over time. Following this, the instructor assigns students to design their own observation session and suggest the strategies to modify the behavior.

The Kolb's Experiential Learning Cycle allows instructors to encourage students to fully engage in the behavior modification process and facilitate them to a better understanding of both theory and practice. The learning process extended beyond the classroom, where instructors assigned students to design a naturalistic observation by applying the six stages of Gibbs' Reflective Cycle. The cycle is an excellent tool for fostering students' understanding and experience through a structured reflection process. Through the stages, instructor helps students to develop insights into their learning as follows:

Description: Students need to clearly describe the experience or task they engaged in. They need to report the details such as where, what, who elements in the study such as "What was the task? Who was involved? Where is the setting? What did you observe or do?"

Feelings: Students need to reflect on their emotions during the experience and how those feelings may have influenced their (current or future) behavior or thoughts related to the task.

Evaluation: This stage aimed for students to indulge in both positive and negative aspects of the experience. Students critically evaluate the effectiveness of their actions or observations by reflecting, "What was positive about this experience? What challenges or negative aspects did you encounter?" identifying strengths and areas for improvement.

Analysis: Students were encouraged to break down the experience and explore why certain things happened the way they did by looking for patterns or causes. This stage helps students to enhance their analytical and critical thinking skills by answering questions such as,

Conclusion: From the whole experience, students draw conclusions about what they have learned and how they might handle similar experiences in the future. Questions like "What have you learned from this experience?" allowing them to improve future behavior, planning and implementation.

Action Plan: This stage ensures that students move from reflection to action, applying their insights to future tasks, and enhancing their learning process. Students are guided to create a plan to apply their understanding in future experiences.

This qualitative, observational method enables for the analysis of behaviour without interference from the observer, ensuring that subjects act as they naturally would. Students select a specific setting and identify the behaviours that normally occur in that setting for observation. The chosen behaviors should be contextually appropriate and inline with the objectives of the study. The behaviors that students are required to observe over a set period include their occurrence, context, and any associated patterns. The research involved the following aspects:

Setting: Participants are observed in any of the following areas: classroom, cafe, mall, or hostel. These environments were selected for convenience and relevance to the objective of the study.

Target behaviors: Three identified behaviors that are typical to the selected setting, are chosen for observation. These behaviors should be clearly defined, observable, and measurable to avoid ambiguity during the observation. The behaviors must be described in such a way that allows for consistent identification and quantification, ensuring accurate and reliable data collection over the observation period.

Participants: Participants in this study remain anonymous, and their behavior is recorded without their knowledge to ensure authentic, unbiased observations. No personal identifiers are collected, assuring ethical compliance and participant privacy.

Observation Duration: Each observation session lasts for 20 minutes, and during the entire time, the observer records instances of the targeted behaviours. The observation is repeated over a three-day period to establish consistent data to identify patterns.

Data collection: Data is collected utilising a frequency data sheet, which the target behaviors are to be recorded each time they occur during observation period. The observer must remain objective and refrain from affecting the environment or participants.

Finding and discussion

Table 1 provides a detailed analysis of the reflective process undertaken by students during their behavioral observation task. Each stage of the cycle is examined in relation to the themes that emerged from students' experiences.

Table 1: The Application of Gibbs Reflective Cycle in Behavioral Observation.

Gibb's Reflective Cycle Stage	Theme	Quotes
Description	Observation Methodology and Strategies	"Our group members split into three separate groups-to make it easier to observe three different chosen behaviours." "Observers targeted the subjects and did the observation for 20 minutes."
	Standardised Procedure	"Same procedures were repeated for three consecutive days."
Feelings	Emotional Reactions to Observations	"It was a nerve-wracking experience for us as it was the first time we received this kind of task from the lecturer. I was especially nervous when suddenly an abundance of students went in and out of the gate simultaneously which challenged my response time to the situation."

	Positive and Negative Emotions	"Despite these difficulties, the experience was highly enjoyable and rewarding overall. Observing human interactions and reactions to everyday situations proved to be a fascinating and enlightening endeavor."
Evaluation	Challenges and Limitations in Observations Insightful Experiences	"There was a challenge during the past three days of observations. Raining for all three days has reduced our observation expectation because there are not a lot of customers during rainy days." "Maintaining such a high level of concentration for a long amount of time was mentally and physically difficult, but it was also extremely educational."
Analysis	Analysis of Behavioural Patterns Observer Bias	"As exemplary, using a phone tends to be helpful for the users in this modern global era and technology advances to browse the information and communicate with others. Hence, this behaviour could lessen students' social communication skills and social interaction as it creates a social isolation among the UNISEL students and is harmful to the student community." "On the other hand, biases can sneak their way into observations without anyone's knowledge, which can result in distorted interpretations of behaviours."
Conclusion	Inter Observer Reliability Maintain Objectivity	"Otherwise, training and having many observers can help reduce this prejudice." "As a means of ensuring the accuracy and dependability of the data collected, observers are required to consistently make an effort to maintain their neutrality and impartiality at all times, while also admitting and resolving any biases they may have."
Action Plan	Suggestion for Future Observations and Research	"Furthermore, future research could delve deeper into specific aspects of chosen behaviour and incorporate additional methodologies and precautions to minimise improper or dangerous behaviour that regularly occurs" "In conclusion, to mitigate these issues, observers should conduct multiple observation sessions to capture a representative sample of behaviors."

Commercialization Potential

ReflecExCycle has high commercialisation as a guideline to enhance student reflection and observation skills through experiential learning and reflective learning. To ensure integrity of the approach, we will secure intellectual property protection through copyrights. In addition, ReflecExCycle is in the process of being compiled into a module for educators as a guideline to design an engaging learning process.

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ID 108: Vowel-age 2.0: Building Better Readers

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Highlights: Vowel-age 2.0 is an innovative, student-centered learning tool designed to support dyslexic pupils and enrich their learning experience in the classroom. The interactive smart board activity begins with pupils matching pictures on flashcards to words featuring long vowel sounds. They then arrange tactile letters to spell out the correct words. Advanced learners tackle the challenges independently, while those needing more support receive vocabulary assistance. Incorporating accessible and sustainable materials alongside technology, Vowel-age 2.0 aligns with contemporary pedagogical trends, offering a versatile approach to personalized learning. The use of QR codes to provide instant feedback further enhances the learning process. Preliminary studies suggest that Vowel-age 2.0 significantly improves engagement and learning outcomes in inclusive classrooms, catering to diverse learners with tailored educational experiences.

Keywords: *Vowel sound, Smart Board learning; Dyslexic pupils; Inclusive classroom; Interactive learning.*

Introduction

In today's educational landscape, meeting the diverse needs of learners is not just important—it's paramount. Traditional methods, particularly when teaching phonics and spelling often do not capture the attention of all learners, especially those with dyslexia. According to Schwarz et.al (2023), the main deficiency in developmental dyslexia is phonological issues. Vowel-age 2.0 addresses these challenges by transforming learning into an interactive adventure, turning what was once a difficult task into an engaging and effective experience for every student. Through smart board integration and tactile materials, students match pictures with words containing long vowel sounds and arrange letters to create correct answers. Duncan (2022) highlights that many readily available and low-cost devices incorporate assistive technology capabilities, so learners with or without formalized adjustments can benefit, making tools like Vowel-age 2.0 invaluable in inclusive classrooms. Hence, inclusive education strategies are crucial to support learners with learning disabilities (Obah, 2024), precisely what Vowel-age 2.0 aims to achieve.

This extended abstract explores Vowel-age 2.0's novelty, creativity, innovativeness, and applicability within the New Academia Learning Innovation (NALI) model. By combining cutting-edge technology with thoughtful pedagogy, Vowel-age 2.0 is more than just an educational tool—it's a catalyst for change, proposed to redefine learners' engagement and empowerment in classrooms everywhere.

Content

Project or innovation objectives

The innovation is driven by three distinct objectives. The first objective is to ensure that dyslexic learners are included and supported within the educational environment. By customizing the Vowel-age 2.0, this tool is created to support students who struggle with reading. It helps students master long vowel sounds like 'ee' and 'ea' through engaging and confidence-boosting activities. The second objective aims to enhance learning accessibility and effectiveness. By integrating QR code technology linking to the ELSA Speak website, it offers interactive tools to elevate reading skills. This combination of online and offline tools provides responsive, tailored activities that help dyslexic learners improve their literacy skills interactively and enjoyably. The third objective focuses on building resilience and ethics. It fosters perseverance through physical challenges while incorporating principles of honesty and integrity, ensuring a holistic approach to education that supports both academic and personal growth.

NALI approach implemented in the research

Vowel-age 2.0: Building Better Readers is unique in transforming conventional learning tools into an interactive, student-centered experience tailored exclusively to educational settings. In contrast to traditional approaches, this innovative smart board meets the specific needs of children with dyslexia while also enriching the learning experience for all students. Vowel-age 2.0 exemplifies an avant-garde method that combines traditional and modern educational paradigms, all while adhering to the principle of flexible education.

The innovation started with humble materials: a plastic file case, tactile letter tiles, flashcards, and a small whiteboard. The compact size of the plastic file case significantly enhances the innovation's value, offering practical and accessible learning tools tailored to the needs of young learners. This thoughtful design ensures that educational resources are not only engaging but also convenient for children to use, making learning both effective and enjoyable, particularly for dyslexic students. The laminated tactile letter tiles exemplify the innovation's commitment to sustainability, ensuring that the product is not only durable but also designed for long-term use. By incorporating materials that withstand frequent handling, the design prioritizes both environmental responsibility and educational efficacy. This focus on longevity means that the learning tool remains purposeful and functional over time, providing consistent value to students and educators alike.

These components were carefully chosen to facilitate hands-on learning and engagement for dyslexia. Refined prototype in ensuring its effectiveness in addressing the specific challenges faced by dyslexic students. Vowel-age 2.0: Building Better Readers showcases creativity in addressing the unique needs of dyslexic students as the innovation's design is both inclusive and adaptive, allowing each pupil to engage with the material in a way that suits their learning style. According to a previous study, a significant finding was made that implementing flashcard media featuring symbols, images, and colorful letters significantly enhances reading abilities in children with dyslexia (Mukaffa, Chasanah, & Ahmala, 2023). By starting with picture-flashcard matching, the tool helps dyslexic students visually associate words with their meanings, a crucial step in overcoming reading challenges. The tactile letter arrangement further supports kinesthetic learning, enabling these students to physically manipulate letters, and reinforcing their understanding of long vowel sounds. This thoughtful combination of visual and tactile elements demonstrates a deep knowledge of dyslexic learners' needs, making the learning experience accessible and effective.

We provided additional support by integrating assistive technology, including a QR code linking to the ELSA Speak website, which significantly enhanced students' reading proficiency. ELSA Speak offers a sophisticated suite of interactive tools designed to elevate reading skills. The platform's AI-driven speech recognition technology enables students to refine their pronunciation with real-time feedback. By empowering students to practice reading aloud, ELSA Speak fosters greater confidence and fluency, ultimately contributing to more effective language acquisition. Almgren Bäck et al. (2023) showcase how dyslexic students' experiences with assistive technology reveal key factors contributing to the success of sustainable interventions. As today's young learners are increasingly proficient with technology, integrating these tools into our innovations encourages them to critically engage in self-paced learning experiences.

This innovation marks a significant step forward in inclusive education. It highlights how intentional design and the integration of modern technology can result in flexible, sustainable learning tools that address a wide range of learning needs. Teachers, in their role as researchers, can leverage this tool to evaluate and refine their teaching strategies, leading to more effective support for dyslexic students and others facing learning challenges. The vowel age not only boosts student engagement and achievement but also sets a new standard in education by demonstrating how traditional and modern teaching methods can be effectively combined to serve all learners.

Research Methodology

The pilot study employed a mixed-methods approach, integrating both quantitative and qualitative methods. Quantitative data was collected through surveys conducted via Google Forms, providing a statistical foundation for analysis. Qualitative insights were drawn from feedback received after the intervention earned an 'A' grade in the Inclusive Education course (TSLB3132). This feedback led to revisions and improvements following the course presentations. Additionally, the project was showcased at the International Invention, Innovation, and Design Competition (I3DC), where it won a silver award, providing further qualitative feedback on its effectiveness. This mixed-methods approach ensured a thorough understanding of the project's impact, enhancing its depth, validity, and overall research implications.

Finding and discussion of the project or innovation

Respondents in this pilot study include primary school teachers, special education teachers, and teacher trainees. There were ten respondents, with 70% having prior experience teaching in an inclusive classroom, while 30% had no experience. Among those with experience, respondents noted that they typically use teaching methods that engage visual, auditory, and kinesthetic activities, such as using flashcards and encouraging students to write objects themselves.

Table 1 illustrates the attitudes of the ten respondents toward Vowel-age 2.0: Building Better Readers. Specifically, 50% of respondents rated the innovation as extremely effective in enhancing learning outcomes for students in inclusive classrooms. An additional 40% found the tool to be fairly effective, while 10% considered it only somewhat effective in improving learning outcomes and student engagement. Regarding the ease of adaptation, 70% of respondents believed that the innovation could easily meet the specific needs of diverse learners, while 30% felt it would be difficult to adapt to some contexts. Feedback was generally positive, with one respondent recommending the inclusion of more digital content to enhance the experience.

Table 1: Respondents' Perspectives Towards Vowel-age 2.0

Participant	Has experience teaching in an inclusive classroom (Yes/No)	Vowel-age 2.0: is an effective tool in enhancing the learning outcomes of students in inclusive classroom	Ability of Vowel-age 2.0 engage students of diverse abilities and learning styles	Vowel-age 2.0 would be easy to adapt to meet the specific needs of diverse learners (Yes/No)	Feedback and Suggestions for Improvement
1	Yes	5 (Extremely Effective)	4 (Good)	Yes	No suggestions.
2	Yes	4 (Fairly effective)	4 (Good)	Yes	It would be better if the pupils practice pronouncing

Participant	Has experience teaching in an inclusive classroom (Yes/No)	Vowel-age 2.0: is an effective tool in enhancing the learning outcomes of students in inclusive classroom	Ability of Vowel-age 2.0 engage students of diverse abilities and learning styles	Vowel-age 2.0 would be easy to adapt to meet the specific needs of diverse learners (Yes/No)	Feedback and Suggestions for Improvement
					the letters / phonemes and writing to help them recognise and remember
3	Yes	4 (Fairly Effective)	4 (Good)	No	I have no suggestions as I think Vowel-age 2.0 is suitable for teaching dyslexic students.
4	Yes	5 (Extremely Effective)	5 (Very good)	Yes	Great!
5	Yes	4 (Fairly Effective)	3 (Acceptable)	No	None
6	No	5 (Extremely Effective)	5(Very good)	No	Interesting!
7	No	3 (Somehow effective)	4 (Good)	Yes	Maybe you could include more digitalised content
8	No	4 (Fairly Effective)	4 (Good)	Yes	All good.
9	Yes	4 (Fairly Effective)	5(Very good)	Yes	No
10	Yes	5 (Extremely Effective)	5(Very good)	Yes	No

Other relevant information

The intervention received an 'A' in the Inclusive Education course (TSLB3132). Following the presentations, this idea underwent some revisions in response to several ideas for improvement. At the International Invention, Innovation, and Design Competition (2024), our project garnered significant attention for its innovative approach, ultimately earning a prestigious silver award. This recognition underscores the project's strong potential for commercialization. This tool can be widely adopted by educational institutions, tutoring centres, and even homeschooling platforms due to its low implementation costs and widespread application, which will result in a large impact and profitability.

Acknowledgement

We express our gratitude to Institut Pendidikan Guru Kampus Temenggong Ibrahim (IPGKTI), our team members, parents, and participants who supported our research.

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ID 110: Harnessing Cross-Disciplinary Coaching: A Winning Formula for UTM in the Materials Lecture Competition

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Highlights: Coaching by Universiti Teknologi Malaysia, UTM's academicians has played a pivotal role in the success of UTM students representing the university in the Materials Lecture Competition (MLC). The diverse expertise and approaches of the coaches, who come from various academic backgrounds and interests, have significantly contributed to the students' achievements, leading to multiple wins over the years, including an international championship. This cross-disciplinary coaching strategy has proven to be an essential factor in enhancing students' performance and ensuring consistent success in the competition.

Keywords: *Cross-disciplinary; Coaching; Competition; Materials Lecture Competition (MLC)*

Introduction; UTM and Materials Lecture Competition (MLC)

For over a decade, the Institute of Materials, Malaysia (IMM) has been dedicated to cultivating young talent in materials science and engineering. At the heart of these efforts is the Materials Lecture Competition (MLC), an event that showcases Malaysia's expertise and significantly impacts the international stage. The MLC provides a valuable platform for students, engineers, and researchers under the age of 28; particularly those specializing in materials science, technology, and engineering—to demonstrate their skills and share their insights on the role of materials in society. This competition has become a signature event on the IMM's annual calendar, with participation from over 20 public and private universities across Malaysia and aims to select a winner to represent Malaysia in the Young Person's World Lecture Competition (YPWLC).

Preparing Malaysian representatives for the global stage requires intensive coaching sessions and meticulous planning to help them excel in the YPWLC competition. This prestigious international event is fiercely competitive, attracting top finalists who have already won at the national level in their respective countries. Participants deliver presentations on a wide range of subjects, including the use of polymers for self-healing materials, the impact of thermal shock on rocks, innovative energy absorption in 3D-printed polymer blend systems, co-electrospinning for developing vascular patches, pitting corrosion, and many other advanced topics.

Universiti Teknologi Malaysia (UTM) has successfully leveraged cross-disciplinary coaching to enhance the performance of its representatives in the MLC. This innovative approach integrates expertise from diverse fields, significantly improving both research and practical skills among the representatives. By fostering a collaborative environment, UTM has encouraged the representatives to excel in the competition and advance their academic and professional capabilities. The effectiveness of this strategy is evident in UTM's notable achievements in the MLC. Most UTM representatives have excelled at both national and international levels, consistently placing in the top three at the national level since 2016, with a historic win at the YPWLC in 2022. This success underscores the impact of cross-disciplinary coaching in driving innovative approaches and achieving academic excellence in materials science, technology, and engineering.

UTM-MLC Coaching Approach

A multidisciplinary coaching approach combines knowledge from various fields to enhance individual and team growth, proving effective in addressing complex challenges. Clutterbuck (2013) emphasizes the importance of integrating multiple disciplines for holistic development, leading to more sophisticated outcomes. Knight (2017) advocates for an interdisciplinary framework in instructional coaching, which tailors techniques to meet learners' unique needs. This approach not only addresses immediate goals but also promotes adaptive, lifelong learning skills, surpassing traditional coaching methods. Consequently, interdisciplinary coaching is recognized as a progressive strategy in education and professional development, fostering comprehensive growth.

The Coaching Model

The uniqueness of the UTM-MLC coaching approach lies in the diverse expertise of its coaches, who come from multi-disciplinary and multi-specialty backgrounds:

1. **Delivery Coach**: Focuses on developing presentation delivery skills, including speech pace, intonation, body language, facial expression, hand gestures, and pronunciation. *One participant noted significant improvement in pacing and intonation after the coaching sessions.*

2. **Language Coach**: Enhances participants' English proficiency by addressing common filler words, preparing presentation scripts, checking grammar, and helping with Q&A sessions. *Participants reported reduced stuttering and increased confidence in their English communication.*
3. **Content Coach**: Ensures scientific content is accurate and accessible to both technical and non-technical audiences. Helps filter out overly technical content and advises on simplifying explanations or adding additional topics.
4. **Technical Skills Coach**: Specializes in the technical aspects of presentation design, including PowerPoint editing and adaptation for virtual presentations. This coach ensures that presentations are visually appealing and technically sound, especially in a virtual format.

"Coaching is unlocking a person's potential to maximise their own performance. It's helping them to learn rather than teaching them." - Timothy Gallwey.

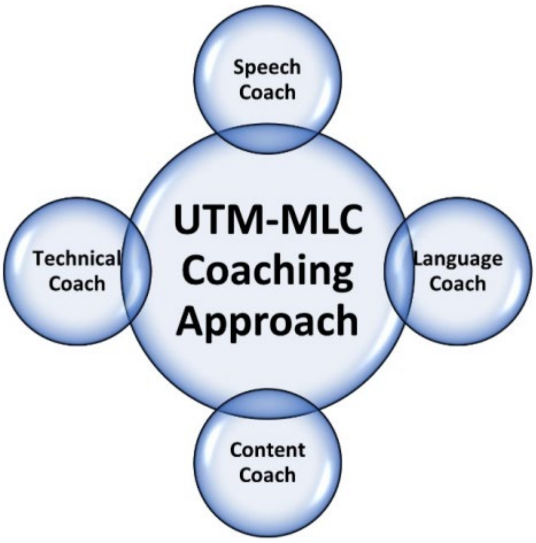

Figure 1: UTM -MLC Coaching Approach

NALI Approach in UTM-MLC Coaching

The innovation of UTM's coaching approach lies in its cross-disciplinary nature. Instead of focusing solely on content knowledge, this approach integrates multiple areas of expertise to address various aspects of competition performance:

Novelty: By combining expertise from different domains, the approach transcends traditional coaching methods, providing comprehensive support that addresses both technical and non-technical skills. **Creativity:** Encourages participants to explore interdisciplinary connections, enhancing their problem-solving abilities and presentation styles. This creative approach results in dynamic and engaging presentations. **Innovation:** Integrates holistic support, including technical skills, public speaking, design thinking, and persuasive communication. The use of simulated competition environments allows participants to practice under real-world conditions. **Applicability:** The skills developed through this coaching approach are valuable beyond the MLC competition, benefiting students in academia, industry, and public science communication. The approach also promotes teamwork and collaboration, essential in research and innovation. **Impact:** The coaching strategy's impact is evident in the consistent success of UTM participants and their long-term development as professionals. It fosters critical thinking, adaptability, and creativity, preparing students for leadership roles in academia and industry.

In summary, the UTM-MLC coaching approach exemplifies the NALI principles of **novelty**, **creativity**, **innovation**, **applicability**, and **impact**, offering a comprehensive and interdisciplinary method that prepares students for competition success and equips them with lifelong skills for professional excellence.

Research Methodology

This study examines the effects of cross-disciplinary coaching on six participants, including UTM's winners, in the Materials Science Lecture Competition (MLC). Data were collected through semi-structured interviews and structured feedback forms, focusing on coaching's impact on competition success, skills gained, challenges faced, recommendations, and the application of learned skills in academic or professional contexts.

To assess the effectiveness of cross-disciplinary coaching, Interpretative Phenomenological Analysis (IPA) was employed, allowing for an in-depth exploration of participants' lived experiences (Smith & Osborn, 2003). Ethical considerations were strictly upheld, ensuring participant confidentiality and informed consent.

The analysis involved examining transcripts for language and content, identifying key themes, and iteratively refining them. Connections between themes were explored, leading to a cohesive structure that highlighted overarching patterns across participants' experiences.

Participants: Tan Yong Chee, Ainaa Amirah binti Marzuki @ Mahadi, Kugambikai Vangetaraman, Rathosivan,Nur Fatihah Tajul Arifin, Mohd Haziq Dzulkifli

Results and Discussion of UTM-MLC Coaching Innovation

This study employed a dual approach to data collection, combining structured feedback forms with semi-structured interviews. Feedback forms provided standardized data on specific metrics, while semi-structured interviews offered in-depth insights into participants' personal experiences. This comprehensive approach ensured that both quantitative and qualitative aspects of the data were thoroughly captured.

Participant Demographics

The six participants in this study were drawn from various academic backgrounds and levels of experience, providing a broad perspective on the effectiveness of cross-disciplinary coaching. This diversity enriched the analysis and highlighted different aspects of the coaching impact.

Qualitative Data

Impact of the Cross-Disciplinary Coaching for the Participants

The analysis of semi-structured interviews with six participants who experienced cross-disciplinary coaching revealed six key themes, highlighting the impact of this approach on participants' success in MLC.

Effectiveness of Coaching: The cross-disciplinary coaching approach was highly effective in enhancing participants' performance. This theme encompasses the overall impact of coaching, including its role in boosting confidence, improving presentation quality, and providing valuable feedback on both presentation style and content.

Improvement in Presentation Skills: Participants reported significant enhancements in their presentation skills due to coaching. Unexpectedly, participants revealed they developed advanced skills beyond their initial expectations. It includes specific aspects such as improvements in audience engagement, the strategic use of visuals (e.g., colors and content organization), and the overall structure of presentations.

Enhanced Q&A Management: Participants emphasized that coaching led to more effective handling of Q&A sessions. They learned techniques to manage questions better, incorporate humor, and respond confidently, which was particularly beneficial for those who were less experienced or non-native English speakers.

Increased Confidence and Fluency: Participants believed that coaching sessions were instrumental in building their confidence and improving their fluency in English, especially for non-native speakers. This theme highlights the role of coaching in fostering greater articulation and comfort in public speaking.

Audience Engagement Techniques: Coaching helped participants develop skills to engage audiences more effectively. This theme covers the use of tone, intonation, gestures, and other strategies to maintain audience interest and effectively communicate their message.

Support and Positive Reinforcement: Continuous brainstorming, positive reinforcement, and support from coaches were crucial for the participants' success. This theme reflects the importance of motivational and supportive aspects of the coaching process.

Application of Learned Skills in Academic and Professional Contexts

The skills acquired from cross-disciplinary coaching have been effectively applied in various contexts. For example, one participant applied these techniques to teach secondary students, leading to significant achievements in the Virtual Innovation Competition 2023 and 2024. Another participants noted an enhancement in presenting ideas effectively in professional settings as educators. Feedback also highlighted improvements in managing time and refining presentation materials during academic teaching.

Quantitative Data

To ensure comprehensive analysis, a structured feedback form was distributed to all participants. Results indicated that all six agreed that cross-disciplinary coaching significantly enhanced their presentation skills and provided valuable practice opportunities. Four participants (66.7%) found the coaching especially helpful for personalized feedback, boosting public speaking confidence, developing time management strategies, and preparing for viva voce.

However, only two participants (33.3%) felt the coaching improved their understanding of materials science concepts and competition rules, with just one noting a better grasp of the rules. The skills gained through coaching were effectively applied in various academic and professional contexts, resulting in improved teaching methods, public speaking, and professional presentations. This supports the conclusion that cross-disciplinary coaching is a powerful strategy for achieving success in competitive academic environments.

Challenges encountered during the coaching process included **time constraints** and **technical difficulties with online platforms.** These issues occasionally hindered the smooth execution of sessions. Participants also identified areas for further improvement, such as **developing better strategies for managing unpredictable Q&A sessions** and **enhancing audience engagement techniques**. Addressing these challenges could further refine the coaching process and improve its overall effectiveness.

Limitations and Future Research

While the findings offer valuable insights, the study has several limitations. The study involved only six participants, which limits the generalizability of the findings. A larger sample size would provide a more comprehensive understanding of the coaching's impact across different academic and professional backgrounds. Next, the reliance on self-reported data may introduce biases, as participants might present their experiences in a more favorable light. Incorporating external evaluations or observations could provide a more objective assessment.

Acknowledgement

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ID 112: Geotrees for Field Experiential Learning

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Highlights: Location is a fundamental element in addressing geographic-based challenges. Understanding how GIS works requires understanding the ability of a Geographic Information System (GIS) to retrieve data input, store, manipulate, analyze, and visualize location and spatial data through geospatial technology. Previous studies have demonstrated how problem-based learning could be applied to teach the subsystem of GIS to first-year students of Geoinformatics and, at the same time, to introduce how GIS works. This project enhanced the previous approach of PBL implementation by incorporating field experiential learning using Geotrees, a copyrighted innovation by UTM.

Keywords: *Problem Based Learning; experiential learning; Geographic Information System (GIS); Geotrees;*

Introduction

Problem-Based Learning (PBL) is one of the teaching and learning methods in the 21st century. The Geoinformatics Program in the Universiti Teknologi Malaysia has been implementing PBL for the Principles of Geographic Information Science (GIS) course for new first-semester students since the 2019/2020 session. This PBL approach, which is based on real-world industry problems, is said to stimulate the learning process, encouraging students to be proactive in finding solutions together to problems directly provided by industry. This, in turn, has the potential to enhance both the technical and generic skills of each student.

The purpose of this project is to enhance the PBL implementation in the existing course. The conventional PBL that was conducted with stakeholders (industry partners) relied on secondary data to be processed by the students as part of the project to be solved. The present project extends (i.e. novelty) the existing approach to include field experiential learning, whereby the students not only rely on secondary data sources but also collect the data using the Geotrees app. By collecting additional data, further analysis can be conducted by the students. For example, on the accuracy of data collected by different sources (i.e. smartphones GPS versus GPS handheld).

Geotrees is a versatile mobile application designed for tree inventory and data collection (Idris et al, 2022a). It is copyrighted by the Universiti Teknologi Malaysia. It empowers users to accurately record tree attributes, including species, diameter, height, and location, using built-in GPS technology in a smartphone and pinpoint map. This data can be visualized on maps and exported for further analysis. Geotrees is widely used in several field, such as urban forestry and environmental research. Geotrees facilitates efficient data collection and contributes to sustainable practices by providing a user-friendly interface and offline capabilities.

The creativity of this project using Geotrees includes

Integration of Field Experience: Adding field data collection using Geotrees provides students with a practical learning experience on-site.

Promote Critical thinking to evaluate data sources: comparing the accuracy of data collected from different sources (smartphone GPS vs. GPS handheld) adds a layer of complexity and depth. This encourages students to critically evaluate the reliability and limitations of different data collection methods.

Industry Synergy: Geotrees, a UTM commercialized product, is being utilized in this PBL project at SIREH Park. The project involves industry collaboration to address a specific operational challenge: tree mapping from location-based sources.

Innovative Changes: In previous cohorts, PBL relied solely on secondary data from stakeholders. This project introduced a novel approach that incorporates Geotrees. Students were empowered to collect primary data (tree biometric data and location) using the Geotrees app, providing valuable hands-on experience. Subsequently, they compared the collected location data with that from a GPS handheld.

Applicability (Relevant to New Academia Learning Innovation Model (NALI)): Experiential learning is an approach to learning that involves doing practical work on-site to connect the concept learned in the lecture. Geotrees enables students to engage in hands-on data collection, followed by data processing, mapping, and source accuracy analysis. This practical experience provides a basic understanding of the GIS subsystems involved in inputting, storing, analyzing, and visualizing location-based data. Using Geotrees to induce experiential learning could provide an alternative to understanding how GIS can benefit environmental-based applications and the compromise on quality that needs to be considered, which is supposed to differ according to the context of the applications.

Objective

The objective of this Geotrees innovation is to incorporate field experiential learning in GIS- Problem Based Learning.

Methodology

The methodology of this study enhances the previous PBL in the Principles of Geographic Information Science course (see Idris et al (2022b) and (2020), which was enrolled by first-year students from the Geoinformatics program in the Faculty of Built Environment and Surveying. Figure 2 presents the enhanced workflow of PBL that incorporates field experiential learning using Geotrees.

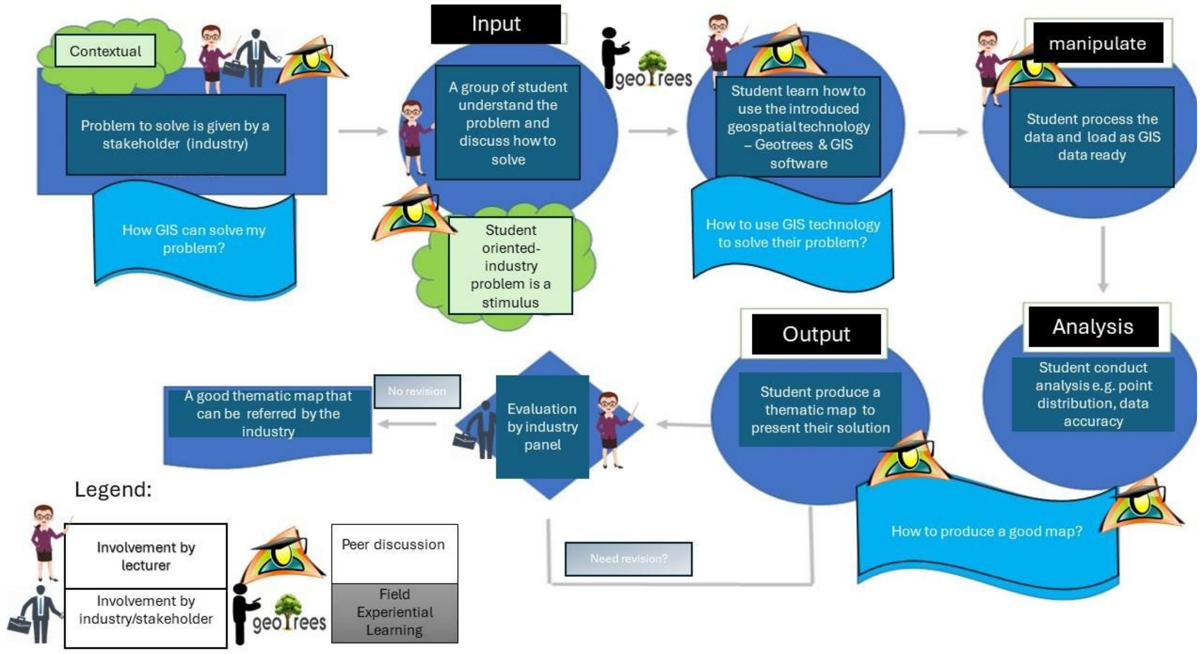

Figure 1: The modified process of PBL implementation in the course by incorporating experiential learning using Geotrees.

Impact assessment

Table 1 presents the students' impact assessment in terms of enhancing experience, empowerment, and understanding. The data provided reveals a comparative analysis of student perceptions regarding implementing Problem-Based Learning (PBL) in two cohorts: 2022 and 2023. The 2023 cohort was engaged in a PBL curriculum enhanced with experiential learning using Geotrees, while the 2022 cohort participated in PBL without field data collection.

A Likert scale questionnaire was administered to both cohorts to assess student perceptions. The results indicate a generally positive response from both groups, with average scores above 4, suggesting a favourable view of PBL implementation. However, a closer examination reveals a subtle trend. While both cohorts demonstrated positive perceptions, the average scores for the 2023 cohort, which incorporated experiential learning with Geotrees, were marginally lower than those of the 2022 cohort. This suggests that while adding Geotrees for experiential learning enhanced the PBL experience, it might have introduced additional challenges or complexities that slightly impacted student perceptions.

Further analysis is required to delve deeper into the reasons for this slight decrease in perception. Factors such as the specific nature of the Geotrees activities, their integration into the PBL curriculum, and potential challenges encountered by students during the experiential learning process could all contribute to the observed trend.

Table 1: Comparison of impact assessment between cohorts

Criteria of assessment	Cohort	
	2022 (PBL without field experiential learning)	2023 (PBL with field experiential learning)
experience	4.87	4.41
empowerment	4.88	4.34
understanding	4.81	4.38

Commercialization

Geotrees is a commercialized product by the Universiti Teknologi Malaysia (LY2018006410, LY2020005462 & LY2022E00494). The innovation won a gold medal in IIDEX 2021, organized by UiTM, and several bronze medals in PECIPTA 2022, INATEX 2021, and INoDEX USM 2021.

Acknowledgement

We are grateful for the Geoinformatics students (first year cohort in 2022 and 2023) and SIREH Park the Nusajaya Natural Heritage Thrust to collaborate in this Problem Based Learning.

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ID 113: Empowering Students through Research-Led Teaching to Enhance Knowledge and Soft Skills Development

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Highlights: Universiti Teknologi Malaysia (UTM), as a Research University, through its Center for Advancement in Digital and Flexible Learning (CDex), actively promotes the integration of research elements into teaching and learning to foster effective study practices among students. Therefore, through subject SBET2133 (Property Taxation and Valuation), educators incorporate research-led teaching into the formative assessment called mini-research project. The main goal of this assignment is to guide students in strengthening their understanding through the research process, including conceptual comprehension, information gathering, data collection, and the production of research reports. This approach enhances academic learning and significantly develops students' soft skills, which are critical for their future career growth.

Keywords: *Assessment; Knowledge; Research-LED teaching; Soft skills*

Introduction

This paper examines the formative assessment used in the Property Taxation and Valuation course (SBET2133), which incorporates a research-led teaching approach through a mini-research project. This project is designed to achieve Course Learning Outcome (CLO3), which focuses on demonstrating the processes and procedures involved in determining property taxation. Additionally, it aligns with the Programme Learning Outcome (PLO), emphasizing practical skills such as conducting tasks professionally (MQF, 2017), following instructions accurately, responding effectively, and applying acquired knowledge in real-world situations.

There are four approaches to implementing research-led teaching at UTM: research-based, research-oriented, research-driven, and research-tutored. This particular assessment employs a research-based approach, where students actively engage in a mini-research project to explore property taxation concepts in depth. Through this process, students develop critical thinking skills, learn to gather and analyze data, and enhance their ability to present findings coherently, thus bridging the gap between theoretical knowledge and practical application (Jiang and Roberts, 2011).

The research-led teaching approach not only enhances students' understanding of property taxation but also fosters a culture of inquiry and lifelong learning. By integrating research activities into the curriculum, students are encouraged to take ownership of their learning and develop a deeper engagement with the subject matter (Kreijkes and Greatorex, 2024). This method equips them with the necessary skills to tackle complex problems in their future professional careers, enabling them to make informed decisions and adapt to the evolving demands of the property industry (Stodolsky and Grossman, 1995).

The implementation of Research LED-Teaching in Property Taxation and Valuation Assessment

This paper examines the formative assessment used in the Property Taxation and Valuation course (SBET2133), which incorporates a research-led teaching approach through a mini-research project. This project is designed to achieve Course Learning Outcome (CLO3), which focuses on demonstrating the processes and procedures involved in determining property taxation. Additionally, it aligns with the Programme Learning Outcome (PLO), emphasizing practical skills such as conducting tasks professionally, following instructions accurately, responding effectively, and applying acquired knowledge in real-world situations.

The assessment is a group assignment, with each group comprising four members, and it is graded out of a total of 20 marks. In total, there are 14 groups, with two groups tackling the same topic to encourage diverse perspectives. Topics assigned include the concepts of tax and non-tax revenue, issues related to land premiums or quit rent, Real Property Gains Tax, Drainage and Irrigation Tax, and Income Tax.

The novelty and innovative aspect of this assessment lies in the students' collection of first-hand information through interviews with industry experts from organizations such as the Inland Revenue Board of Malaysia, State Government, Land and Mines Office, Land Office, and Local Authorities. This direct engagement with professionals enhances the learning experience by connecting theory with practical, real-world insights. While, the creativity aspect is naturally embedded in the unpredictable nature of fieldwork, which enhances students' problem-solving skills and adaptability, pushing them to think creatively and critically in managing unforeseen challenges. Furthermore, group work and conducting data collection outside the classroom environment stimulate creativity by encouraging students to exchange ideas, embrace diverse perspectives, and collaborate in developing innovative solutions.

The Objective of Mini-Research Project

There are three objectives of this assessment as follows:

1. To demonstrate the process and procedures involved in determining property taxation through conducting Literature Review and interview.
2. To develop practical skills in conducting research and responding to real-world tax-related issues: Through the mini-research project, students are expected to cultivate professional skills, including understanding instructions, conducting tasks proficiently, and applying learned knowledge in practical scenarios
3. To enhance learning through direct engagement with industry experts. By collecting first-hand information from professionals in relevant organizations, students are encouraged to bridge the gap between academic knowledge and real-world practice, gaining deeper insights into property taxation issues.

The Approach and Methodology

Conducting Research-Led Teaching (RLT) through assessment typically involves several key steps to ensure a comprehensive and effective evaluation as follows:

1. Step 1: The educator lists out the topics and provides a brief overview of the key issues to the students. A voting process is then conducted to assign topics to each group.
2. Step 2: Students conduct a literature review (4-6 pages) on concepts related to their assigned topic. The educator monitors the literature review reports to ensure that students are finding relevant information and clearing up any misconceptions before proceeding to the next step.
3. Step 3: Students develop interview questions. The educator reviews these questions and provides guidance to ensure they are appropriate and related to the topic. During this stage, students also prepare by obtaining a data collection letter from the Undergraduate Office and contacting the relevant agencies to schedule interview sessions.
4. Step 4: Students conduct the interview sessions with the identified agencies as shown in Figure 1.0.
5. Step 5: Students write a mini-research report, including sections such as an introduction, problem statement, literature review, methodology, analysis, and conclusion. Throughout this process, students can seek guidance from the educator as needed.

Figure 1.0: Interview session involving different agencies according to the topic given

The impact of Research-Led Teaching assessment on students' knowledge and soft skills.

After students submit their reports, an assignment evaluation is conducted via a Google Form (https://forms.gle/u5uqttDtTLxh52UUA)to gather feedback on the suitability and impact on their knowledge development, practical skills, and soft skills. At the end of the evaluation form, students can provide general comments on the best and not-so-good aspects of completing the assignment. A total of 51 out of 53 students have committed to answering this evaluation. This feedback helps educators assess the implementation of the assignment and make improvements in the future. Table 1 shows students' feedback on Research-Led Teaching assessment.

Table 1: Students Feedback on Research-Led Teaching Assessment

Criteria	Response		
The relevance assigned topic	Somewhat Relevant 2%	Quite relevant 21.6%	Very relevant 76.5%
The appropriateness of the time allocated for the task	Somehow appropriate 2%	Appropriate 45.1%	Very appropriate 52.9%
The instruction by the educator	Sometimes confusing but manageable 25.5%	Understood 37.3%	Well understood 37.3%
The guidance from the educator	Somewhat sufficient 9.8%	Sufficient 21.6%	Very Sufficient 68.6%
The improvement in knowledge	≥ 25% improvement 3.9%	≥ 50% improvement 29.4%	≥ 75% improvement 66.7%
The improvement in information searching	≥ 25% improvement 2%	≥ 50% improvement 31.4%	≥ 75% improvement 66.7%
The difficult encounter in collecting primary data	Slightly challenging 25.5%	Moderately challenging 37.3%	Challenging 37.3%

The feedback highlights several key elements of research-led teaching, which focuses on incorporating research practices into the learning process. This approach not only deepens students' understanding of theoretical concepts but also equips them with practical skills essential for their academic and professional development. First, the alignment of the assigned topic with the syllabus, while generally strong, suggests that the topic is relevant to the learning outcomes. Research-led teaching emphasizes the connection between course content and real-world research practices, allowing students to explore topics that are directly linked to the discipline. By engaging with a topic that is largely consistent with the syllabus, students are able to see how academic theory translates into research-based inquiry.

The time allocated for completing the task was seen as appropriate, reflecting one of the pillars of the research-led approach: giving students sufficient time to engage deeply with research activities. In research-led teaching, time is critical for students to immerse themselves in the research process, from understanding the problem to collecting and analyzing data. However, the feedback on the clarity of instructions and guidance from the lecturer points to areas where research-led teaching can be enhanced. Research-led education often requires students to take initiative and work independently. Therefore, while the lecturer's role is to provide a framework, it is also essential to offer clear instructions and ongoing guidance. The fact that students felt the instructions and guidance could be improved suggests a need for more structured support, ensuring that students feel confident navigating complex research tasks.

Next, this task is successful in enhancing students' understanding of the topic and their ability to search for information. A core benefit of research-led teaching is its focus on inquiry-based learning, where students develop skills in gathering, evaluating, and synthesizing information. Finally, the challenges encountered in collecting primary data highlight one of the common difficulties in applying research-led teaching. While students benefit from hands-on research experience, the process of gathering primary data can be demanding and sometimes complex. This feedback suggests that while the assignment allowed students to engage in real-world research, more support or training in primary data collection techniques could further strengthen the research-led learning experience.

Reflection and improvement by the educator

Three main key points of reflection through this assessment are:

Educators found that students' understanding of basic concepts is still weak. This was identified from the literature review writings, where concepts were inaccurate and unrelated despite being explained in lectures. The educators' review of the literature helped identify critical weaknesses in students' understanding and writing of basic concepts.

Educators were able to get to know the students' personalities better, as two-way communication became more active during discussions with students in small groups.

Students' soft skills were enhanced as educators identified and corrected issues related to communication ethics, students' responses to problems, lackadaisical attitudes, and more. Overall, the process and challenges faced during this mini-research were valuable lessons for the students.

Lastly, for improvement, educators should focus on improving the guidance provided to students in planning and executing the project, as Research-Led Teaching (RLT) demands significant time and commitment for effective student support. Additionally, incorporating student presentations alongside report submissions could be considered in the future to further enhance the learning experience.

Conclusion

In conclusion, the research-led approach in this task has been largely successful in improving students' understanding and research skills, though there are areas such as clearer instructions and enhanced support in primary data collection, where further refinement could make the experience even more effective. Additionally, introducing and applying research-led teaching in the second year is highly appropriate as an early preparation because students need to complete a case study report during their industrial training in the third year and undertake a final year project in the fourth year.

Acknowledgment

We extend our heartfelt gratitude to Universiti Teknologi Malaysia for its unwavering support and commitment to fostering innovative and impactful educational experiences.

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ID 114: Integrating an Online Learning Community into a Flipped Classroom to Empower College Students' Oral English Communicative Competence and Motivation

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Highlights: Integrating an Online Learning Community (OLC) into a flipped classroom is an innovative approach to empower college students' oral English communicative competence and motivation. This teaching method brings together students with common interests, forming a supportive online community for pre-class learning. The OLC emphasizes pre-class interactions, allowing for collaboration and timely feedback, which enhances the effectiveness of pre-class preparation and fosters a more engaging learning experience.

Keywords: *Online Learning Community; Flipped Classroom; Oral English Communicative Competence; Motivation; Pre-Class Learning*

Introduction

The international community considers communicative competence one of the key competencies for lifelong learning in the twenty-first century (Boyko et al., 2021). To meet the communicative demands of a rapidly globalizing society, it is more important than ever to actively examine what teaching methods might best assist students in developing English communicative competence (Tanaka, 2012). This study investigates the integration of an OLC into a flipped classroom, focusing on enhancing the effectiveness of pre-class learning to empower college students' oral English communicative competence and motivation. The OLC brings together students with common interests, creating a collaborative environment where they can interact and engage in meaningful activities before class. By participating in these online interactions and receiving timely feedback, OLC members become more prepared and confident, which increases their willingness to participate in interactive learning during in-class stage actively. This teaching method aims to optimize pre-class preparation and foster greater student engagement in communicative competence learning.

Content

Objectives

Create a learning environment where students engage with course content and peers who share common interests before class. The OLC can foster collaboration and discussion, helping students better understand the course materials and preparing them for more effective in-class interactions.

Enhance students' readiness and confidence. Pre-class engagement with content and OLC members can boost preparedness, while timely feedback can build confidence, leading to more active participation in class activities.

Empower college students' oral English communicative competence and motivation. Interactive online activities can allow students to learn and practice in a low-pressure environment, which empowers their oral English communicative competence and motivation for active participation in communicative competence learning.

Novelty

This study is novel in its approach by combining an OLC with the flipped classroom, specifically within the context of communicative competence learning. Unlike the traditional flipped classroom, this study shifts the emphasis to pre-class learning, utilizing various online platforms (Xuexitong, Tencent QQ, WeChat, etc.) to form the OLC that facilitates peer interactions and feedback. This unique integration provides a fresh perspective on how technology platforms can be used to empower oral English communicative competence learning, particularly in preparing students for active participation in face-to-face class activities.

Creativity

The creativity of this study lies in its innovative use of the OLC as an online learning environment to facilitate pre-class learning. By facilitating discussions, peer interactions, and timely feedback online, this method transforms the traditional flipped classroom into more interactive and student-centered learning, which encourages students to take an active role in their pre-class learning process, fully preparing them for effective classroom learning and ultimately promoting the development of oral English communicative competence and motivation.

Innovativeness

This study is characterized by its innovative integration of OLC to enrich the pre-class stage of the flipped classroom. It employs the OLC as a space for interactive and collaborative learning during pre-class preparation. This innovation not only empowers college students' oral English communicative competence and motivation but also offers a new teaching method for college language education that utilizes technology platforms to create a more engaging learning environment.

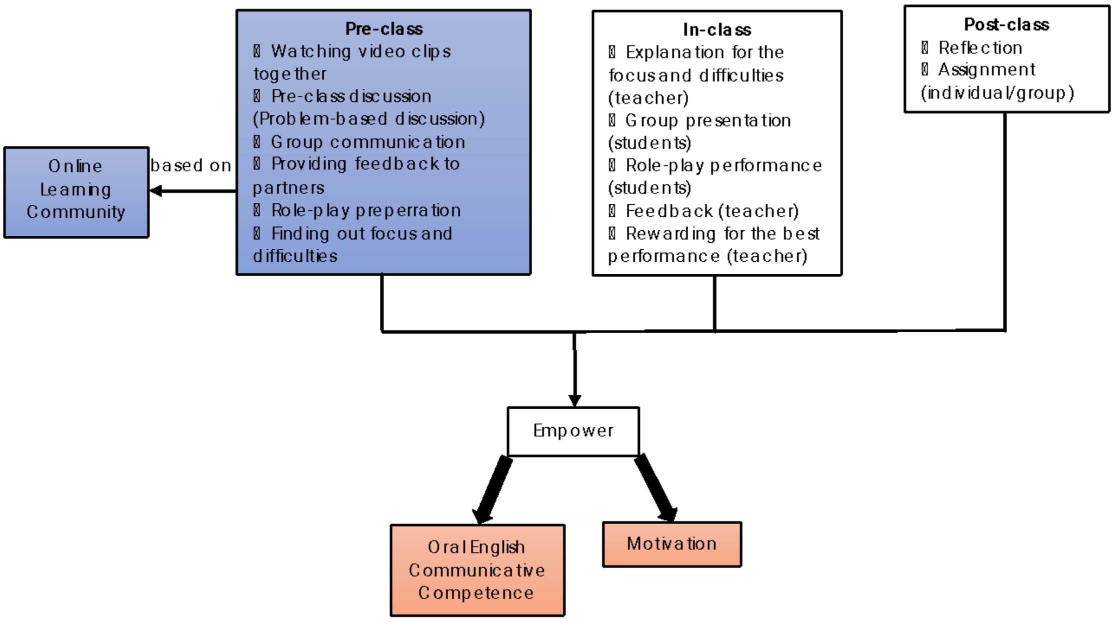

Figure 1: A Flipped Classroom Integrated with an Online Learning Community

Applicability

The findings and methodologies of this study have implications for a range of educational settings. Integrating an OLC into a flipped classroom is flexible and can be adapted to various subjects, making it a valuable teaching method for enhancing student engagement and learning outcomes. This method is particularly effective in environments that emphasize blended learning. In addition, the positive results seen in teaching oral English communicative competence indicate that this method can also be beneficial in other disciplines. Fields such as science, technology, engineering, and mathematics can particularly benefit from this method, as it supports practical and experiential learning during pre-class preparation.

Impact

Integrating an OLC into a flipped classroom can change the learning experience of Chinese college students. By encouraging active participation and collaboration in the OLC, this teaching method promotes early engagement with the course materials and preparation, ultimately leading to enhanced learning outcomes. Students benefit from increased confidence, greater motivation, and empowered communicative competence. This teaching method not only helps students better prepare for in-class activities, thereby empowering their oral English communicative competence and motivation but also gives them basic social communication skills they will need in future professional environments.

Research Methodology

This study adopted a mixed methods research design. The term “mixed methods research” is often used to describe research that combines qualitative and quantitative data in one study (Wisdom et al., 2012). Quantitative research is the collecting and analysis of numerical data, whereas qualitative research focuses on narrative or experience data (Hayes et al., 2013). In this study, pre-test and post-test were used to measure changes in students’ oral English communicative competence, while questionnaires and interviews were conducted to get students’ feedback on their motivation and perceptions of integrating an OLC into a flipped classroom. The quantitative data was analyzed using statistical methods to assess the effectiveness of the intervention, while qualitative data was thematically analyzed to provide deeper insights into students’ feedback and perceptions.

Two groups of students participated in this study: the control group and the experimental group. The students in the control group engaged in traditional flipped classroom learning, where they learned and practiced various learning resources on their own in the pre-class stage and then participated in collaborative activities only in class. The students in the experimental group participated in a flipped classroom integrated with an OLC, which enabled more collaborative learning by integrating an OLC into the pre-class stage of a flipped classroom.

Finding and Discussion

The findings of this study indicate that integrating an OLC into a flipped classroom enhances the effectiveness of students’ pre-class preparation and empowers their oral English communicative competence and motivation. After taking part in the OLC activities, students reported they felt more prepared and confident for in-class activities. Quantitative and qualitative results highlight the importance of peer interactions and timely feedback in the pre-class stage of a flipped classroom, which contributes to enhancing both the effectiveness and motivation of in-class learning.

Commercialization Potential

Integrating an OLC into a flipped classroom offers educational institutions a cost-effective innovation, particularly in reducing infrastructure and maintenance expenses. This teaching method allows institutions to serve a larger and more diverse number of students, which increases the reach of their programs. For successful implementation of this innovative teaching method, institutions need to invest in training educators and students on how to use the various platforms that form the OLC to ensure its effective application. Such investments will improve the learning environment and contribute to better educational quality and students' learning outcomes.

Acknowledgement

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ID 115: Knowledge Transfer of Sustainability: Repurposing Old Tires into Attractive Flowerpots

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Highlights: Kolej Rahman Putra (KRP) and the Faculty of Computing, Universiti Teknologi Malaysia (UTM), successfully organized a program on environmental sustainability and planetary health from 29 to 30 April 2024, in line with the National Science Week theme, "Planetary Health." The program, held in collaboration with SMK Taman Universiti (SMKTUN), was part of a STEM initiative titled *Interactive Workshop: The Waste Material Reuse Challenge*. Teachers and students from the Program Pendidikan Khas Integrasi (PPKI) learned about the importance of environmental conservation through the 3R approach and engaged in activities designed to enhance their awareness of sustainability and creative waste management solutions.

Keywords: *creative recycling; special needs education; sustainability in education; tire flowerpot project; hands-on learning for PPKI students*

Introduction

Environmental sustainability and planetary health have become central focuses for educational institutions aiming to instill these values in younger generations. In line with this mission, Kolej Rahman Putra (KRP), Universiti Teknologi Malaysia (UTM), in collaboration with SMK Taman Universiti (SMKTUN), organized a two-day STEM-based program titled *Interactive Workshop: The Waste Material Reuse Challenge*. Held from 29 to 30 April 2024, the program was designed to raise awareness of environmental conservation and promote sustainable practices through hands-on activities, particularly focusing on repurposing discarded materials.

The program was attended by twelve students from the Program Pendidikan Khas Integrasi (PPKI), with the core objective of engaging participants in sustainability through the 3R approach (Reduce, Reuse, Recycle). A specialized module was developed for the PPKI students, which introduced them to the creative reuse of discarded tires, transforming them into decorative flowerpots. This hands-on activity not only enhanced students' motor skills but also instilled a sense of accomplishment and environmental responsibility. The enthusiasm displayed by the students throughout the workshop reflected the effectiveness of practical, engaging learning methods in promoting STEM education and environmental stewardship.

The workshop was supported by 10 staff members and 4 students from various departments, including Kolej Rahman Putra, Faculty of Computing, and the UTM Security Division. Under the leadership of Associate Professor Dr. Mohd Haizal bin Jamaluddin, Principal of KRP, the initiative aimed to empower students with the knowledge and skills necessary to integrate sustainability into their everyday lives. The closing ceremony, officiated by YB Tuan Haji Aminolhuda bin Hassan, marked the culmination of the workshop. Notable attendees included the Principal of SMKTUN, En. Saiful Azizi bin Mohammad Yasin, PPKI Coordinator Cikgu Wong Shui Wah, Program Coordinator Cikgu Nur Aina Nazihah binti Abd Jalal, along with several other PPKI teachers.

As a key outcome of the program, all flowerpot products created during the workshop were retained by SMKTUN to be used as landscape decorations, symbolizing the program's tangible impact. Participants were awarded certificates of participation from MOSTI and UTM, alongside a guidebook on the process of making flowerpots from discarded tires, published by KRP.

The program demonstrates the potential of sustainability-focused STEM education in cultivating a culture of environmental awareness among students. By fostering innovative, hands-on learning experiences, such initiatives contribute to the holistic development of students, equipping them with the skills and knowledge needed to address environmental challenges and support sustainable development.

Objectives

The primary objective of the workshop was to develop students' motor skills and instill a sense of responsibility towards the environment. Participants were encouraged to engage in activities that stimulated their creativity and problem-solving abilities. The initiative also aimed to raise awareness about the benefits of recycling and its potential impact on environmental sustainability.

The Importance of Tire Recycling

The Tire Flowerpot Making workshop demonstrated the practical benefits of tire recycling by using basic, affordable, and easily accessible materials such as old tires, brushes, markers, paint thinner, and oil-based paint. These materials were chosen to ensure that recycling activities are both cost-effective and easy to replicate, reinforcing the importance of making tire recycling achievable for everyone.

Tire recycling addresses a significant environmental challenge by reducing the disposal of tires in landfills. Through this workshop, participants learned how to convert old tires into functional and aesthetically pleasing flowerpots. The process involved cutting, shaping, and decorating the tires, showing how recycling can breathe new life into waste materials. By focusing on tire reuse, the workshop highlighted the crucial role of recycling in minimizing landfill waste and protecting the environment through creative, sustainable practices.

Advantages of Tire Flowerpot Making

The process of making flowerpots from discarded tires offers several advantages

Recycling and Waste Reduction: Repurposing used tires helps to reduce waste, contributing to environmental conservation efforts.
Fostering Creativity: The activity encourages students to think creatively, exploring different ways to shape and decorate the flowerpots.
Environmental Awareness: By participating in recycling activities, students develop an understanding of the importance of protecting the environment.
Motor Skill Development: The hands-on process improves students' motor skills and hand-eye coordination.
Unique Garden Decoration: The finished flowerpots can serve as attractive, eco-friendly garden decorations. The *Tire Flowerpot Making* workshop utilized several basic materials that were easily accessible and affordable. The key materials required for this project included tires, brushes, markers, paint thinner and oil-based paint. These basic.

Methodology, Process and Tools

The workshop involved several steps:

	**Selecting the Tires**: Participants learned how to choose the appropriate tire sizes (13 to 15 inches) for making flowerpots.

	**Cutting and Shaping**: With the help of basic tools such as cutting knives and markers, the tires were shaped into flowerpot designs
	**Decorating**: The flowerpots were then painted and decorated using durable weather-resistant paint to enhance their visual appeal
	**Final Touches**: After painting, the flowerpots were left to dry before being used as functional garden containers for plants

Supporting Sustainability Goals

The tire flowerpot workshop aligns with several United Nations Sustainable Development Goals (SDGs), particularly:

SDG 12: Responsible Consumption and Production, by promoting recycling and repurposing materials.

SDG 13: Climate Action, by reducing the environmental impact of tire disposal.

SDG 15: Life on Land, by minimizing pollution and encouraging sustainable land use.

SDG 4: Quality Education, as the workshop integrates environmental education into hands-on learning activities.

Applicability & NALI

The *Tire Flowerpot Making* workshop is a prime example of how sustainability and hands-on learning can be integrated into the broader educational framework, in line with Malaysia's New Academia Learning Innovation (NALI) model. NALI emphasizes active and experiential learning, encouraging students to engage deeply with the material through problem-solving, collaboration, and creative thinking. The workshop applied this framework by offering Program Pendidikan Khas Integrasi (PPKI) students an interactive, real-world task that honed their motor skills while promoting environmental awareness.

The core principles of NALI—student-centered learning, peer-to-peer knowledge transfer, and active engagement—were embedded throughout the workshop. Students were not only guided through the technical process of turning discarded tires into flowerpots but were also encouraged to collaborate, exchange ideas, and support each other. This peer-driven approach fostered a strong sense of community and learning ownership, critical components of NALI's philosophy.

In terms of applicability, this workshop demonstrated how project-based learning activities can be adapted to suit different educational contexts, especially for students with special needs. By engaging in a tangible, creative project, PPKI students were able to develop essential skills such as problem-solving, creativity, and teamwork. Moreover, the workshop provided an opportunity for students to contribute to sustainable practices, aligning with the global push towards eco-friendly solutions.

The project's relevance goes beyond the classroom, showing the potential for similar workshops to be integrated into broader educational programs across Malaysia. By promoting hands-on activities that are meaningful, engaging, and aligned with sustainability goals, the workshop aligns perfectly with the NALI framework's vision of producing students who are well-equipped with critical life skills for future challenges. This innovative approach demonstrates the potential for wider application, not only within special education programs but across various educational levels.

Impact, Future Potential, and Commercialization

This workshop not only provided students with valuable skills but also raised awareness about the importance of environmental conservation. By engaging in hands-on recycling activities, students developed a practical understanding of sustainability while enhancing their motor and problem-solving skills. Additionally, this initiative contributes to the local economy by providing opportunities for creative recycling initiatives, potentially leading to small-scale entrepreneurial ventures in the future.

The flowerpots created during the workshop demonstrate the practical application of recycling in real-world settings. These flowerpots, made from discarded tires, have the potential to be commercialized as unique, eco-friendly garden decorations or landscape features. With further refinement, the products can be marketed to urban developers, landscape designers, and individuals seeking sustainable home and garden solutions. The commercial potential of these flowerpots highlights the possibility of transforming a simple educational activity into a viable business model for small-scale entrepreneurship, especially in local communities.

Moreover, the workshop's products can be used to beautify urban landscapes, contributing to sustainable urban development (SDG 11). By encouraging the reuse of waste materials in public spaces, the initiative not only helps to reduce waste but also promotes the concept of a circular economy, where materials are continuously reused and repurposed. This can further stimulate community engagement and local business opportunities in the area of sustainable product development.

The potential commercialization of these products adds a significant layer of value to the workshop, showing that educational activities can also foster entrepreneurial mindsets. The skills and knowledge gained from the workshop can inspire students and local communities to explore other creative recycling ventures, contributing both to environmental conservation and economic growth.

Conclusion

In conclusion, the *Tire Flowerpot Making Workshop* demonstrates the powerful combination of skill development and sustainability. Through creative recycling and hands-on learning, the students not only gained motor skills but also contributed to environmental preservation. This program underscores the importance of educational initiatives that blend practical skill development with broader sustainability goals, paving the way for a more responsible and eco-conscious future.

Findings and Discussion

Before the workshop began, both a pre-workshop survey and a post-workshop survey were administered to gauge the participants' initial understanding and confidence, as well as to measure the impact of the workshop on skill development. The pre-workshop survey aimed to assess the participants' existing knowledge about recycling practices, tire preparation, and basic horticultural concepts. By comparing the results of the pre- and post-workshop surveys, the effectiveness of the workshop could be clearly evaluated.

The results from the pre-workshop survey revealed that many participants had limited knowledge and confidence in several key areas. Only 25% of the students felt very confident in cleaning and preparing discarded tires, while 30% admitted they were not confident at all. In addition, 50% had no prior experience with cutting tires or assessing plant root health, which are fundamental skills for the workshop. Similarly, participants were unfamiliar with other crucial areas, such as selecting suitable paints (45% unfamiliar) and mastering proper planting depths (60% not confident).

However, the post-workshop survey results showed a remarkable improvement in both skill acquisition and confidence. After the workshop, 73% of participants strongly agreed that they now felt more confident in cleaning and preparing tires, with 27% agreeing. Additionally, 82% strongly agreed they had mastered the steps for cutting and preparing tires, while 18% agreed. The workshop's hands-on approach clearly had a profound impact, with participants demonstrating increased confidence in areas like selecting paints (64% strongly agreed) and mastering planting depths (55% strongly agreed, with 45% agreeing). Furthermore, 91% of participants strongly agreed that they had gained valuable knowledge in post-planting care, such as proper watering and fertilizing techniques.

The overall results highlight the significant positive impact of the workshop in transforming participants' understanding of recycling and horticultural practices. The shift from limited confidence to mastery of the skills involved in tire recycling and plant care suggests that experiential learning is highly effective for promoting both environmental stewardship and practical skill development. This workshop not only provided participants with a deeper understanding of sustainability but also equipped them with practical skills that can be applied to real-world situations.

Pre Workshop Survey Results

Table 2: Post Workshop Survey Result

Survey Question	Very Confident/Yes (%)	Somewhat Confident (%)	Not Confident/No (%)
How confident are you in cleaning and preparing discarded tires for flowerpots?	25%	45%	30%
Have you previously learned how to cut and prepare tires for recycling purposes?	18%	32%	50%
Do you understand which types of paint are suitable for decorating tires?	20%	35%	45%

Survey Question	Very Confident/Yes (%)	Somewhat Confident (%)	Not Confident/No (%)
Are you familiar with which plants are suitable for growing in tire flowerpots?	22%	33%	45%
Do you feel confident in preparing the correct planting holes for plants?	25%	40%	35%
How familiar are you with post-planting care, such as watering and fertilizing?	18%	37%	45%
Do you know how to assess the health of a plant's roots before planting?	20%	30%	50%
Have you mastered the correct planting depth for different types of plants?	15%	25%	60%
Are you confident in your understanding of proper watering and fertilizing practices?	25%	35%	40%
Do you know the best times for planting to ensure healthy plant growth?	20%	30%	50%

Survey Question	Strongly Agree (%)	Agree (%)
Do you feel more confident in cleaning and preparing tires as flowerpots?	73%	27%
Have you mastered the steps to cut and prepare tires for flowerpots?	82%	18%
Do you understand which types of paint are suitable for decorating the tires?	64%	36%
Do you know which types of plants are suitable for planting in tire flowerpots?	82%	18%
Are you confident in preparing the correct planting holes for plants?	73%	27%
Do you have improved knowledge of post-planting care, such as watering and fertilizing?	91%	9%
Do you understand how to assess plant root health before planting?	73%	27%
Have you mastered the correct planting depth for plants?	55%	45%
Do you understand proper watering and fertilizing practices for the plants?	91%	9%
Do you know the best times to plant to ensure healthy growth?	73%	27%

Recognition & Awards

This project has garnered notable recognition, including a 3 Star and 5 Star Rating CCIN Award from UTM and acknowledgment from Pejabat Pendidikan Daerah Johor Bahru (PPD JB). The initiative's success in promoting sustainability and skill development, particularly among Program Pendidikan Khas Integrasi (PPKI) students, has been widely acknowledged. The innovative approach of combining environmental awareness with hands-on learning through tire recycling has been praised for its profound impact on PPKI students.

The program's ability to enhance creativity and motor skills among PPKI students while promoting sustainability has made it a standout project. These accolades underscore the effectiveness of the project in fostering a deeper understanding of environmental conservation, skill development, and inclusivity in education. The recognition also highlights the success of the initiative in creating meaningful learning experiences for students with special needs, showcasing how education can be adapted to cater to diverse learning requirements.

Acknowledgement

We would like to extend our deepest gratitude to the Kolej Rahman Putra, Faculty of Computing at Universiti Teknologi Malaysia (UTM), SMK Taman Universiti, and Pejabat Pendidikan Daerah Johor Bahru (PPD JB) for their invaluable support and collaboration in making the tire flowerpot-making workshop a success. Special thanks go to the staff and students of UTM for their active participation and guidance throughout the program. We also acknowledge the contributions of the teachers and students involved, whose enthusiasm and dedication were crucial in achieving the objectives of the workshop.

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ID 116: Improving The Performance of Students with Disabilities through 21st-Century Learning Infrastructure

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Highlights: Learning infrastructure plays an important role in shaping the learning process of students. In this project, the learning infrastructure refers to the space or classroom where students and teachers engage in the teaching and learning process. Embracing a 21st-century learning infrastructure as part of educational transformation enables schools to prioritize the delivery of high-quality education. Consequently, there is a growing need to enhance the learning environment for students with disabilities. Implementing these changes has yielded positive results, with students demonstrating performance improvements of 50-70 percent.

Keywords: *Disabilities; 21st-Century; Performance; Classroom, Learning Infrastructure*

Introduction

In the past century, educators have gained a lot of knowledge about the learning process. However, our current classrooms still bear a striking resemblance to those of previous generations. A redesigned classroom would foster active learning experiences and promote student-directed learning. Furthermore, it would effectively cultivate 21st-century skills, including communication, collaboration, problem-solving, critical thinking, creativity, and leadership.

Teachers can improve outcomes by adapting their teaching methods to the era of globalization, but it requires supporting infrastructure facilities (Pongsakorn Limna et al, 2022). This can foster the activeness of students and teachers in packaging and managing learning to provide support so students can be active in the learning process (Hyun, Ediger, & Lee, 2017).

The 21st-century classroom is student-centered, not teacher-centered. Instead of lecturing, teachers now act as facilitators of learning. Students engage in hands-on learning experiences, and the teacher serves as a coach, providing support as students work on projects. With the changes in students' learning styles, schools have to ensure the construct of a ubiquitous learning environment to allow the students and the environment with the combination of the available technological resources to communicate and exchange information at any time and anywhere (Wong Kin Mun et al, 2016). The 21st-century classroom should accommodate flexible and random shapes, and be geared towards creativity, innovation, and active learning. Also true, and just like before, the focus on the core curriculum will remain important. This is in preparation for an all-out STEM-based curriculum that is still taking shape (Alfred Amuno, 2021).

The ideal 21st-century classroom (see Figure 1) should be student-centered, focusing on learners discovering themselves and exploring opportunities through active learning and discussions. This approach can foster critical thinking and the practical application of knowledge. Additionally, technology should be integrated into the classroom, allowing students to use multimedia and other visual elements to fully engage and retain information. Collaborative learning and leadership practices can help build self-esteem, confidence, and tolerance for differing opinions and ideas. Promoting critical thinking and creativity is also essential. Lastly, the classroom should be flexible, incorporating flexibility and unconventional shapes to support these principles.

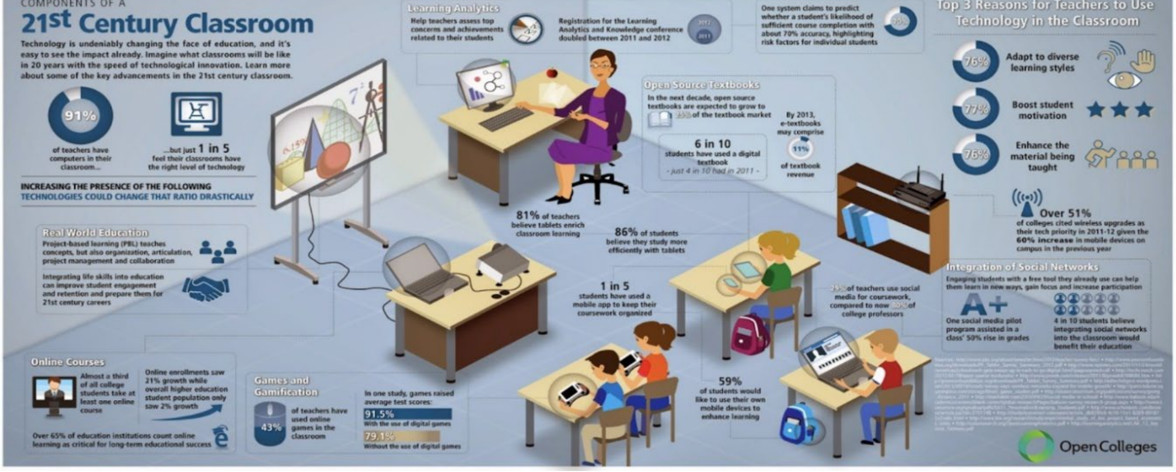

Figure 1: Components of a 21st Century Classroom

21st Century Learning Infrastructure for Students with Disabilities

This project involves students with hearing loss, visual impairment, and speech impairment. Therefore, several challenges need to be addressed to create an inclusive and effective learning environment when designing a 21st-century classroom. For the creation of an ideal 21st-century classroom for students with disabilities, various factors have been considered. This encompasses:

i. **Accessibility**
Ensuring that the classroom is accessible to all students with different types of disabilities, including visual impairments, hearing impairments or loss, and speech impairments.

ii. **Technology Integration**
Incorporating assistive technologies and adaptive tools to support diverse learning needs and styles, including accessible digital resources, interactive whiteboards, and other technology-based learning aids.

iii. **Flexible Seating and Layout**
Designing a flexible and adjustable seating arrangement to accommodate students with physical disabilities and creating a layout that allows for easy mobility and navigation within the classroom.

iv. **Sensory Considerations**
Addressing sensory sensitivities and providing a sensory-friendly environment through controlled lighting, acoustics, and sensory supports for students with sensory processing differences.

v. **Inclusive Teaching Tools**
Providing a variety of teaching tools and materials that cater to diverse learning styles, preferences, and abilities, such as tactile resources, multi-sensory learning materials, and alternative formats for instructional content.

Students' Performance and Opinion

A total of 240 questionnaires were distributed to the respondents, who were students of Sekolah Menengah Kebangsaan Vokasional Pendidikan Khas Indahpura Kulai Johor. The results are as shown in the following Table 1:

Table 1: Students' Opinions on the Benefits of 21st Century Learning Infrastructure in Their Performance

Level of Agreement Criteria	Strongly Disagree <				> Strongly Agree
	1	2	3	4	5
The 21st century classroom was able to help me develop new ways of thinking.	0%	0%	10%	33.%	55%
The 21st century classroom was able to help me understand lesson better.	0%	0%	0 %	71.7%	28.3%
The 21st century classroom was able to help me be more creative in expressing myself and collaborating with others.	0%	0%	13 %	26%	61%
The 21st century classroom was able to help me to solve problems and create innovative solutions.	0%	0%	6 %	26%	68%
The 21st century classroom was able to help me to gain a deeper understanding of how to use technology responsibly and effectively.	0%	0%	13%	26%	61%

After the program was conducted, 132 students, or 55%, strongly agreed, and 84 students, or 35%, agreed that the 21st-century classroom was able to develop new ways of thinking. The use of learning aids can not only foster the creative minds of students but also help in improving the understanding and quality of learning in the classroom. A total of 172 students agreed, and a total of 68 students strongly agreed that the 21st-century classroom was able to help them understand lessons better.

A total of 149, or 62% of students strongly agree, and 77, or 32% of students agree that there are benefits in learning performance from the change and collaboration with others. The results of the analysis show that the majority of respondents totaling 163, or 68% of people strongly agree and 62, or 26% of people agree that the 21st-century class encourages the use of innovation in problem-solving. A total of 146, or 61% of the students strongly agree, and a total of 62, or 26% of the students agree that they experience a transformation of mind regarding the use of technology in learning.

Based on feedback from 20 teachers collected through interviews, it was found that students' performance improved by 50-70%. This improvement encompassed increased student participation, a greater interest in learning, encouragement of creativity and critical thinking, as well as an enhanced interest in the use of technology.

Conclusion

In conclusion, the implementation of a 21st-century learning infrastructure holds tremendous potential for improving the performance of students with disabilities. By addressing the unique needs of students with hearing loss, visual impairment, and speech impairment, and creating inclusive and accessible learning environments, we can ensure that all students have the opportunity to thrive and succeed in the modern educational landscape. This approach not only enhances academic outcomes but also fosters a more equitable and supportive educational experience for all students.

Acknowledgment

I would like to express my gratitude for the generous support provided by the Center for Community & Industry Network (CCIN). Their sponsorship of this project under the Knowledge Transfer (KTP) CE/2022/00084 has been invaluable and greatly appreciated.

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ID 117: Oceanographic Data from Space: Building Resilience to Climate Impacts through Massive Open Online Course (MOOC)

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Highlights: A virtual capacity building development (CBD) program through a Massive Open Online Course (MOOC) Open Learning platform was successfully developed involving 13 modules presented on the pre-recorded videos, plus a student-mentorship program to foster active interactions between our experts and participants. This CBD is the first to support university initiatives to foster learning on-demand and flexible education. Therefore, the objectives of this program are 1) Elaborate the fundamentals of remote sensing, GIS, along with in situ measurements and its techniques for monitoring the oceans, marginal seas, and coastal areas; 2) Communicate effectively both in written and orally by giving practical examples of remote sensing techniques used for monitoring the ocean-atmosphere system especially in research and operations, 3) Develop networks among students and senior scientist from all over the globe for conducting ocean-atmosphere project using remote sensing techniques. The CBD theme focused on 'Ocean Remote Sensing towards Climate Resilience' to curate early-career scientists and students to benefit from interactions and mentored by experts from all over the globe. Developing these relationships helps young scientists generate new scientific ideas, plan research programs, and write academic papers.

Keywords: *Remote Sensing; Oceans and Coastal; MOOC; Learning on Demand*

Introduction

Technology that can comprehensively and methodically monitor the oceans, marginal seas, and coastal areas is required to support marine climate readiness development. Space-based remote sensing (RS) provides unmatched spatiotemporal coverage. Remote sensing technology, combined with in situ measurements, is critical for monitoring marine natural resources and assessing climate and human impacts in coastal areas, such as monitoring sea levels, coral reefs, and marine utilisation planning for various economic sectors such as tourism. It is also critical for monitoring and understanding climatic variability and change, biodiversity and ecosystems, changes in the atmospheric, marine, and coastal domains, and their societal implications. According to Bao, W. (2020), Massive Open Online Courses (MOOC) are significant because they provide anybody with internet access with easily accessible, reasonably priced, and adaptable education. They offer many courses, encourage lifelong learning, and aid with job progression through skill-based training. They can reach a lot of pupils all over the world because of their scalability.

A virtual capacity building development (CBD) program on the Universiti Teknologi Malaysia (UTM) MOOC Open Learning platform was successfully developed, with 13 modules presented on pre-recorded videos, as well as a student-mentorship program to foster active interactions between our experts and participants. This CBD is the first of its type, supporting university initiatives to promote learning on demand and flexible education. The CBD theme was 'Ocean Remote Sensing towards Climate Resilience' to bring together early-career scientists and students worldwide to benefit from interactions and specialist mentorship. This relationship-building will help young scientists generate scientific ideas, research projects, and papers.

The flexible learning was supported in various capacities by the Tropical Resource Mapping Research Group of UTM, Pan Ocean Remote Sensing (PORSEC) Association, Centre of Excellence of Geoscience and Digital Earth Centre (INSTEG, UTM), UTM MOOC, Asia Pacific Network (APN) for Global Change, and Committee of Space Science Research (COSPAR). The physical CBD tutorials have been a feature of past PORSECs since 2000 and have been found to provide valuable interaction between senior professionals and researchers, early career scientists and professionals, and students. Due to pandemic COVID-19, the physical CBD was transformed to a digital and flexible learning. A total of 70 students from different Asian countries have enrolled in the virtual course from 2020 to the present.

Participants were among the research students towards their Master/PhD, and researcher/postdoctoral from the national/governmental institutions. Whereas, honored instructors were from 8 countries across the continents. Apart from the learning process via the pre-recorded videos, the student-mentorship relationships between senior scientists and young scientists and students were encouraged. These relationships help new scientists develop scientific ideas, research projects and papers, which becoming one of our remarkable outcomes. It gives students and early-career scientists detailed practical examples of remote sensing techniques used for monitoring the ocean-atmosphere system for research and operations, and the ability to develop networks with other students and senior scientists.

The implementation of this course for one month based on the capacity building was divided into three (3) main parts, namely, 1) Supporting maritime development in the region for climate preparedness technology, 2) Monitoring marine natural resources, 3) Assessing climate and human impacts on coastal areas, (e.g., monitoring sea level and sea level rise, coral reefs, and marine resources utilization planning for tourism and 4) Linking interaction coastal/ocean and between atmospheric processes and its impact on society.

Methodology

At the beginning of this course, students were divided into seven (7) groups. The Capacity Building Development (CBD) on Ocean Remote Sensing towards Climate Resilience was innovated to work on the Open Learning Massive Open Online Course (MOOC) Platform. The MOOC course consists of 13 modules prepared by 13 international instructors worldwide to ensure students achieve the Course Learning Outcome. Figure 1 illustrates the depicts 12 Malaysians, three (3) Indians, six (6) Indonesians, and one (1) each from Bangladesh, Pakistan, Sri Lanka, Taiwan, and the Phillipines., while Figure 2 shows the overall process of conducting the MOOC approach for the capacity building of climate resilience. Each module contained pre-recorded videos, and assessments to measure the student understanding. In addition to the 13 modules. student-mentorship program had added values to the course, where instructors became mentors to group of students and assist in developing scientific ideas, research projects and papers. were involved in this course to ensure students achieve the CLO through their real projects

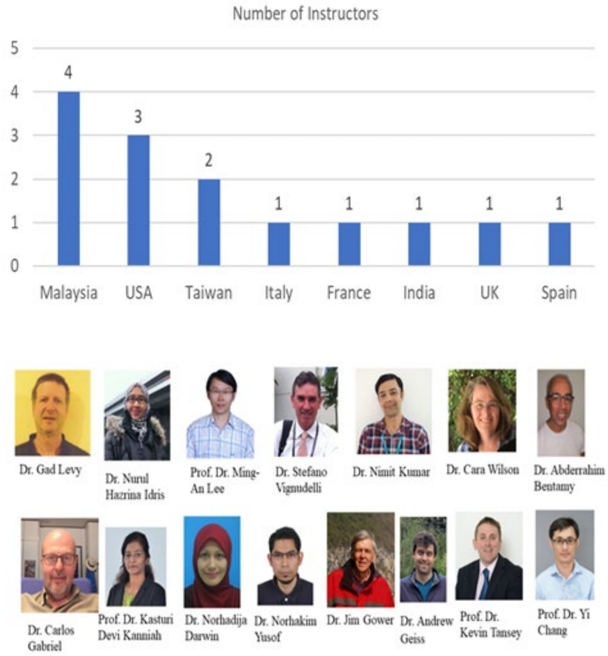

Figure 1: Number of instructors globally

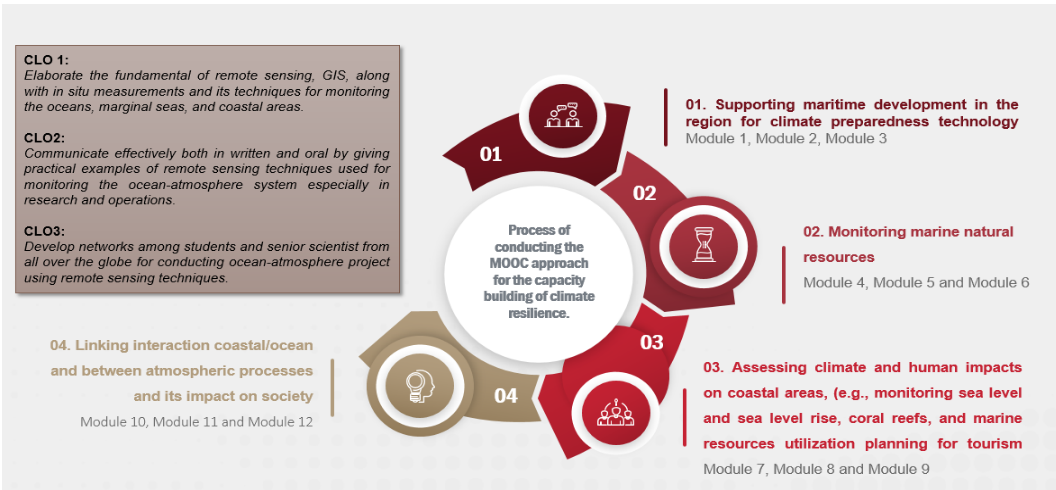

Figure 2: Overall process of conducting the MOOC approach for the capacity building of climate resilience

Effective policies for sustenance of coastal countries can be devised from informed decisions, for which, robust monitoring of oceans is a must. The persistent advancement of satellite remote sensing technology offers an array of parameters through which behavior of oceans can be monitored and predicted. Undoubtedly, ocean remote sensing (ORS) has not only saved millions of lives and assets in past few decades, the technology has led to the prosperity manifold. It is thus imperative that the ORS will continue to guide the way for better management of our resources and environment in the future. However, the best outcomes of the technology can only be achieved through the continuous exchange of the know-how across the globe, especially to the rising generation.

The physical CBD tutorials have been a feature of past PORSECs since 2000 and have been found to provide valuable interaction between senior professionals and researchers, early career scientists and professionals, and students. Due to pandemic COVID-19, the physical CBD was transformed to a digital and flexible learning. The course was designed with two important components: 1) teaching and learning materials through pre-recorded videos and assessments;

and 2) student-mentorship program. The instructors are among the leading scientists and professors from reputable governmental agencies and universities from Malaysia, United States, United Kingdom, France, Italy, Taiwan and Spain. The CDB course offers flexible learning and learning-on-demand. Remote sensing techniques are very useful tools in the study of sustainability research, widely used in support to science-based decision-making. During CDB, participants have an opportunity to learn new technical and scientific approaches that have been used not only in the Asia-Pacific region but elsewhere, and that can be used alongside modeling and other sources of in situ data towards decision making. Figure 3 shows the title of each modules and module activities.

NU.	MODULE	SPEAKER
1	Fundamentals of Remote Sensing	Prof. Dr. Kasturi Devi Kanniah Universiti Teknologi Malaysia
	Fundamentals of SST and Thermal Front Analysis	Prof. Dr. Ming-An Lee National Taiwan Ocean University Prof. Yi Chang National Sun Yat-sen University
2	Fundamentals of Altimetry	Dr. Stefano Vignudelli The National Research Council Italy (CN Assoc. Prof. Dr. Nurul Hazrina Idris Universiti Teknologi Malaysia
	Fundamentals of Microwave Radiometric Sensing of the Earth from Space Fundamentals of UAV for Coastal Monitoring	Dr. Leonid Mitnik Russia Academy of Sciences Dr. Norhadija Darwin Universiti Teknologi Malaysia
3	Satellite Wind Data and Applications	Dr. Aberrahim Bentamy IFREMER
4	Fundamentals of Ocean Color	Dr. Cara Wilson National Oceanic and Atmospheric Administration (NOAA)
5	Data Assimilation	Dr. Gad Levy NorthWest Researh Associates - Seattle
6	Machine Learning	Dr. Andrew Giess Pacific Northwest National Laboratory -
7	Satellite Applications in Fisheries	Dr. Nimit Kumar Indian National Centre for Ocean Informa Services (INCOIS)
8	Nearshore Altimetry	Assoc. Prof. Dr. Nurul Hazrina Idris Universiti Teknologi Malaysia Dr. Stefano Vignudelli The National Research Council Italy (CN
9	Accessing Satellite Data with ERDDAP	Dr. Cara Wilson National Oceanic and Atmospheric Administration (NOAA)
10	Accessing Satellite Data with ArcGIS	Dr. Norhakim Yusof/ Assoc. Prof. Dr. Nurul Hazrina Idris Universiti Teknologi Malaysia
11	Getting Published in an International Journal	Prof. Dr. Kevin Tansey, IJRS Editor-in-Chie University of Leicester
12	Student Mentorship Program	Mentor and students

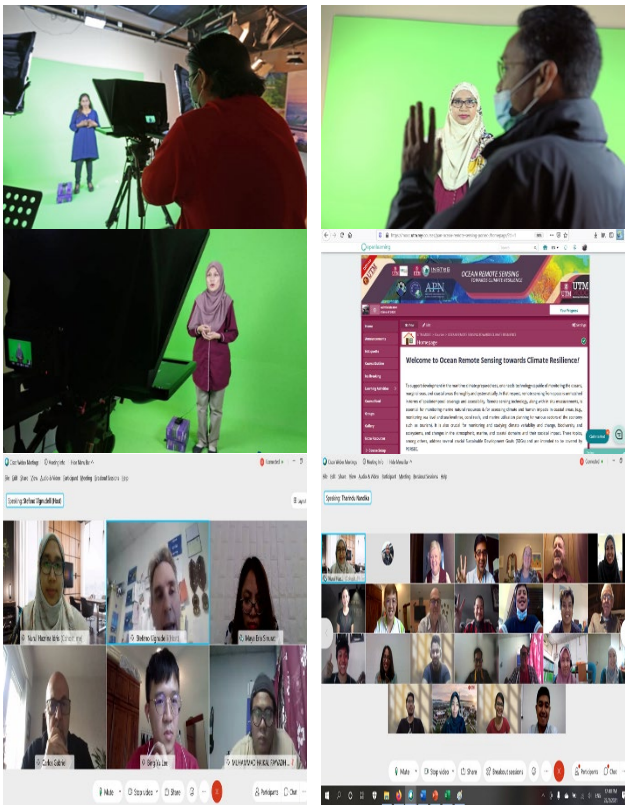

Figure 3: Title of each module and module activities.

The advantage of this course is it improves participants' understanding of and capacity to deal with issues of the maritime environment. By utilising remote sensing technology, students can more effectively assess and track Earth's environmental processes, including climatic variability and oceanic risks such as pollution and sea level rise. By enabling data collection from satellites or airborne equipment, remote sensing aids in developing more practical solutions to address these problems and offers vital insights into changes in the marine ecosystem.

In addition, this course also offers flexible learning; students can adjust the course to meet their schedules and study on their own time. Hence, learning on demand enables rapid and customized learning experiences by giving students access to instructional materials whenever needed. Because participants can immediately obtain knowledge or training when new developments happen, this technique is especially effective in sectors that require ongoing updates. This allows education to be better tailored to the needs of individual students.

Impacted of MOOC on Capacity Building

This MOOC UTM-PORSEC has outlined three Course Learning Outcomes where the students will be able to first elaborate on the fundamental of remote sensing, GIS, along with in situ measurements and its techniques for monitoring the oceans, marginal seas, and coastal areas. Secondly, students able to communicate effectively both in written and oral by giving practical examples of remote sensing techniques used for monitoring the ocean-atmosphere system especially in research and operations. Finally, student developed networks among fellow students and senior scientist from all over the globe. A total of 71 students from all around the world have successfully participated in this MOOC UTM-PORSCE. Based on Figure 4, we found that 71% of students were able to explain the fundamentals of remote sensing, GIS, as well as in situ measurements and its techniques. The assessment of CLO1 is based on the quiz and test given by the instructor for every module after their completed watched the pre-recorded videos. Meanwhile, 73% of students able to communicate effectively both in written and oral as well as developed networks among fellow students and senior scientist from all over the globe. These CLO2 and CLO3 achievements is based on report produced by the students and meeting between mentor and students. Apart from that, a survey was conducted to measure students' personal achievement in 1) technical skills, 2) Knowledge Enhanced, and 3) Organising skills. The enhanced PBL approach focusing on collaboration with academic and industry experts has shown a significant positive impact on students' personal achievement, as shown in Figure 5. Figure 5 shows that 91% of students achieved technical skills. Meanwhile, 92% of students gain enhanced knowledge from this course, and 93% achieve organising skills at the end of this course. As for student satisfaction, 100% of students were satisfied with this MOOC on capacity building approach, where students found this course engages students with active learning and flexible sharing with experts via online and physical mode.

In conclusion, students are capable of managing the planning phase until the practical phase of using the remote sensing data for mapping purposes through MOOC approach. This teaching and learning approach in the capacity building to climate impact courses will surely provide a new digital learning experience and improve students' critical thinking ability to manage their projects research and innovations.

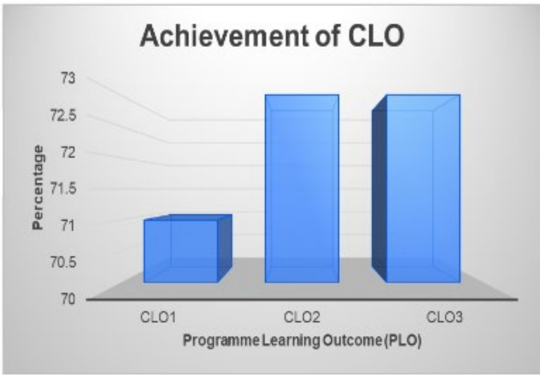

Figure 4: Achievement of Course Learning Outcome (CLO)

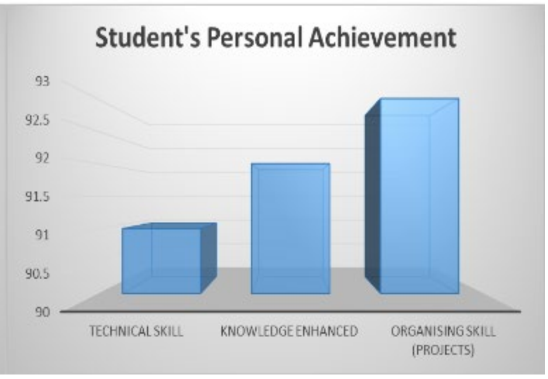

Figure 5: Student's Personal Achievement

Figure 6: Student's Feedback on MOOC approach for the Capacity Building

Acknowledgement

We thank PORSEC Association for the expert advice and contributions to the teaching materials, Universiti Teknologi Malaysia (UTM) MOOC team for the technical assistance, the Asia Pacific Network (APN) for Global Change Research for supporting the CBD program under the Capacity Building Development program (CAPaBLE; Ref. CBA2020-08SY-Idris), and Committee of Space Research (COSPAR) for the expert advice and support funding.

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PORSEC publishes a Bulletin 3 times per year, with news and articles on the association's activities. All can be accessed via https://porsec.nwra.com/bulletins. The following Bulletins have final reports of previous CB courses:

Selected other PORSEC publications are listed on the PORSEC website: https://porsec.nwra.com/publications/

The Capacity building program is also described in:

Katsaros, K. B., G. Levy, A. Bentamy, S. King, J. F. R. Gower, and C. Wilson: TUTORIAL ON REMOTE SENSING FOR CAPACITY BUILDING, Outreach and Broader Impacts session, 26th Symposium on Education, Proceedings of The 97th AMS Annual Meeting, Seattle, WA, January 22–26, 2017. American Meteorological Society (available on: https://ams.confex.com/ams/97Annual/webprogram/Paper313965.html).

Kumar, Nimit, Kristina B. Katsaros, Gad Levy, Stephanie King, and Cara Wilson, 2018: PORSEC Activities - An Overview: Remote Sensing Tutorials For Capacity Building Across The Globe. Programme Guide (p.16) and Book of Abstracts & Lead Articles (p. 159), The Second International Symposium Remote Sensing for Ecosystem Analysis and Fisheries. Societal Applications in Fisheries and Aquaculture using Remote Sensing Imagery. January 15 to 17 Kochi, India. ISBN: 978-93-82263-19-7

ID 118: Pet Zoo Mini: Menyemai Nilai Pelajar dan Membantu Pendidikan Awal Kanak-Kanak melalui Pembelajaran Pengalaman

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Sorotan: Projek "Pet Zoo Mini: Menyemai Nilai Pelajar dan Membantu Pendidikan Awal Kanak-Kanak melalui Pembelajaran Pengalaman" mengintegrasikan inisiatif komuniti dengan pembangunan peribadi melalui penciptaan mini pet zoo di tadika. Pelajar Pandu Puteri terlibat dalam semua aspek projek, termasuk perancangan, pelaksanaan, dan pengurusan zoo, yang meningkatkan kemahiran kepimpinan, kerjasama, dan empati mereka. Kanak-kanak tadika mendapat manfaat daripada persekitaran pembelajaran interaktif yang memperkukuhkan minat mereka terhadap penjagaan haiwan. Projek ini tidak hanya memupuk kemahiran sosial dan peribadi tetapi juga memperkuat hubungan antara komuniti dan institusi pendidikan melalui pendekatan inovatif dalam pengajaran dan pembelajaran.

Kata kunci: *Pembelajaran Pengalaman; Pembangunan Peribadi; Projek Komuniti; Kepimpinan; Kerjasama*

Pengenalan kepada Projek

Projek Pet Zoo Mini adalah inisiatif yang bertujuan untuk memupuk pembelajaran melalui pengalaman dengan mencipta zoo mini di sebuah tadika. Melibatkan 34 pelajar Pandu Puteri, projek ini merangkumi setiap peringkat dari perancangan dan pelaksanaan hingga pengurusan zoo, dengan matlamat utama meningkatkan kemahiran kepimpinan, kerjasama, dan empati pelajar. Sementara itu, kanak-kanak tadika mendapat manfaat dari pembelajaran interaktif yang meningkatkan minat mereka dalam penjagaan haiwan dan mengembangkan kemahiran sosial melalui modul yang direka dengan pendekatan kreativiti dan komunikasi bersama haiwan peliharaan.

Dalam konteks pembelajaran melalui pengalaman, menghubungkan teori dengan amalan adalah elemen penting dalam pembangunan kemahiran peribadi pelajar. Kolb (2015) dan Fleming & Haigh (2017) menunjukkan bahawa pembelajaran pengalaman membolehkan pelajar memahami konsep akademik secara lebih mendalam dan memajukan kemahiran hidup seperti penyelesaian masalah dan kepimpinan. Jackson (2019) menekankan bahawa latihan amali dan projek kumpulan mengasah kemahiran komunikasi, kerja berpasukan, dan kepimpinan, yang dihargai oleh majikan. Moore (2020) dan Sattin-Bajaj (2021) mengesahkan bahawa pengalaman praktikal meningkatkan kebolehpasaran pelajar dan keyakinan mereka dalam menerapkan pengetahuan akademik.

Projek ini membolehkan pelajar mempraktikkan teori yang telah dipelajari dalam situasi sebenar dengan menggabungkan kreativiti dan interaksi sosial. Kajian sebelumnya menunjukkan bahawa pendekatan pembelajaran berasaskan pengalaman, seperti projek komuniti dan interaksi dengan haiwan, boleh meningkatkan kemahiran sosial dan perkembangan emosi kanak-kanak (Koh et al., 2019; Smith & Brown, 2020). Anderson dan Green (2018) mendapati bahawa program perkhidmatan komuniti meningkatkan kemahiran kepimpinan dan empati dalam kalangan pelajar. Oleh itu, projek ini memanfaatkan penemuan tersebut dengan menggunakan mini pet zoo sebagai alat pembelajaran praktikal, memberikan manfaat kepada pelajar Pandu Puteri dan kanak-kanak tadika.

Projek Mini Pet Zoo

Interaksi kanak-kanak dengan haiwan peliharaan memupuk empati, meningkatkan rasa tanggungjawab, dan memperbaiki kemahiran komunikasi. Kanak-kanak yang menjaga haiwan peliharaan belajar memahami keperluan makhluk hidup lain, yang membantu mereka mengembangkan sikap empati dan perhatian, serta memperbaiki hubungan sosial mereka. Tanggungjawab harian seperti memberi makan dan membersihkan haiwan peliharaan mengajar disiplin dan keprihatinan. Kajian menunjukkan bahawa haiwan peliharaan dapat membantu kanak-kanak yang pemalu atau mempunyai kesukaran komunikasi untuk lebih yakin dan terbuka (Melson, 2003; Endenburg & Baarda, 1995).

Projek ini dilaksanakan di Tadika Kemas Taman Universiti yang sebelum ini tidak mempunyai mini pet zoo akibat kekangan pengendalian dan kewangan. Dengan pendekatan inovatif ini, pelajar Pandu Puteri memperkasa pembangunan peribadi mereka melalui pengembangan kemahiran seperti kepimpinan, kerjasama, dan empati. Projek ini juga menggalakkan penglibatan pelajar dalam komuniti, menambah pengalaman mereka sebelum menjalani latihan perguruan.

Keaslian: Projek ini menggabungkan elemen perkhidmatan komuniti dengan pembangunan peribadi melalui penggunaan mini pet zoo, menawarkan pendekatan baru dalam pendidikan awal kanak-kanak dan penglibatan komuniti.

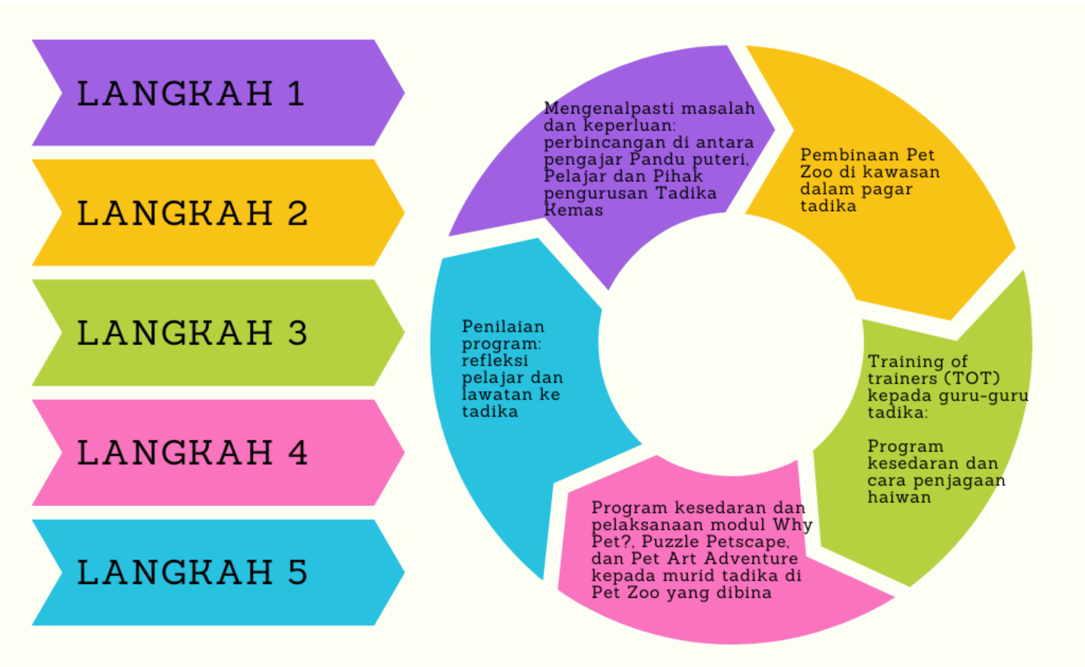
Kreativiti: Menunjukkan kreativiti dalam merancang dan melaksanakan projek yang memberi manfaat kepada kanak-kanak dan memupuk kemahiran peribadi pelajar Pandu Puteri melalui tiga modul penjagaan haiwan yang dibangunkan.

Inovatif: Menggunakan mini pet zoo dan pembangunan modul sebagai alat inovatif untuk menghubungkan pengajaran dengan pengalaman praktikal, menyokong perkembangan peribadi pelajar dan memberikan manfaat pendidikan kepada kanak-kanak.

Kebolehlaksanaan: Model ini boleh diterapkan dalam pelbagai konteks pendidikan dan komuniti, menunjukkan kebolehlaksanaan dan kesesuaian pendekatan ini untuk meningkatkan pengalaman pembelajaran dan pembangunan peribadi.

Impak: Projek ini menunjukkan impak positif dengan memperkasa pelajar Pandu Puteri melalui pengalaman praktikal dan memberi manfaat kepada kanak-kanak di tadika, serta memperbaiki hubungan antara komuniti dan institusi pendidikan. Pihak pengurusan tadika bersama pelajar berjaya mengendalikan mini pet zoo selepas projek ini, menunjukkan kelestarian program ini.

Kaedah Kajian



Rajah 1: Langkah Pelaksanaan Projek

Projek ini melibatkan lima langkah iaitu 1) Mengenalpasti masalah dan keperluan; 2) Pembinaan Pet Zoo Mini; 3) TOT kepada guru-guru tadika; 4) Program kesedaran dan pelaksanaa modul kepada Murid Tadika Tadika Kemas; 5) Penilaian Projek. Projek ini dijalankan dari April hingga Jun 2024 di Tadika Kemas Taman Universiti, melibatkan 34 orang kanak-kanak tadika. Pelajar Pandu Puteri merancang dan melaksanakan mini pet zoo dengan input daripada pengajar untuk memastikan modul yang dihasilkan sesuai dengan pendidikan kanak-kanak, termasuk pemilihan haiwan dan reka bentuk kawasan. Terdapat tiga modul penjagaan haiwan yang melibatkan elemen kreativiti dan empati untuk meningkatkan kesedaran tentang penjagaan haiwan peliharaan yang betul.

Kaedah penilaian kualitatif menggunakan analisis kandungan diterapkan untuk menganalisis data. Seramai 34 pelajar memberikan refleksi mengenai apa yang mereka peroleh semasa menjalankan projek ini, cabaran dan penambahbaikan projek, yang dianalisis menggunakan analisis tematik (Braun & Clarke, 2006). Analisis ini menilai kesan program terhadap pembelajaran pengalaman pelajar dalam meningkatkan kemahiran peribadi mereka.

Dapatan Kajian

Dapatan kajian telah menyerlahkan tiga tema utama mengenai bagaimana projek ini mempengaruhi pengalaman pembelajaran pelajar dalam meningkatkan kemahiran peribadi mereka:

Kerja Berpasukan dan Kerjasama

Cabaran utama termasuk isu penyelarasan semasa projek, komunikasi yang jelas, dan peranan setiap ahli kumpulan. Peranan pemimpin serta komunikasi terbuka dan kerjasama yang tinggi di kalangan ahli kumpulan adalah faktor kritikal kejayaan projek. Strategi seperti mesyuarat tetap, pembahagian tugas yang jelas, mendengar secara aktif, dan penggunaan pelbagai platform komunikasi dapat memastikan kerjasama yang berkesan.

Strategi Komunikasi

Keupayaan berkomunikasi baik antara ahli kumpulan dan antara pemimpin dan ahli kumpulan dikenalpasti sebagai faktor kejayaan. Kesalahpahaman dan kurang kejelasan dalam arahan boleh menimbulkan kekeliruan, menjadi halangan kepada kejayaan projek. Pelajar mencadangkan strategi seperti kekerapan mesyuarat dan pembahagian tugas yang jelas untuk mengatasi masalah ini.

Pembelajaran melalui Pengalaman

Aktiviti praktikal seperti interaksi dengan kanak-kanak dan pengurusan haiwan memperkukuh pembelajaran melalui pengalaman, meningkatkan kemahiran organisasi dan kecekapan interpersonal pelajar. Projek Pet Zoo Mini dilihat sebagai platform pembelajaran yang signifikan, di mana pelajar dapat mengaplikasikan teori dalam konteks praktikal, mengukuhkan kefahaman mereka terhadap tanggungjawab sosial sambil mengintegrasikan pengetahuan akademik dengan realiti masyarakat.

Secara keseluruhan, refleksi pelajar menekankan kepentingan kerja berpasukan, komunikasi, dan peranan tersusun dalam memastikan kejayaan projek kerjasama seperti Mini Pet Zoo. Pelajar memperoleh pengalaman praktikal dan kemahiran kerja berpasukan yang berharga, yang boleh dipindahkan ke projek masa depan.

Kesimpulan

Projek "Pet Zoo Mini: Menyemai Nilai Pelajar dan Membantu Pendidikan Awal Kanak-Kanak melalui Pembelajaran Pengalaman" telah menunjukkan kejayaan dalam mengintegrasikan pembangunan peribadi pelajar dengan manfaat pendidikan kepada kanak-kanak tadika. Pelajar Pandu Puteri memperoleh kemahiran kepimpinan, kerjasama, dan empati melalui perancangan, pelaksanaan, dan pengurusan mini pet zoo, sementara kanak-kanak tadika mendapat pembelajaran interaktif yang memperkukuhkan minat mereka terhadap penjagaan haiwan.

Kajian ini membuktikan bahawa pendekatan pembelajaran melalui pengalaman, seperti interaksi dengan haiwan, memperbaiki kemahiran sosial dan emosi kanak-kanak serta meningkatkan kemahiran peribadi pelajar. Projek ini memberikan bukti kuat bahawa model ini boleh diterapkan dalam pelbagai konteks pendidikan dan komuniti, dengan impak positif yang signifikan dalam pengajaran dan pembelajaran.

Penghargaan

Penghargaan diberikan kepada semua pelajar Pandu Puteri dan pihak Tadika Kemas Taman Universiti atas komitmen dan sokongan dalam menjayakan projek "Pet Zoo Mini: Menyemai Nilai Pelajar dan Membantu Pendidikan Awal Kanak-Kanak melalui Pembelajaran Pengalaman". Terima kasih juga kepada penyelia dan pengajar yang telah memberikan bimbingan serta kepada semua yang terlibat dalam penilaian dan analisis data projek ini.

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ID 119: Business Case Lab: Transforming Entrepreneurship Education with Practical Case Studies

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Highlights: The "Business Case Lab: From Real-World Challenges to Cutting-Edge Solutions" project harnesses experiential learning to deepen students' entrepreneurial skills by engaging them directly with real-world business scenarios. The project flow begins by selecting entrepreneurs whose experiences align closely with the course objectives, focusing on complex challenges that offer substantial learning opportunities. These entrepreneurs are invited to deliver online talks, during which they share detailed case studies about their businesses. This setup not only provides students with practical insights but also firsthand experiences from the entrepreneurs' perspectives. Following the talks, these case studies are designed and uploaded to the 'Business Case Lab' (BCL) website, creating a repository of real-world problems for students to access. Students then undertake research and devise innovative solutions to these challenges, culminating in presentations of their solutions in class. This interactive process not only allows students to apply theoretical knowledge in practical settings but also encourages the development of feasible business prototypes. The direct engagement with entrepreneurs through this structured framework significantly enhances students' abilities in business planning, prototype development, and resource management, preparing them for real entrepreneurial environments. This approach enhances their skills in business planning, prototype development, and resource management, by engaging directly with the entrepreneurs. It's not just about learning, it's about being part of the entrepreneurial journey.

Keywords: *Experiential Learning; Entrepreneurship; Industry Talk Series; Case Studies; Website Development*

Introduction

In today's dynamic entrepreneurial environment, students often find it challenging to connect classroom theory with the practical realities of starting and managing a business. Traditional education methods, which rely heavily on theoretical instruction, can leave students underprepared for the complexities of real-world entrepreneurial challenges (Wang et al., 2019). This gap between theory and practice can hinder their ability to develop innovative solutions and effectively launch new ventures.

The "Business Case Lab: From Real-World Challenges to Cutting-Edge Solutions" project addresses this problem by incorporating experiential learning into the entrepreneurship curriculum (Motta & galina, 2023). Recognizing the limitations of a theory-only approach, this project transforms industry talks from successful entrepreneurs into comprehensive case studies. These case studies bridge theoretical concepts and real-world applications, offering students practical insights into feasibility analysis, technology-oriented ventures, and entrepreneurs' challenges (Ramsgaard & Christensen, 2018). The project involves several key steps: planning and selecting entrepreneurs for the talks, hosting webinars, and developing a dedicated website to house the case studies. Students engage with these resources by conducting feasibility studies and presenting their findings to industry experts in the classroom. This interactive process enhances their understanding of entrepreneurship and hone critical skills in business planning, prototype development, and resource management.

By integrating real-world experiences into the learning process, the "Business Case Lab" equips students with the tools they need to navigate the entrepreneurial landscape. It transforms theoretical knowledge into practical, actionable insights that prepare students for success in their future ventures.

Objectives of the study

The objectives of the teaching innovation are:

i. **Enhance Practical Entrepreneurial Skills:** To provide students with practical, hands-on experience in solving real-world business problems, thereby enhancing their entrepreneurial skills such as strategic thinking, problem-solving, and innovation.

ii. **Facilitate Direct Interaction with Industry Leaders:** To enable students to interact directly with experienced entrepreneurs, gaining insights into the challenges and decision-making processes in the business world, which will enrich their understanding and perspective on entrepreneurship.

iii. **Resource Accessibility and Integration:** To create a central repository where students can easily access and retrieve case studies, recorded talks, and supplementary materials. The website will be designed to facilitate seamless navigation and integration of learning resources, enhancing the educational experience.

Novelty

The novelty of the designed Entrepreneurial experiential learning through 'Business Case Lab (BCL)' is:

i. This project seamlessly blends academic research with practical teaching by transforming industry talks from experienced entrepreneurs into detailed case studies.

ii. Unlike traditional classroom-based learning, this project strongly emphasizes applying theoretical concepts to real-world entrepreneurial challenges.

iii. The project contributes to the broader entrepreneurial ecosystem by highlighting Malaysian entrepreneurs' successes and challenges.

iv. By documenting and showcasing these entrepreneurs' journeys on a dedicated website, the project provides a valuable resource and central repository for students and the wider community.

Kolb Experiential Learning in Entrepreneurship Education

Experiential learning is defined as "the process by which knowledge is created through the transformation of experience. The results of knowledge from a combination of grasping and changing experiences" (Kolb, 1984). Kolb's Experiential Learning Theory structured the entrepreneurship experiential learning process in the "Business Case Lab: Transforming Entrepreneurship Education with Practical Case Studies" project. Concrete Experience begins with students identifying challenges and validating opportunities, performing feasibility analysis, and mapping technology-oriented ventures Reflective Observation follows as students analyze and reflect on insights gained from documented industry talks and develop conceptual prototypes based on their reflections. In the Abstract Conceptualization phase, students formulate new business concepts and write detailed technology business plans, integrating their reflective observations with theoretical frameworks. Finally, Active Experimentation involves testing and implementing strategies and applying the acquired knowledge to real-world activities, such as pitching solutions to industry experts. This structured approach ensures that students gain practical insights, enhance their business planning skills, and effectively manage resources, bridging the gap between theory and practice in entrepreneurship education.

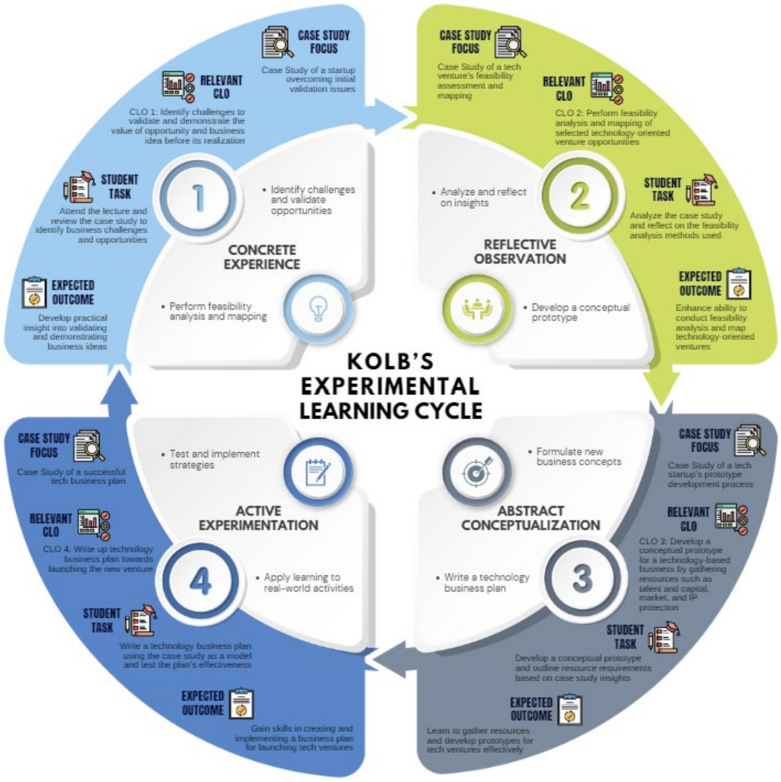


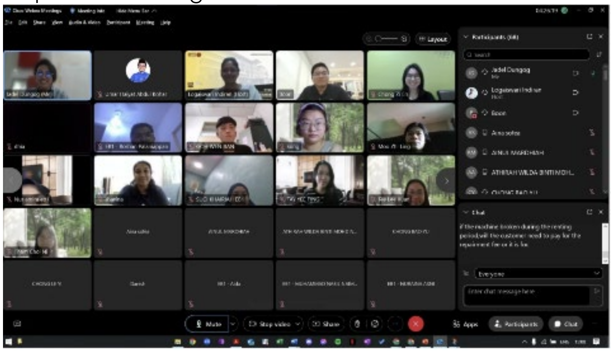
Figure 1: Kolb Experiential Learning in Entrepreneurship Education

Methodology

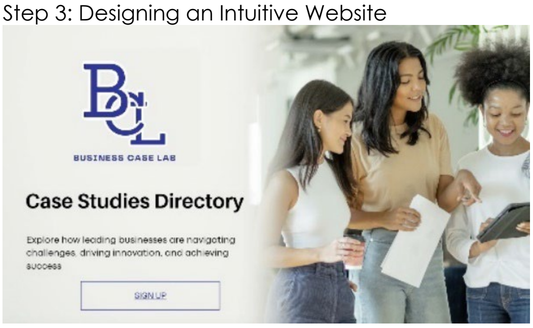
The research method for the "Business Case Lab: From Real-World Challenges to Cutting-Edge Solutions" project involves a systematic approach that begins with identifying and selecting entrepreneurs whose experiences will provide valuable insights into the entrepreneurial process. These entrepreneurs participate in online webinars, where their talks are documented and later transformed into case studies. A dedicated website is then designed and developed to host these case studies, making them accessible to students and the broader community. The content is carefully integrated and uploaded to ensure it is engaging and informative. Students use these case studies to conduct feasibility studies, applying theoretical knowledge to real-world scenarios. Finally, students present their solutions to industry experts in the classroom, providing them with direct feedback and further enhancing their learning experience.

Step 1: Identifying Visionary Local Entrepreneurs

Step 2: Conducting Webinars

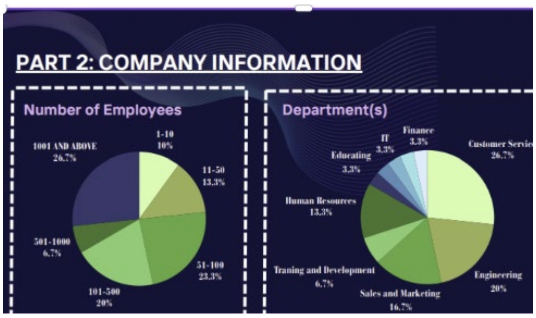


Step 3: Designing an Intuitive Website

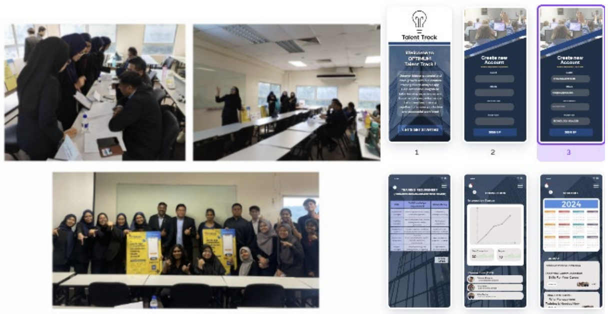


Step 4: Uploading and Managing Quality Content

Step 5: Students Conduct Feasibility Studies



Step 6: Students Presenting Solutions to Industry in the Classroom



Result and Discussion

The results regarding students' perceptions of the "Business Case Lab: From Real-World Challenges to Cutting-Edge Solutions" project are illustrated in Table 1. These findings indicate that students have made significant progress and gained valuable insights from implementing the project's instructional approach. The research method has been effective, and it involves identifying and selecting entrepreneurs, hosting online webinars, documenting talks, and creating case studies. Students have notably improved in conducting feasibility studies and applying theoretical knowledge to practical scenarios. Developing and using a dedicated website and presenting solutions to industry experts have further enhanced students' skills in business planning, prototype development, and resource management.

Table 1: The Effectiveness of Using Case Study in Teaching Entrepreneurship

Questions	Mean
The industry talk series were helpful in the case studies.	4.5
The case studies helped me understand tech entrepreneurship well.	4.0
The case studies improved my problem-solving skills.	4.7
Working on case studies helped me develop innovative business ideas.	4.7
Presenting case solutions to the industry was impactful.	4.1
The case studies prepared me for real-world challenges.	4.7
The instructions for the case studies were clear and easy to follow.	4.3
Overall, I am satisfied with using case studies to learn about tech entrepreneurship.	4.7

Commercialization Potential:

The development of 'Business Case Lab (BCL)' (Figure 2) offers a few commercialization opportunities:

Subscription Model
BCL implements a tiered subscription model for the Business Lab Cases website, offering basic, premium, and corporate levels. Basic includes limited access, while premium features comprehensive resources. In addition, corporate subscriptions provide tailored content and analytics, ensuring a steady revenue stream.

Institutional Licensing
BCL offers licensing agreements for institutions, with options for single- or multi-institution access. Custom licenses can include additional services like on-site training, expanding the project's reach and fostering institutional partnerships.

Consulting Services
BCL provides expert consulting to assist with curriculum development, training workshops, and custom solutions. These services enhance institutional use of resources and generate additional revenue, establishing the project as a leader in entrepreneurship education.

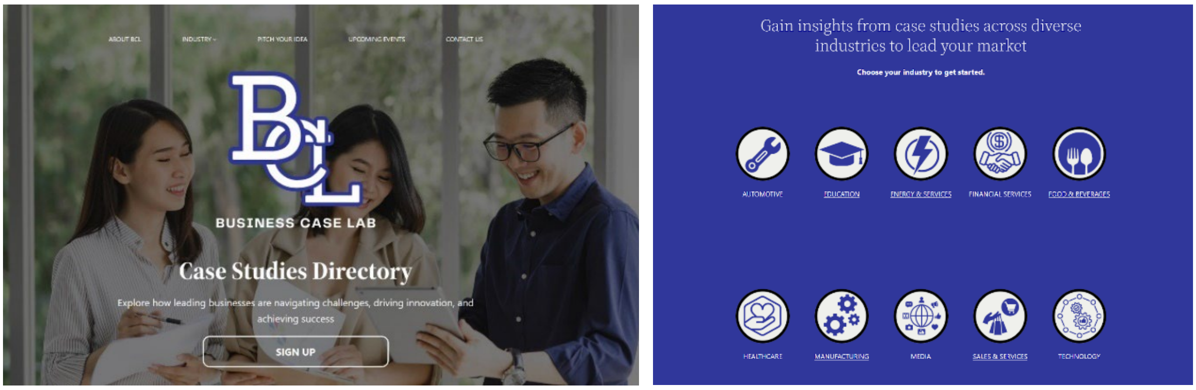


Figure 2: Business Case Lab website user interface

Conclusion

The "Business Case Lab: From Real-World Challenges to Cutting-Edge Solutions" project stands as a pioneering initiative in entrepreneurship education, deeply rooted in experiential learning. This educational model is meticulously designed to bridge the often-cited gap between theoretical knowledge and real-world application, providing students with a robust platform to engage directly with practical business challenges and seasoned entrepreneurs. By incorporating actual case studies from industry and facilitating direct interaction with the entrepreneurs involved, the project offers an immersive learning experience that is rare in traditional academic settings. These interactions are about hearing success stories and dissecting the complexities and setbacks these professionals face. This method allows students to see the realities of entrepreneurship beyond what textbooks can offer thus preparing them for the unpredictability and dynamism of the business world.

Moreover, the project's structure supports a comprehensive learning journey from the initial introduction of case studies to the interactive online talks, followed by in-depth analysis and solution development. Students are encouraged to develop and present innovative solutions to the presented challenges, critiqued by their peers and the entrepreneurs themselves. This presentation, feedback, and refinement cycle is crucial for developing critical thinking and problem-solving skills.

The dedicated 'Business Case Lab' website amplifies the reach and impact of this initiative by providing a central repository for all learning materials, including recorded talks, case study documentation, and student presentations. This accessibility ensures that the learning does not end with the semester but continues as students can revisit the materials and refine their understanding and approaches. The website also serves as a living library of entrepreneurial knowledge that can be continually updated with new cases and insights, making it a valuable resource for both current students and alumni. Figure 3 shows the overall process of this project: Business Case Lab.

Furthermore, the project contributes significantly to the entrepreneurial ecosystem by highlighting the journeys of Malaysian entrepreneurs, thereby providing localized content that is more relatable and applicable to the students' context. This focus not only enriches the students' learning experience but also fosters a sense of community and connectivity with the local business landscape. In conclusion, the "Business Case Lab" project is more than an educational program; it is a vital link connecting academic learning with the entrepreneurial world. By enabling students to interact with real businesses and develop practical solutions to genuine problems, the project equips them with the skills, confidence, and insights necessary to succeed in their entrepreneurial endeavors. This approach ensures that graduates are not only well-versed in the theories of business management but are also adept at applying these concepts in meaningful and innovative ways, thereby contributing to their personal growth and the broader economic landscape.

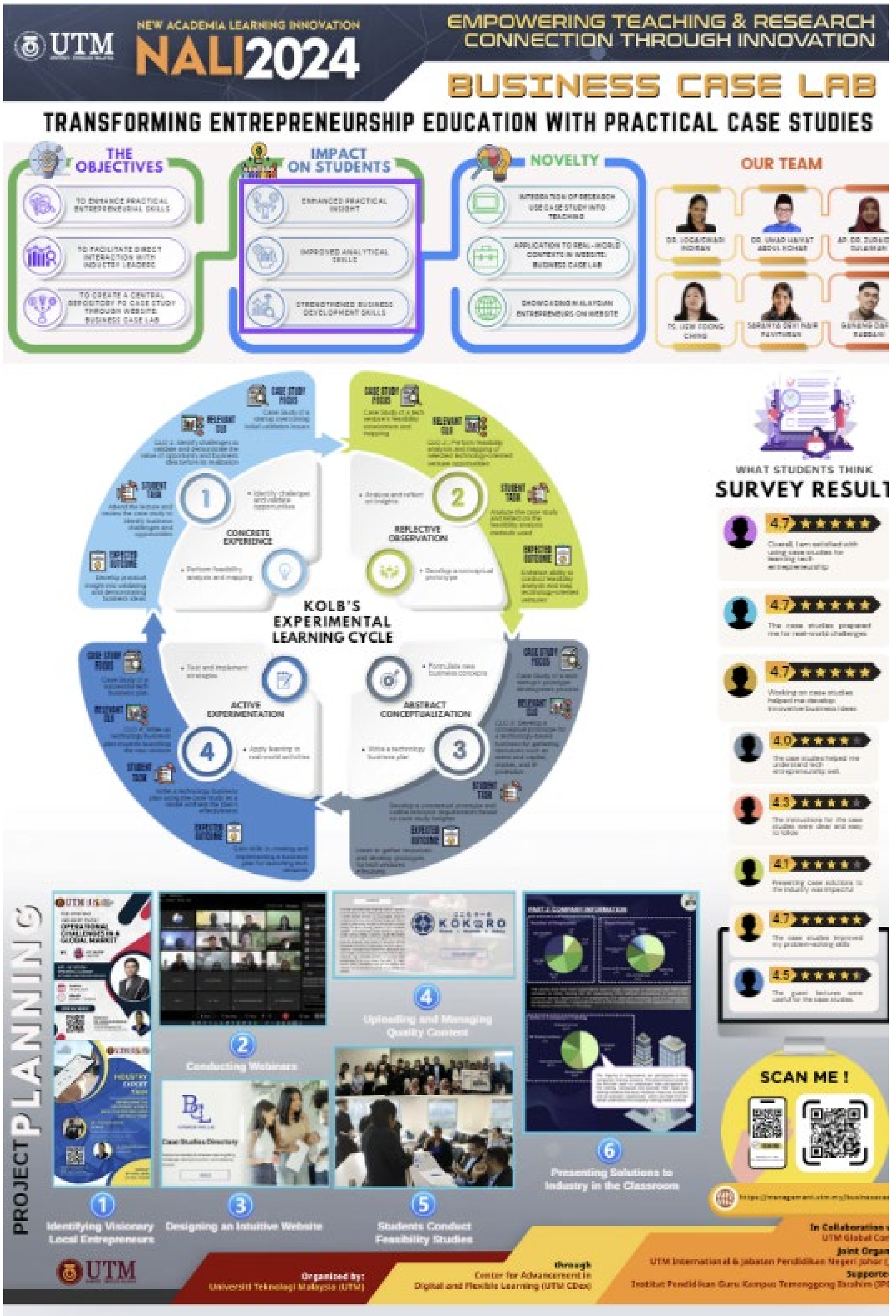


Figure 3: The overall process of this project: Business Case Lab (BCL)

Acknowledgement

We would like to express our sincere gratitude to OPTIMUM Professional Training Academic (OPTA) and ATP Group Sdn. Bhd. for generously providing their company case studies. Their contributions have significantly enriched our project and enhanced the learning experience for the students.

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ID 120: Sip & Learn: Exploring Price Perception through a Mineral Water Marketing Experiment

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Highlights: Through a classroom-based experiment to enhance active learning, this project investigates how price and origin beliefs influence consumer taste perceptions. Thirty undergraduate marketing students were divided into two groups: receiving higher-priced mineral waters and lower-priced ones. After a blind taste test, ginger pickle was provided to reset the taste buds between samples, and the students ranked the waters before engaging in collaborative analysis. They combined sensory data and pricing information to recommend products for different client segments, simulating real-world decision-making.

Keywords: *Price perception; scenario-based learning; situated cognition; collaborative inquiry; consumer behaviour.*

Introduction (Project or Innovation)

Pricing is fundamental in consumer decision-making, particularly for products with minimal physical differences, such as mineral water. In this innovative teaching project, students apply pricing theory through a scenario-based approach, using real-world examples to understand how price perception, quality, and brand reputation influence consumer behaviour. The practical application of this research is evident in the students' ability to recommend products for different client segments, simulating real-world decision-making. This real-world relevance of the project makes it applicable and impactful. This activity aligns with the Situated Cognition theory, where students learn by engaging in real-life scenarios that simulate market conditions.

To maintain consistency and accuracy in taste assessment, ginger pickle was provided between water samples to cleanse the palate, ensuring that each sample was tasted neutrally. This project is designed to foster a sense of collaboration and shared learning. It focuses on student-centred and experiential learning. This exercise enhances students' analytical skills in pricing decisions by positioning them as event consultants, allowing them to apply theoretical knowledge in a practical context collaboratively. The collaborative nature of this project ensures that students feel connected and involved in their learning process.

Content (Project or Innovation)

Project Objectives

The primary objectives of this project are:

- Investigate the role of price in shaping consumer perceptions of product quality.
- Examine the influence of origin beliefs on taste perception.
- Engage students in experiential learning that illustrates key pricing theory concepts.
- Demonstrate the applicability of pricing theory in real-world marketing scenarios through hands-on experimentation.

Novelty (New Ideas)

The project combines pricing theory with scenario-based learning, enabling students to act as event consultants to select mineral water for three hypothetical clients. This practical, real-world scenario allows students to apply theoretical knowledge dynamically as they adjust their decisions based on client needs, pricing constraints, and perceived product value.

The novel approach lies in simulating a real-world consultancy experience, encouraging students to go beyond textbook learning and critically engage with market factors such as pricing, branding, and quality perceptions.

Creativity (Design of Ideas)

In this exercise, the students are divided into two groups and assigned different types of mineral water based on price categories. After participating in blind taste tests, students may engage in collaborative inquiry, sharing their observations and perceptions about taste, price, and product origins.

Scenario Design:

The students are placed in the role of event consultants, serving three different types of clients with varying budget constraints and expectations:

Client 1 (Luxury Event): VVIP clients looking for premium products.

Client 2 (Corporate Conference): Mid-range, seeking a balance between quality and cost.

Client 3 (Community Event): Budget-conscious, where affordability trumps other factors.

With this information, students may collaborate and provide tailored recommendations, understand the pricing dynamics from different consumer segments, and apply this knowledge to their decision-making process.

Innovativeness

This project employs a Situated Cognition approach, where students are placed in a real-world scenario that requires them to apply their theoretical knowledge. The innovation lies in group collaboration: Group A samples high-end mineral waters, while Group B samples low-cost brands. This study categorised the samples into three pricing tiers: high-end, low-cost, and middle-range. The middle-range category was further divided into two subgroups: top-middle and bottom-middle. Group A sampled high-end and top-middle-priced mineral waters, while Group B sampled low-cost and bottom-middle-priced brands. They must then collaborate, share their insights, and recommend the best products for each client. The interaction and exchange of group experiences provide a richer learning experience, simulating real-world consultancy work where decisions depend on collective expertise and negotiation.

Research Methodology

The experiment was conducted with 30 undergraduate marketing students of SBSF2133 Pricing Decision subject from Universiti Teknologi Malaysia. The methodology involved:

Step 1: Group Assignment

Students were divided into two groups: Group A received four of the most expensive and two top mid-range waters, while Group B received four of the cheapest and two bottom mid-range waters.

Step 2: Blind Taste Test

Each group conducted a blind taste test of their assigned mineral waters, evaluating them solely based on taste. Ginger pickle was provided between samples to reset taste buds, ensuring an unbiased evaluation.

Step 3: Ranking and Collaboration

Students ranked the waters according to taste. They then collaborated across groups, sharing their insights on price, origin, and brand perception to make recommendations.

Step 4: Client Scenarios

Students recommend the most suitable mineral water for three clients based on provided profiles, simulating real-world marketing consultancy.

Client Profiles are as follows:

Client 1: VVIP Luxury Event Planner

- Budget: High
- Taste Preference: Premium and refined
- Key Decision Factors: Willing to consider mid-range if the branding exudes luxury.

Client 2: Mid-Range Corporate Conference Organizer

- Budget: Moderate
- Taste Preference: Balanced and professional
- Key Decision Factors: Balance between cost and quality, willing to stretch budget if justified.

Client 3: Budget-Friendly Community Event

- Budget: Low
- Taste Preference: Adequate for mass distribution
- Key Decision Factors: Cost-focused, but open to slight increases if quality significantly improves perception.

Applicability

The experiment is highly relevant, particularly in promoting experiential, collaborative learning and student-centred approaches. By engaging in scenario-based learning, students take active roles in their learning process, applying pricing theory in a tangible, relatable setting. The activity's structure encourages critical thinking, decision-making, and collaborative problem-solving. It offers a practical demonstration of how pricing strategies and consumer psychology influence decision-making, preparing students for real-world challenges in marketing consultancy. This approach can be adapted to different products and industries, making it versatile for various educational contexts.

Impact on Student Learning

This hands-on experiment significantly enhanced student engagement and understanding of pricing theory. Placing students in an evolving scenario empowered them to think critically and make informed decisions. The collaborative nature of the exercise fostered deeper learning, as students had to adjust their strategies based on shared insights, mirroring real-world marketing decision-making complexities.

The project significantly enhances student engagement by introducing real-world challenges. Acting as an event consultant allows students to develop essential skills in market analysis and pricing decisions. The collaborative inquiry model encourages peer learning and empowers students to approach pricing decisions confidently, ultimately improving their ability to apply theoretical concepts in a practical context.

The student's ability to draw from their observations and apply them to different consumer profiles fosters a deep understanding of pricing mechanisms. This impacts their comprehension of how price perception influences consumer behaviour in various market segments.

Research Methodology

This study used a blind taste test to evaluate whether price influences taste and quality perceptions. They rated each sample based on taste, quality, and perceived price. The mean values for these ratings were calculated to determine how price perception correlates with perceived quality and taste. This method provided insight into whether higher prices consistently result in better perceptions of product quality.

The experiment revealed that price does not always correlate with higher taste ratings.

Table 1: Mean (Perceptions Value).

Sample Code	Taste Rating	Quality Rating	Price Guess (RM)
Sample A (High-priced)	7.2	6.8	4.5
Sample B (Mid-priced)	8.0	7.5	6.0
Sample C (Low-priced)	6.5	6	3.75

- ✓ Sample A (High-priced): Despite its premium price, it did not receive the highest taste or quality ratings based on perception, challenging Client 1's assumption that price equals luxury.
- ✓ Sample B (Mid-priced): According to perception, it performed the best in taste and quality, suggesting value for both Client 1 and Client 2.
- ✓ Sample C (Low-priced): It received the lowest ratings based on perception but is suitable for Client 3’s budgetary needs.

Conclusion

This project provides a comprehensive learning experience, blending theoretical concepts with real-world applications. The findings highlight the psychological complexities of price perception and its implications for consumer behaviour. This experiment enhances student engagement and comprehension of pricing strategies by simulating professional consultancy through a collaborative, scenario-based learning approach.

Acknowledgement

We thank the Faculty of Management, Universiti Teknologi Malaysia, for supporting this project.

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ID 121: Enhancing Online Learning Performance: The Role of Learning Analytics-Based Feedback Provisions

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Highlights: This project investigates the impact of learning analytics-based feedback provision on enhancing ESL learners' learning performance in online learning. This project designed the learning analytics-based feedback provisions for learners, and it examines the effects on learners' learning performances in online forums. The findings reveal that personalized feedback from learning analytics improves learners' learning performance in online learning. Future research is encouraged to explore more this approach further for improving ESL learners' learning performance in online learning.

Keywords: *learning analytics; feedback provisions; online learning performance*

Introduction

Generally, distance learning learners face a challenge in maintaining motivation to learn and to communicate especially in English language because they do not have regular interaction with other learners, faculty, or the university. According to Mat and Yunus (2014), based on previous research, many learners especially in ESL context understand the value and benefits of learning English, and yet they do not put on sufficient effort to improve their learning. Online discussion or online learning can be utilized in enhancing the learner communication skills especially in written form by the implementation of feedback provision. However, the utilization of feedback in ESL learner's written communication skills in online learning platform remains almost underexplored (Muhsin, 2016) especially in Malaysian context. Therefore, this study aimed to fill in this gap to understand and study more about how learning analytics-based feedback provision can be utilized in improving English language learners' learning performance in online learning.

Objectives

This project has two objectives:

- To examine the impact of learning analytics-based feedback on the learning performance of ESL learners in online learning.
- To assess the influence of learning analytics-based feedback on the motivation levels of ESL learners in online discussion forums.

Online Discussion Forum and Learning Performance

An online discussion forum often serves as the primary means of interaction between students, their instructor, and peers, aside from occasional online classes (Redmond & Petrea, 2019). This platform allows learners to engage with their teachers and classmates, gaining knowledge while directly interacting with them. In this study, the term "online discussion forum" specifically refers to the forum conducted via the UTM e-learning platform. With the influence of technology on teaching and learning, the usage of online forums is broadly used to link people who usually have the same objective to let them share and interchange the information and ideas, like in classes where teacher aims to educate and gives knowledge while learners' goals are to learn as much as possible. Online forum is designated as web-based application that has been used extensively to bring people together with shared interests and mind-set and is widely practised these days to supplement conventional ways of giving lectures and conducting tutorials in which the materials are saved on Google application such as Drive and Classroom. Nonetheless, some problems were identified to happen to the learners in learning virtually. Nartiningrum and Nugroho (2020) supported this by stating that the learners are facing the problem where they are having difficulties in learning English written communication skills via online learning. Therefore, it is a need to provide solutions and aids to the learners to cater for the issues.

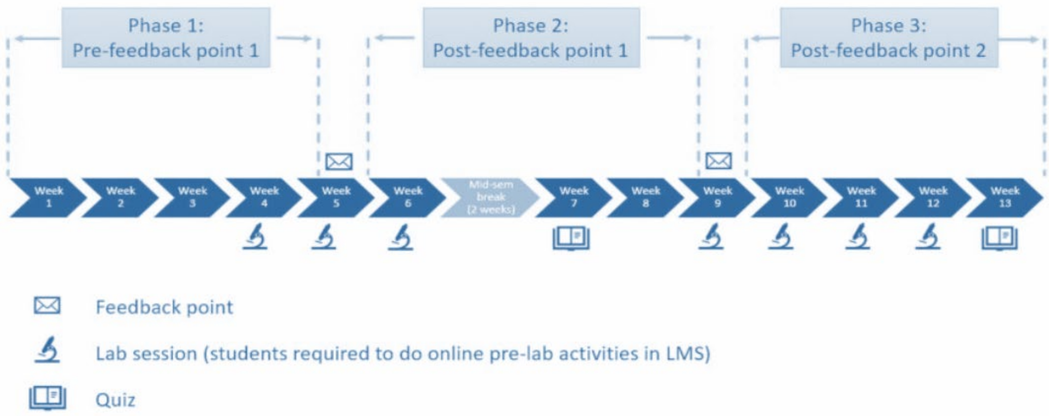

Figure 1: Scheduled Feedback Support (Lim et al., 2020)

Lim et al. (2020) highlighted that learning analytics can be integrated into feedback procedures to provide additional insights into students' learning progress and promote self-regulated learning. This research used to adapt and innovate this approach to cater the problem faced by Malaysian students in online learning.

Research Methodology

this study aimed to utilize quasi-experimental studies, as described above and in accordance with Choueiry (2021), considering it as the most compatible design for the nature of the studies, involving two comparison groups of learners from different classes. There were two methods for the instrumentation in which firstly collected through the online discussion forum which was closely related with the E-Learning platform and learning analytics tools. The other method was the online questionnaire that aims to explore the ESL learner's communication skills and motivation based on the intervention before and after; also consists of the learning analytics-based feedback provision in E-Learning.

Research Findings

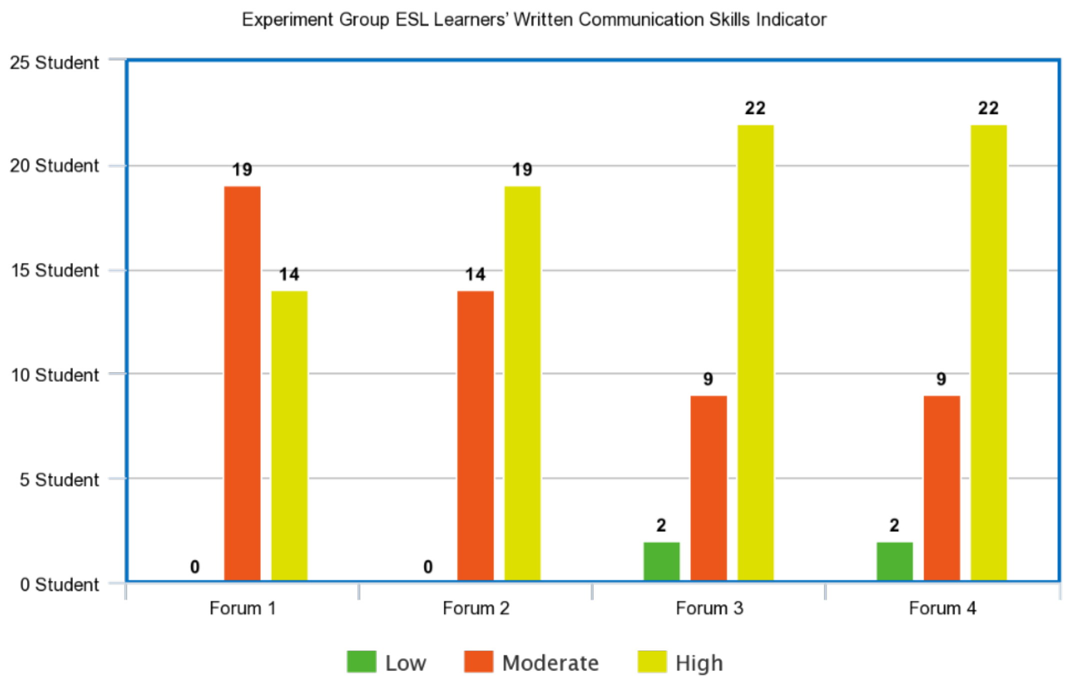

Figure 2 Results of Students' Learning Performance In Online Learning

To demonstrate the positive impact of the feedback intervention through learning analytics utilization on learners, it is evident in the learning performance (refer to Figure 2).

Table 1: Result of Learners' Motivational Level

Motivational Level	Experiment		Control	
	Total student	(%)	Total student	(%)
High	29	87.8	6	28.5
Medium	4	12.1	5	23.8
Low	0	0	8	38.0

The experiment group has a total of 29 participants (87.85) of high-level motivation, followed by 4 participants (12.1%) with medium level and none recorded for low level of motivation. The study's findings reveal a positive impact of learning analytics-based feedback provision on the learning performance and motivation.

Acknowledgement

The authors would like to thank the Universiti Teknologi Malaysia (UTM) for their support in making this project possible. his work was supported by the Research University Grant (RUG) Program: [Q.J130000.3852.21J81] initiated by UTM.

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ID 122: Implementing the SPOC-based Blended Learning Approach in English Reading Courses

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Highlights: The SPOC-based blended learning approach combines online and offline learning to achieve student-centered goals. It includes small group learning, online reading materials, microlectures, formative assessments, and self-reflection. Tested on each 50 students in both the control group and the experimental group, this approach significantly improved students' reading comprehension and learning autonomy, demonstrating its positive impact.

Keywords: *SPOC-based blended learning; reading comprehension; learning autonomy*

Introduction

Reading is an important component of language China's Ministry of Education has deemed important for English majors because it affects listening, speaking, and writing substantially (Fan, 2024). However, such traditional English reading courses in China as teacher-centered approach and overuse of grammar-translation method limit students' independent reading skills (Yin, 2015; Liu & Wang, 2023). Lack of consideration to learner differences and the imitation of Western learning models also influence learning outcomes (Wu, 2014; Liu, 2021).

Recently with the advancement in technology and due to Covid 19 pandemic, there is a shift towards the use of blended learning but the challenges still persist like large class sizes and more teacher control and less autonomy for students (Kang et al., 2021; Zhi, 2019; Shen, 2021). It is, therefore, possible to suggest a SPOC-based blended learning approach to address these challenges.

A study conducted with 100 students from a private university in China used reading comprehension tests, surveys, and interviews. The changes also demonstrated that students in the experimental group significantly improved their English reading skills and learning autonomy. This article will also present how SPOC-based approach can improve on the English reading courses.

Objectives and Methodology

To investigate the effects of the SPOC-based blended learning approach on students' reading and learning autonomy, the approach was piloted in English reading courses. The study targeted 100 freshmen with English major in China's private university whereby the participants were grouped into experimental and control groups. While both of the groups were exposed to the blended learning approach in the first semester, in the second semester of learning, the experimental group practiced the SPOC-based learning. The study covered a period of 14 weeks in the second semester.

Phase 1: Online Learning Phase

Students completed individual and group tasks via the professional online learning platform. Teachers provided audiovisual resources, recorded microlectures, or uploaded pre-recorded lessons under 10 minutes. Students watched videos, answered embedded questions, and completed quizzes. This helped them grasp general and specific knowledge and master difficult concepts for offline classes. They could also post questions, engage with peers and teachers, choose readings, and develop personalized learning plans to foster autonomy. Teachers used the platform to track progress and address pre-class doubts during in-class learning.

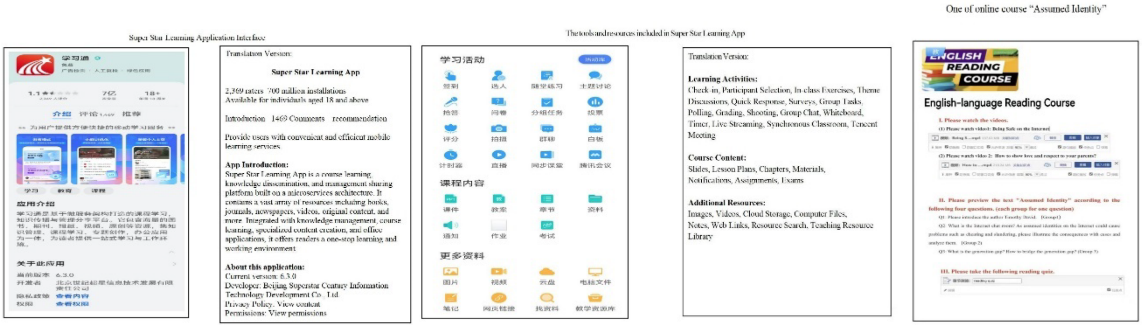
Phase 2: Face-to-face Learning Phase

The learning process consisted of four stages. They are warm-up, pre-reading, while-reading, and post-reading activities. During the warm-up, the teacher employed the "Check In" feature for roll call, and posed a question. For instance, during pre-reading, participants discussed questions and in a group presentation mode, the assessment was conducted using the "Grading" option of the platform. In the while-reading stage, students read the text, used the "Quick Response" option to answer questions and discuss on skimming and scanning strategies. The teacher gave feedback and students read the text again and answered the detailed questions using the "Theme Discussions" and answered the same questions using the "Participant Selection" feature.

Phase 3: Post-reading Phase

During the post-reading stage, students reviewed skim-reading and scan-reading skills, asked questions and analyzed the content, and shared feedback through private messages on the professional online learning platform. They also worked on tasks, chosen further reading, and received feedback from formative and summative assessments. The

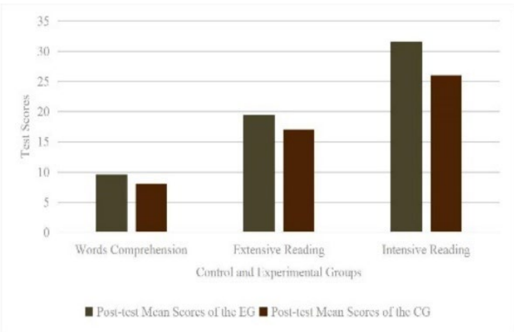
"Group Chat" feature and direct messages through this online learning platform helped students to work on their own and encouraged more questions and self-directed learning.

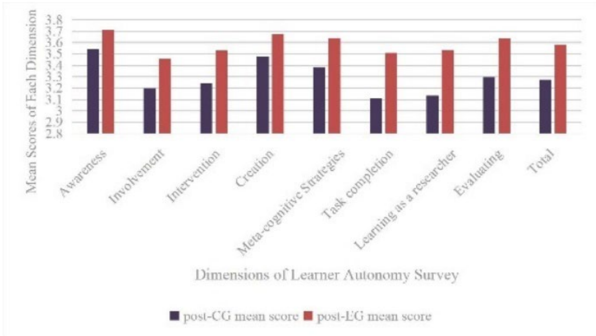


Findings

1. From the quantitative analysis:

The SPOC-based blended learning approach positively impacted students' reading comprehension in all aspects, with the most notable improvement observed in intensive reading skills and had a more positive impact on enhancing students' learning autonomy in English-language reading courses in all dimensions indicated in the figure.





2. From the qualitative analysis:

a. Impact on Students' Reading Comprehension

The SPOC-based blended learning approach improved reading comprehension more than the blended learning approach. It was a hybrid approach that combined online and offline activities, including background reading materials and text-based activities, which enhanced learning comprehensiveness and effectiveness. Online features like the "Quick Response" helped in enhancing the class time and the participation of the students. Improved interaction between teachers and students helped tailor the guidance and dialogue, while mind maps and other materials available online helped the students to better comprehend and prepare for the tasks. Through self-reflection and teacher feedback, memory and comprehension were enhanced through the use of an interactive classroom which promoted learning and group discussions.

b. Impact on Students' Learning Autonomy

Based on pre- and post-surveys and interviews, it was found that SPOC-based blended learning approach could be highly effective for enhancing learners' self-directed learning skills. It encouraged students by providing online assignment due dates that helped students to be more involved in reading materials and text previews. Group assignments and offline discussions made students to think independently and participate actively. The approach promoted self-regulated learning by allowing students to control their pace and choose readings through online activities and individual plans. Additionally, giving students additional reading materials and pre-class exercises enhanced reading rate and comprehension besides increasing the efficiency of the offline lectures.

Conclusion

In conclusion, the SPOC-based blended learning approach was superior to the blended learning approach used in China. This innovative approach organized the students into small groups which allowed for effective group activities such as preparation, presentation, and discussion both virtually and physically. It offered online readings, microlectures by teachers, formative assessments, and tools for students to evaluate their learning.

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ID 123: Step into the Future: Metaverse Education for Schools Nationwide

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Highlights: This is an initiative by Universiti Kebangsaan Malaysia in collaboration with Malaysia Digital Economy Corporation and Ministry of Education called "MetaSkool" to develop a metaverse-based educational program in schools nationwide. This project involves training teachers and students from pilot schools, focusing on creating immersive lesson plans across 18 virtual worlds and 9 subjects, including sciences and languages. Student training and data collection was deployed from November 2023 to January 2024 with nine schools in six states involving 500 students in areas such as virtual world creation and 3D digital asset creation. The project's impact was assessed using qualitative and quantitative methods.

Keywords: *Metaverse education, school, nationwide, virtual world creation, immersive learning*

Introduction

In the era of rapid technological advancements, the education sector must evolve to prepare students for an increasingly digital future. The "Step into the Future: Metaverse Education for Schools initiative", is an innovative approach to education designed to revolutionize traditional teaching through metaverse integration. The project aims to align with the objectives of the *Digital Education Policy (DEP) 2021–2030 and key national strategies such as MyDIGITAL, 4IR, and JENDELA to foster a generation well-versed in digital literacy.

This extended abstract presents Metaverse Education for Schools Nationwide (or MetaSkool) transformative approach, examining its novelty, creativity, and impact on students' learning. This project was piloted across nine schools, creating immersive learning environments that span nine different subjects. Here, we highlight the innovation's objectives, research methodology, findings, and discussion, as well as its commercialization potential and future impact on education.

Content

The project aims to:

1. Transform the traditional classroom by integrating metaverse-based learning environments where students engage with immersive, interactive content.
2. Bridge the gap between conventional education and cutting-edge technologies such as Web 2.0 and Web 3.0, fostering digital literacy among students and educators.
3. Upskill teachers with digital competencies needed to create, manage, and teach in virtual learning spaces.
4. Develop and deploy virtual worlds across nine subjects, including science, mathematics, languages, and social sciences, to provide interactive and experiential learning opportunities for students.
5. Promote collaboration and engagement through virtual environments that transcend geographical limitations, ensuring equitable access to quality digital education.

NALI Approach: Novelty, Creativity, Innovativeness, and Applicability

1. Novelty (New Ideas):

The metaverse is a pioneering frontier in education. While digital platforms and e-learning systems are not new, the integration of fully immersive metaverse worlds represents a significant leap forward. MetaSkool offers a new paradigm for learning, allowing students to 'learn by doing' in virtual environments that simulate real-world experiences. This approach stands out by merging physical classrooms with virtual worlds, offering students an unprecedented level of interactivity and immersion.

2. Creativity (Design of Ideas):

The design of MetaSkool's virtual learning environments taps into the creativity of both educators and students. Teachers are trained to create virtual worlds using tools such as Spatial.io, Blender, and Ready Player Me, allowing them to tailor their classrooms to fit specific learning outcomes. For example, a history lesson can take place in a simulated ancient civilization, or a science lesson can be conducted in a virtual lab, enabling students to perform experiments that would be otherwise impossible in a traditional classroom setting.

3. Innovativeness (Changes/Improvements):

MetaSkool introduces innovative teaching strategies that challenge the status quo of classroom-based learning. The program leverages 3D modeling, avatar creation, and virtual reality tools to create a dynamic learning environment.

Students are no longer passive recipients of information; they become active participants in their education, engaging with subject matter in ways that were previously unimaginable. Additionally, the use of 3D asset management and avatar creation tools empowers educators to develop personalized, engaging learning experiences.

4. Applicability (Relevant to NALI):
This initiative aligns with the principles of the New Academia Learning Innovation (NALI) model by emphasizing experiential learning, collaboration, and inquiry-based learning. Through the metaverse, students can explore virtual worlds, conduct simulations, and collaborate on projects, fostering critical thinking and problem-solving skills. The platform's accessibility ensures that it can be applied across different subjects, making it a versatile tool for educators at all academic levels, from preschool to post-secondary education.

Research Methodology

The project adopted a "multi-phase approach", beginning with a "proof-of-concept*" implemented across nine pilot schools nationwide. The methodology included:

1. Teacher training workshops: A series of six workshops—five online and one face-to-face—were conducted to upskill teachers in metaverse world creation, 3D asset management, and multimedia content development.
2. Development of virtual worlds: Educators, with the assistance of UKM and MDEC, designed and deployed 18 virtual worlds tailored to nine subjects, including accounting, additional mathematics, biology, Japanese language and English language.
3. Student engagement: Students participated in virtual classroom simulations, allowing them to engage with lesson content through interactive, experiential activities.
4. Framework creation: UKM played a key role in developing the MetaLearn Framework, which consists of three constructs**—learning design, space design, and learning assessments—and 10 sub-constructs.
5. Impact study: The project's success was evaluated through quantitative research, measuring student engagement.

Findings and Discussion

Data analysis was conducted using partial least squares structural equation modeling (PLS-SEM). This approach allows for the estimation of complex cause-effect relationships in path models with latent variables and facilitates the testing of hypotheses and analysis of relationships between variables. The measurement models examine the connections between observed data and latent variables, while the structural model analysis focuses on relationships between the latent variables (Figure 1). SmartPLS version 4 was used for this analysis.

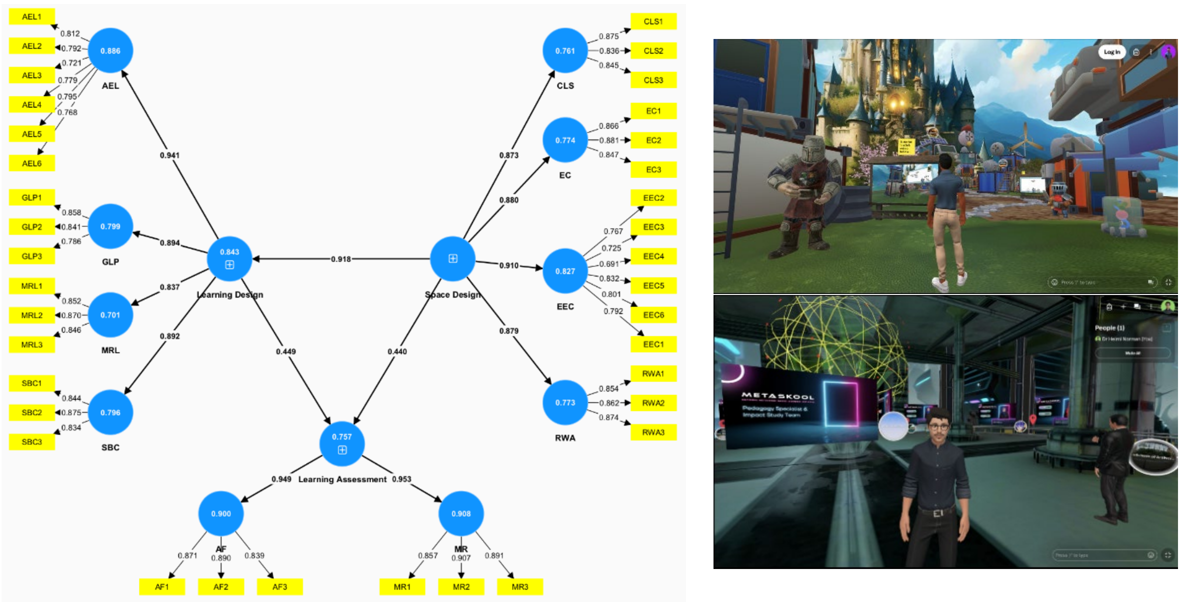


Figure 1: PLS-SEM algorithm results analysis & metaverse worlds created

Measurement Model Analysis:
Construct validity was performed to ensure that the constructs effectively measure their intended targets. Factor loadings were also assessed, with higher loadings indicating stronger relationships between factors and constructs, while lower loadings suggest weaker associations.

Construct validity analysis included:
- Highest and second highest factor loadings for learning design, space design, and learning assessment constructs.

- Lowest and second lowest factor loadings for learning design, space design, and learning assessment constructs.

Highest Factor Loadings:
- Learning Design: The highest factor loading was for active experiential learning, where the metaverse enabled students to engage deeply with the learning content. The second-highest factor was the guided learning pathway, which provided clear instructions for students' learning progression.
- Space Design: The highest factor loading was engaging environment creation, where the metaverse allowed students to enhance their learning by designing environments from an empty virtual world. Ethical considerations had the second-highest factor loading, focusing on the integration of digital ethics and data privacy.
- Learning Assessment: The highest factor loading was for metacognitive reflection, where students analyzed their learning strategies to enhance thinking skills (i.e., metacognition).

Lowest Factor Loadings:
- Learning Design: The lowest factor loading was for mixed reality learning, where AR and VR headsets were used for exploration. The second lowest was for skill-based challenges, where students participated in 3D model simulations.
- Space Design: The lowest factor loading was collaborative learning spaces, allowing students to collaborate in virtual environments. The second lowest was real-world applications, where students engaged in scenarios transferable to practical situations.
- Learning Assessment: The lowest factor loading was for assessment and feedback, where students used interactive assessments to demonstrate their skills.

Convergent Validity, Structural Model Analysis and Hypotheses Testing:
Convergent validity analysis, assessing if related constructs correlate positively, was conducted. In PLS-SEM, this is measured through the outer loadings of indicators and the average variance extracted (AVE). Results showed AVE values above 0.5 for all constructs, confirming positive correlations between the constructs. Structural model assessment in PLS-SEM focuses on the significance of path coefficients, tested using the R-squared value, which should exceed 0.5. Hypothesis testing was performed, revealing P-values below 0.05 for all hypotheses, indicating acceptance. Hypotheses regarding the relationships between learning design, space design, and learning assessment constructs were confirmed through bootstrapping analysis using 5000 samples.

Discussion and Implications

- Learning Design: Active experiential learning achieved the highest factor loading. The metaverse's immersive nature actively engages students, improving motivation and learning outcomes. Studies show that VR-based immersive learning improves comprehension and retention (Zhang et al., 2022). This signifies that importance of incorporate active experiential learning activities in the metaverse.
- Guided Learning Pathway: The second-highest loading indicates the importance of structured guidance in virtual learning environments. Teachers act as guides, facilitating students' progression through clear learning pathways (Hirsh-Pasek et al., 2022). Thus, this signifies that future metaverse should ensure the integration of guides to provide clear learning pathways.
- Space Design: Engaging environment creation scored the highest in space design, highlighting the potential of the metaverse to transform education by creating immersive, shared spaces (Hazan et al., 2022). This signifies that features for the creation of engaging environments in the metaverse are important for teaching and learning in schools.
- Learning Assessment: Metacognitive reflection received the highest factor loading in learning assessment. Metacognition, which involves self-regulation and reflection, is essential for learning success (Mitsea et al., 2024). Thus, this shows that spaces for metacognitive reflection in the metaverse should be designed.
- Lowest Factor Loadings: Mixed reality learning and skill-based challenges showed lower factor loadings, possibly due to the early stage of technology integration in education. Similarly, collaborative spaces and real-world applications were not fully optimized for educational use. This signifies the importance of the integration of mixed reality learning and collaborative features in the metaverse.
- Assessment & Feedback: The lowest factor loading for learning assessment suggests that the assessment mechanisms in the metaverse need further development (Tlili et al., 2022; El Said, 2023). Hence, this signifies that interactive assessment and feedback features in the metaverse should be enhanced.

The project also highlighted several key challenges:
1. Connectivity issues: While the metaverse offers vast potential for immersive learning, it requires reliable internet connectivity, which proved to be a barrier for some schools in rural areas.

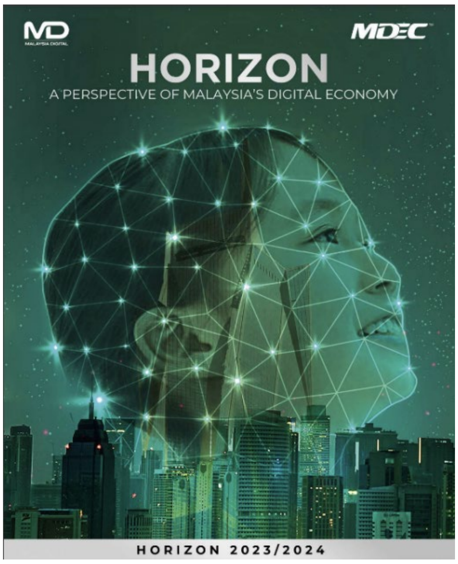
2. Cultural adaptation: The use of digital avatars and virtual worlds posed challenges in terms of cultural relevance, requiring adaptations to ensure content was relatable for students from different backgrounds.

Despite these challenges, the overall impact of the project has been overwhelmingly positive, with 500 students and nine educators directly benefiting from the initiative in its inaugural year. The success of the project demonstrates the metaverse's potential to revolutionize education by providing a structured yet flexible learning environment.

Commercialization Potential and Awards

Given its success, the MetaSkool initiative has significant commercialization potential. The frameworks, training modules, and virtual worlds developed as part of the project will be scaled and adapted for use in schools across Malaysia in the near future. Additionally, the project's innovative approach has the potential to attract further investments from both the public and private sectors to support the development of digital education infrastructure.

MetaSkool has been recognized for its innovation, showcase at the #MyDigitalMaker Fair and the Ministry of Education's Digital Education Policy Framework launch in 2023. It has also been published in MDEC's Horizon Report 2023/2024: A Perspective of Malaysia's Digital Economy (Figure 2). The initiative has also garnered attention from educational institutions, policy makers, and technology leaders who are keen to explore the metaverse's potential in education.



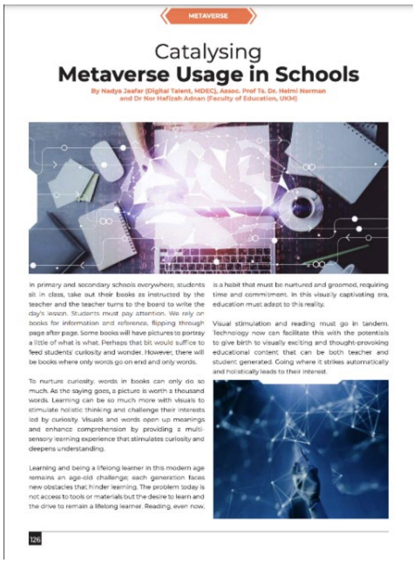


Figure 2: Publication in MDEC's Horizon Report 2023/2024: A Perspective of Malaysia's Digital Economy

Conclusion

The project is a "groundbreaking initiative" that aligns with Malaysia's Digital Education Policy and the national agenda for digital transformation. Through its focus on innovation, creativity, and collaboration, MetaSkool has proven to be an effective tool for enhancing both student-engagement and learning outcomes. As the initiative continues to grow, its potential to revolutionize education and foster a future-oriented, digitally literate generation becomes more apparent. By integrating traditional teaching methods with cutting-edge technologies like the metaverse, the MetaSkool initiative not only reshapes the educational landscape but also prepares students for a future where digital fluency is essential. The success of the project in its pilot phase highlights its applicability across different subjects and academic levels, making it a versatile and scalable solution for future education systems.

Ultimately, MetaSkool aims to inspire a new norm in education, where immersive digital environments complement and enhance conventional learning, fostering creativity, critical thinking, and collaboration. By addressing both the opportunities and challenges of integrating the metaverse into schools, the project sets a benchmark for the future of digital education, helping students thrive in a world that is increasingly shaped by technology and innovation. This collaborative effort, involving policymakers, educators, and technology experts, will be key to ensuring the continued success and expansion of MetaSkool, aligning with Malaysia's national vision of becoming a leader in digital education and preparing students for a globally connected and digitally integrated future.

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