UNIVERSITI TEKNOLOGI MARA

iS2E2A
INTERNATIONAL SYMPOSIUM ON SUSTAINABLE ENGINEERING EDUCATION & ACCREDITATION

iS2E2A E-PROCEEDING

INTERNATIONAL SYMPOSIUM ON SUSTAINABLE ENGINEERING EDUCATION & ACCREDITATION

"Enhancing Engineering Education to Foster Sustainability in the Future"

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College of Engineering
Universiti Teknologi MARA Cawangan Pulau Pinang
Kampus Permatang Pauh

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INTERNATIONAL SYMPOSIUM ON SUSTAINABLE ENGINEERING EDUCATION & ACCREDITATION

CONTENT

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FOREWORD

Professor Dato' Ir. Dr. Ahmad Rashidy Razali

Rector, UiTM Cawangan Pulau Pinang

Alhamdulillah, we express our deepest gratitude to Allah SWT for His grace and mercy, allowing us to gather in good health for this significant event. This symposium, hosted by the Department of Academic Affairs and organized by Civil Engineering Studies, marks an important milestone for UiTM Pulau Pinang Branch and Malaysia as we strive to enhance engineering education and accreditation.

With 70 participants from various local and international learning institutions, this platform fosters the exploration of best practices in teaching, learning, assessment strategies, and innovative tools to improve education and equip graduates for the evolving professional landscape.

We are grateful for the unwavering support from all parties involved in making iS2E2A 2024 a success. This event reflects a collective effort, driven by passion and dedication since the planning stages in 2023. I encourage faculty members to actively contribute through writing and publishing articles on education, ensuring diverse perspectives enrich the conversation. My heartfelt appreciation for the iS2E2A committee, participants, and all contributors for their hard work. I hope this symposium continues to be an annual prestigious event, benefiting all those involved and enhancing UiTM's global standing in education. Thank you.

WELCOME
GREETING

Assoc. Prof. Ir. Ts. Dr. Hjh. Siti Noraini binti Sulaiman

Deputy Rector, Department of Academic Affairs,
UiTM Cawangan Pulau Pinang

A very warm welcome to all distinguished guests, esteemed colleagues, and fellow educators Thank you for being here at the International Symposium on Sustainable Engineering Education and Accreditation (iS2E2A). It is a great honor to introduce this inaugural educational symposium, the first of its kind organized here at UiTM Cawangan Pulau Pinang.

We are excited to see this event as a stepping stone towards future successes, and we hope it will become an auspicious beginning for many more impactful events to come. This symposium is not only a gathering of brilliant minds but also a kick-start to deeper analysis and publications related to the work we do daily as academicians. It is our hope that the discussions and knowledge shared here will help gather valuable insights to improve the teaching and learning process, ultimately benefiting our students in particular and our stakeholders as a whole.

Thank you once again to all participants, keynote speakers, and the dedicated committee members who have worked tirelessly to make this event a success. We look forward to the fruitful outcomes that will emerge from this symposium.

PREFACE

Dr Suhailah Mohamed Noor

Chairman of iS2E2A

A warm welcome to all participants of the International Symposium on Sustainable Engineering Education and Accreditation (iS2E2A). We are deeply grateful for your presence and participation in this significant event. This year's theme, "Enhancing Engineering Education to Foster Sustainability in the Future," underscores our collective commitment to shaping a sustainable future.The iS2E2A is hosted by the Department of Academic Affairs and led by the Civil Engineering Studies, UiTM Cawangan Pulau Pinang.

This first-ever symposium, a landmark event for our institution, brings together educators and academicians from diverse disciplines to create a collaborative platform for sharing knowledge and developing innovative solutions in education.

Pedagogical aspects of education, such as Outcome-Based Education (OBE), constructive alignment, teaching methodologies, and assessment strategies, are equally vital to the education industry. In addition, we need to harmonise sustainable engineering education and accreditation with the advent of artificial intelligent technologies and ensure that these enhance, rather than hinder, the educational process.. Together, we aspire to equip future generations with the skills and insights needed to address the pressing challenges of sustainability and to ensure a better, more resilient world for all.

We would also like to express our heartfelt appreciation to our keynote speakers for generously sharing their valuable knowledge and experiences in their respective fields. Last but certainly not least, we extend our sincere thanks to the dedicated iS2E2A committee members, whose hard work and commitment have been crucial in making this event a success.

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List of Extended Abstract

Developing a Web Map Application for Educational Use: A Case Study in Geotechnical Engineering

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ABSTRACT

This research presents a web map application designed to improve access to spatial data and analyse this data for public users. The app is designed and developed based on a set of rules formulated according to user needs, enabling it to download and convert complex spatial analyses into clear outcomes, such as text. The app is used and tested by students engaged in preliminary desk study of geotechnical site investigations. They utilise and assess the app, extracting pertinent data on soil composition, erosion risks, aiding in comprehensive assessments prior to fieldwork. The use of the app improves the accuracy of site investigation results and enhances student engagement during the project. Our research showed that by bridging accessibility gaps and providing practical and simple tools for using spatial data tools and analysis, we can empower both the public and students in gathering, analysing, and converting data into information.

Keywords: Data accessibility, GIS, Public access, Student engagement, Web map

INTRODUCTION

The application of Geographic Information Systems (GIS) in undergraduate student projects on geotechnical site investigation offers a unique opportunity for hands-on learning and practical application of theoretical concepts. Literature highlights that integrating GIS into undergraduate curricula enhances students' understanding of spatial data analysis and geotechnical engineering principles (Adu-Gyamfi et al., 2020). By utilizing GIS software and geospatial datasets, students can conduct comprehensive site investigations, including soil mapping, geological hazard assessment, and infrastructure planning (Gomez et al., 2018). GIS-based projects enable students to develop critical skills in data collection, analysis, and visualization, fostering interdisciplinary collaboration and problem-solving abilities (Marbouty et al., 2019). Furthermore, student-led GIS projects facilitate experiential learning experiences, allowing students to explore real-world geotechnical challenges and propose innovative solutions (Arumugam et al., 2021). Addressing these challenges, this research focuses on simplifying the use of GIS tools and enhancing data accessibility for undergraduate students. The proposed method involves translating complex GIS analysis requests, such as calculating network distances and spatial queries, into more manageable, text-based outputs. This approach aims to make GIS technology more accessible and straightforward, enabling students to engage more effectively with the material and better understand the complexities of their studies.

RESULTS AND DISCUSSION

As part of their undergraduate project, students in the Civil Engineering program conducted a geotechnical site assessment for a proposed residential timber building within the study area. Utilizing web mapping applications and geospatial data (Fig. 1), the students aimed to determine the suitability of the site for construction and justify the appropriate depth of footing to support a two-storey residential structure exerting a bearing pressure of 100 kPa.

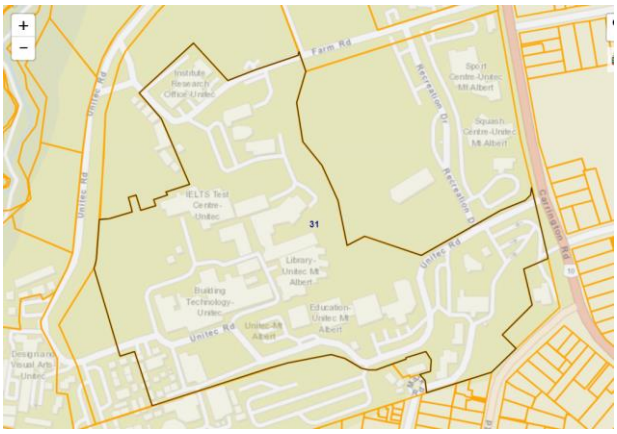


Fig. 1 Proposed site at 139 Carrington Rd, Mt Albert, Auckland

Using GIS software (Fig. 2), students gathered geospatial data on soil deposits, overland flows, flood plains, topographical features, erosion susceptibility and volcanic field boundary within the study area. They overlaid this information with zoning regulations and building codes to identify potential construction sites. (Table 1). Subsequently, students conducted field investigations to collect soil samples and perform in-situ tests, such as scala penetration tests and shear vane tests, to assess soil properties and strength characteristics (Table 2). Employing geotechnical engineering

principles, students analysed the soil data to determine bearing capacity and allowable footing pressures. They utilised empirical formulas to estimate the depth of footing required to support the residential structure and ensure stability under imposed loads. Factors such as soil composition, moisture content, and seismic considerations were considered during the analysis process.

Fig. 2 Geospatial data on proposed site showing soil deposits, overland flows, flood plains, topographical features, erosion susceptibility and volcanic field boundary.

Table 1. Summary report of 139 Carrington Rd based on GIS software.

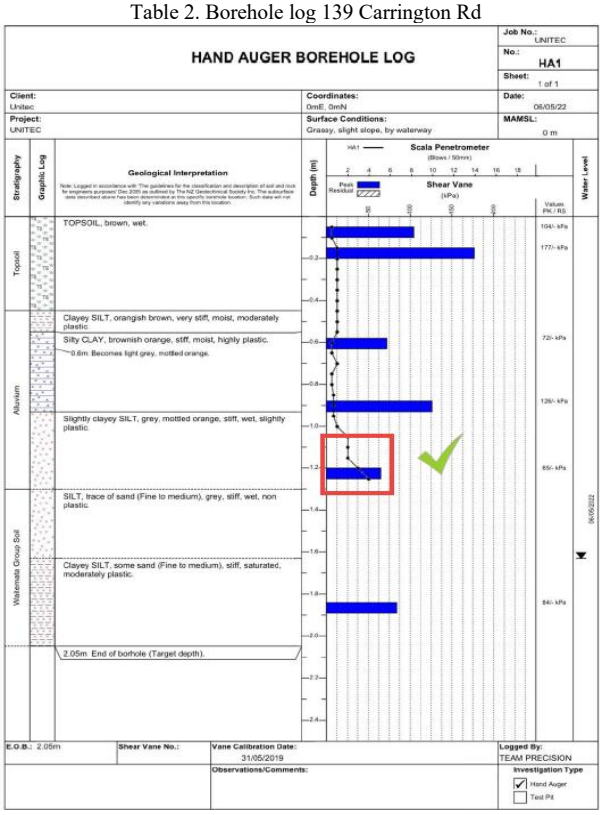
Map Layer	Description
Soil deposits	Grey, dense, fine-grained
Flood plain area	Chosen parcel overlaps.
Overland flow path	Chosen parcel intersects.
Unitary plan	Zone 64
Wastewater manhole 1	Distance 0.12km
Wastewater manhole 2	Distance 0.16km
Stormwater manhole 1	Lid level 28.3m Invert level 27.1m Distance 0.03km
Stormwater manhole 2	Lid level 29.41m Invert level null. Distance 0.07km
Erosion susceptibility	Distance 0.24km (Gladstone Primary)
Past volcanic deposits	Within lava area

Based on their geotechnical analysis, students recommended a suitable depth of footing to accommodate the anticipated bearing pressure of 100 kPa exerted by the two-storey timber building. They justified their recommendations by considering factors such as soil bearing capacity in accordance with relevant standards. Additionally, students proposed mitigation measures, such as soil improvement techniques or foundation reinforcement, to address any geotechnical challenges identified during the site assessment.

CONCLUSION

Through their geotechnical site assessment, students demonstrated the practical application of web mapping technology in evaluating site suitability and informing engineering design decisions for residential construction projects. By integrating geospatial tools with geotechnical engineering principles, students gained valuable insights into site characterization, foundation design, and risk assessment processes. This approach highlights the nature of modern engineering education and underscores the importance of leveraging technology to address real-world challenges in sustainable construction and urban development.

Table 2. Borehole log 139 Carrington Rd



REFERENCES

Adu-Gyamfi, Y., Chan, A. P., & Darko, A. (2020). Integrating GIS into geotechnical engineering education: A review of literature. International Journal of Advanced Structural Engineering, 12(2), 123-136.

Arumugam, M. P., Srinivasalu, S., & Durairaj, V. (2021). A study on the application of GIS in undergraduate geotechnical engineering education. International Journal of Engineering Research & Technology, 10(1), 15-25.

Gomez, C., Garcia, J., & Alcalde, J. (2018). Teaching geotechnical engineering with GIS: An educational tool. Journal of Engineering Education, 107(3), 451-463.

Marbouty, D., Halmaoui, F. Z., & El Ouardi, H. (2019). Integrating GIS in undergraduate civil engineering education: A case study on geotechnical engineering. Journal of Geographic Information System, 11(6), 723-734.

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Alternative Assessment Using Design Thinking for Outcome Attainment: Addressing ETAC 2024 Standards in Integrated Technology Design Projects

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ABSTRACT

An alternative assessment was designed for evaluating students' work in an Integrated Technology Design Project (ITDP) to meet ETAC Standard 2024 requirements. This assessment incorporates broadly-defined engineering problems and activities simulating a real-world environment and integrates a design thinking (DT) approach to help students develop higher-order thinking skills (HOTs). The paper presents an assessment instrument based on a performance criteria matrix aligned with course and program outcomes, and the characteristics of broadly defined engineering problems and relevant knowledge profiles. This study introduces a unique alternative assessment instrument for the ITDP, incorporating design thinking to analyze expected outcomes. The ITDP course and curricula were assessed through document analysis and the creation of an assessment instrument by subject matter experts. The instrument was used by 88 civil engineering students during the Semester 1 Academic Session 2023/2024. Results showed that the most common grades were B+ and B, aligning with the peak of the bell curve. The lecturer suggested continual quality improvement (CQI) to enhance outcomes attainment in the next assessment cycle.

Keywords: Alternative Assessment, Broadly Defined Problems, Integrated Design Project, Rubrics

INTRODUCTION

Engineering Technology Accreditation Council Standard 2024

Programme outcomes (POs) are the graduate attributes that reflect on the knowledge and skills that are expected to be acquired by the students upon graduation. In Malaysia, the Board of Engineers Malaysia (BEM) manages the accreditation process through the Engineering Technology Accreditation Council (ETAC) to evaluate engineering technology programmes. Students of an engineering technology programme are expected to attain all 12 graduate attributes or known as programme outcomes (PO) in the practice-oriented learning environment (Board of Engineers Malaysia, ETAC 2020).

Generally, the evaluation is based on the PO assigned to courses, thus universities that offer engineering technology programmes in Malaysia need to fulfil the minimum requirements set by the BEM to ensure that the programmes are being recognized, hence the graduates will be able to carry out relevant engineering practices as registered technologists during their career life. In Malaysia, since 2004, OBE is the prime criterion for engineering accreditation required by the Engineering Technology Accreditation Council (EAC) to be qualified as a full member of the Sydney Accord (SA).

The current ETAC Standard 2020 has prescribed 12 programme outcomes or graduate attributes with six (6) broadly defined engineering problems (SP), five (5) broadly defined engineering activities (TA) and 8 knowledge profiles (SK) to be incorporated in the engineering technology programmes. The programme outcomes for this programme are mapped to the ETAC Standard 2020. Alternative assessment is chosen directly to assess the learning outcomes upon student graduation are achieved effectively (Yusop & Amira Firdaus, 2021). Design thinking process is also incorporated to enhance student's critical thinking skill. The main objective of this paper is to study the alternative assessment method used for a culminating course, namely Integrated Technology Design Project.

RESULTS & DISCUSSION

This study utilized a qualitative approach aimed to gather comprehensive data from the chosen cohort of 88 students. This approach allowed for a more in-depth understanding of the quality improvements in teaching, learning, and assessment in the ITDP course. There are five (5) course outcomes mapped to five (5) IHL programme outcomes which are (1) CO1: Ability to analyze particular conditions of a project and its requirements mapped to PO2: Solve broadly defined engineering problems systematically to reach

substantiated conclusions, using tools and techniques appropriate to their discipline or area of specialization, (2) CO2: Ability to design different civil infrastructure technology system using different types of softwares and simulation tools mapped to PO5: Select and apply appropriate techniques, resources and modern engineering tools, with an understanding of their limitations, (3) CO3: Ability to enhance the project design with application of appropriate green technologies and sustainable practices mapped to PO8: Demonstrate an awareness of and consideration for societal, health, safety, legal and cultural issues and their consequent responsibilities, (4) CO4: Ability to demonstrate collaborative work through project ideas, design, and final products mapped to PO6: Function effectively as individuals, and as members or leaders in diverse technical teams and finally, (5) CO5: Ability to develop a project management plan that consists of master works programme and related project management elements mapped to PO10: Demonstrate an awareness of management, business practices and entrepreneurship.

Fig. 1 shows a bar chart representing the normalized attainment of course outcomes (COs) and three (3) sets of data are represented for each outcome for the ITDP course in the given semester.

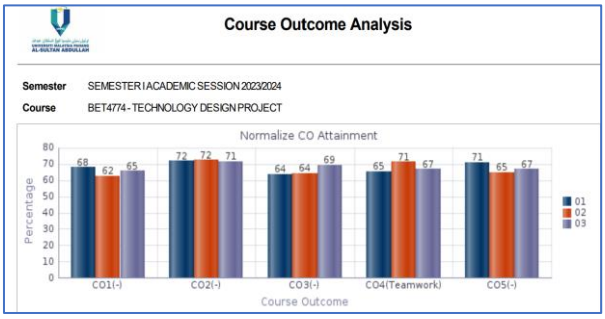

Fig. 1 Normalized Course Outcome Attainment

Each bar represents the percentage attainment of a specific course outcome, which corresponds to how well students have achieved these outcomes on average.

Each CO is mapped to PO2, PO5, PO6, PO8 and PO12, respectively as shown in Fig. 2 while Fig. 3 shows that the highest bars (B+ and B) on the bar chart, which represent the most common grades, would align with the peak of the bell curve, indicating the mean or mode of the distribution. In a perfectly normal distribution, the grades would spread symmetrically around the mean, with fewer students receiving grades much higher or lower than the mean. In the provided chart, there is a steep drop-off on either side of the B range, which suggests that while the distribution is somewhat bell-shaped, it might be skewed slightly due to the lower percentages of A- and C grades.

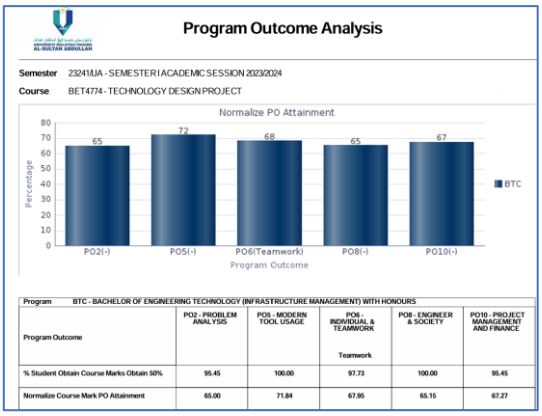

Fig. 2 Normalized Programme Outcome Attainment

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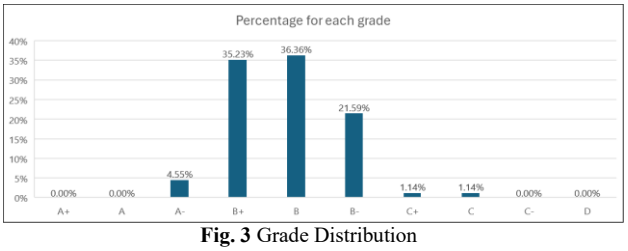

Fig. 3 Grade Distribution

CONCLUSION

The study presents an alternative assessment instrument based on the performance criteria matrix aligned with the course and program outcomes, and the characteristics of broadly defined engineering problems (SP) and relevant knowledge profiles (SK). The results demonstrate a general success in meeting the learning outcomes. However, the paper suggests the need for Continual Quality Improvement (CQI) by the lecturer to improve outcomes attainment for the next cycle of assessment, indicating there is room for further enhancement in both the delivery and assessment of the course content. Overall, the study indicates that while the alternative assessment methods employed are on track with meeting the ETAC Standard 2020, there are opportunities for refinement to ensure even better alignment and to facilitate higher attainment of the desired learning outcomes in future offerings of the course.

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The authors would like to express their gratitude and thanks to IHL for supporting this research.

REFERENCES

Board of Engineers Malaysia (2020). ETAC Standard 2020.

Crawley, E. F., Malmqvist, J., Östlund, S., & Brodeur, D. R. (2014). Rethinking Engineering Education: The CDIO Approach. Springer.

Farrah Dina Yusop & Amira Firdaus. Alternative Assessments in Malaysian Higher Education. Voices from the Field. 2021. Springer.

Elevating Student Performance: CQI for Course Outcome Attainment in Civil Engineering Design Project

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ABSTRACT

Analyzing the trends of course outcome attainment across different cohorts provides valuable insights into the effectiveness of instructional practices and areas for improvement within the course. However, the effectiveness of the continual quality improvement (CQI) for a specific course is not broadly reported. This paper evaluates the effectiveness of the CQI towards the course outcomes for civil engineering design project. Data of course outcome attainment was collected from the Revolution on Assessment for Student Monitoring System (iRAS) developed by Civil Engineering Studies UiTM Pulau Pinang Branch. A quantitative approach was utilized for trend analysis. It was found that through ongoing evaluation and refinement of CQI efforts, educators can ensure that students are better equipped with the designed curriculum and professional endeavors.

Keywords: Course Outcomes, Continual Quality Improvement, Civil Engineering Design Project.

INTRODUCTION

A capstone course is a multifaceted assignment or final project that portrays the culmination of a student's academic experience. The objectives of the capstone courses are to integrate and apply the knowledge and skills acquired throughout the academic curriculum to a real- world problem and scenario. It also requires students to demonstrate problem solving, lifelong learning, communication, and project management skills. Civil Engineering Design Project is offered in Semester 5 in Year 3 for capstone course Diploma in Civil Engineering, Universiti Teknologi MARA. This course is designed to provide students with culminating experience and knowledge that prepares them for future academic or professional endeavors. It is a guided project-based learning to conceive and design a double storey building using Eurocode 2 by integrating the relevant knowledge obtained from other courses such as structural analysis, structural concrete design, geotechnical, project management and bill of quantities.

There are five (5) course outcomes mapped to the program outcomes that provide student to the skills of design solutions (PO3), apply appropriate techniques (PO5), conduct investigations (PO4), communication (PO10) and integration of the professional ethics and responsibilities (PO8) in well-defined engineering problems as stipulated in Engineering Technician Education Programme Accreditation (ETAC) Standard 2020. The course outcomes designed for this course are as shown in Table 1.

The continuous quality improvement for the teaching and learning especially on the assessment had been carried out based on the comment by the external examiner during the visit in year 2022 and the attainment trends. The written test which contributed 20 percent of the summative assessment had been replaced by the project technical report starting from cohort 20224.

Table 1. Course outcomes for Civil Engineering Design Project

Course outcome	Description
CO1	Design reinforced concrete elements and system to meet requirements for public safety, societal with environmental considerations
CO2	Construct civil engineering design projects in accordance with relevant code of practices
CO3	Utilize appropriate techniques in civil engineering design project within the scope and limitations.
CO4	Demonstrate effective communication skills in civil engineering design project
CO5	Integrate professional ethics and responsibilities in civil engineering design project

In this paper, the attainment of course outcomes for four (4) different cohorts 20214, 20224, 20232 and 20234 were established. Comparison between before and after CQI process is explored further. The qualitative method is used to collect data from the Revolution on Assessment for Student Monitoring System (iRAS) developed by Civil Engineering Studies. A quantitative approach was also utilized for the analysis of the attainment of the course outcomes. The CQI was carried out for the student in cohort 20224 onwards.

RESULTS AND DISCUSSION

The attainment of course outcomes across multiple cohorts reveals varying degrees of achievement, indicating potential trends and areas for improvement within the civil engineering design subject. Fig.1 shows overall analysis of course outcome for all cohorts that are required to face accreditation under Engineering Technology Accreditation Council (ETAC). Cohorts 20214, 20224, and 20234 consistently demonstrate relatively higher attainment rates for CO1 and CO2 compared to other outcomes. These outcomes likely encompass fundamental concepts and skills that are effectively conveyed and mastered by the majority of the students across different cohorts. CO3 exhibits a consistent trend of lower attainment rates across all cohorts. CO4 and CO5 demonstrate varying levels of attainment across cohorts, with fluctuations observed in their percentages. Cohorts 20224 and 20234 stand out for their relatively high attainment rates for CO1 (77% and 84%, respectively). Changes in the assessment weightage by replacing written test with project technical report implemented during these academic terms may have been particularly effective in facilitating student learning and achievement of CO1. The trends depicted the high numbers of students attaining more than 50 percent of CO1 for both cohorts as shown in Fig.2. However, the results are contrarywise for the CO3.

Cohorts 20214, 20224, 20232, and 20234 all show percentages below 60% for CO3. The assessment for CO3 is a 20 percent practical test that involves modern tools usage. This persistent challenge in achieving the learning objectives associated with CO3 indicates the need for targeted interventions and instructional improvements to address barriers to student mastery in the modern tool usage. As part of the continual quality improvement process, extra classes focusing on the use of modern tools have been introduced for cohort 20224 onwards to provide students with targeted instruction and hands-on experience. These classes are designed to address specific areas of difficulty identified within CO3. The number of students attaining more than 50 percent increased once the changes been implemented. However, the average attainment has not significantly improved. Thus, further improvements need to be made, especially on the rubrics and the questions for practical tests addressing CO3.

CO4 was found good in average where it is portraying communication skills during presentation as it assesses by the industrial panel. As suggested by Burhanuddin (2021), students require more practice to improve their speaking skill. Other than that, according to Wu et al. (2023), communication skills, as one of the important soft skills, affect the employability of engineering students through verbal skills and non-verbal skills.

Based on results, there is room for improvement in each course outcome where clear continual quality improvement process should take place every semester. Involvement of stakeholders in this subject should be systematically guided by the resource person to improve the teaching and learning.

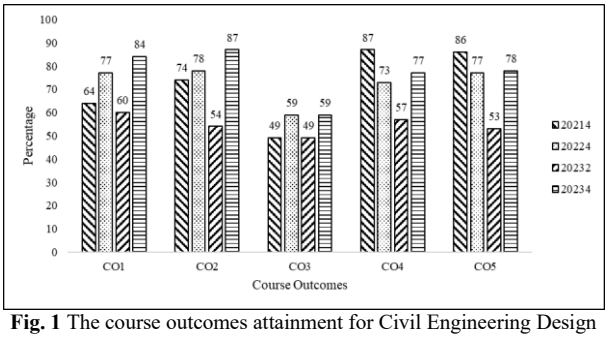

Fig. 1 The course outcomes attainment for Civil Engineering Design Project

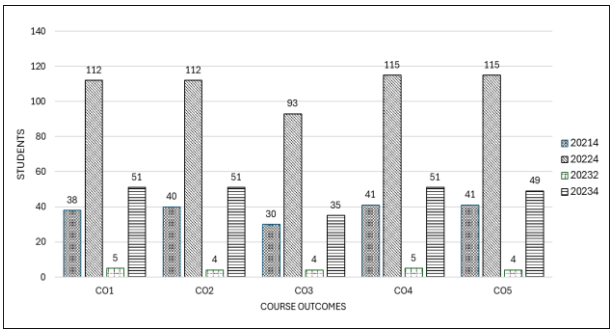

Fig. 2 The number of students attaining more than 50 percent.

CONCLUSION

The results obtained for course outcomes demonstrate variability in attainment rates across different cohorts. While some cohorts achieved relatively high levels of attainment, others exhibited lower rates. By examining these results and identifying factors influencing attainment, educators can implement evidence-based strategies to enhance student learning experiences and improve the overall achievement of course outcomes for future cohorts.

REFERENCES

Burhanuddin A., (2021). Improving Students' Oral Communication Skills in Public Speaking through Individual Presentation Task. *Jurnal Ilmiah Lingua Idea* Vol. 12, No. 2, December, pp.159-167.

Wu Y., Xu L., Philbin S.P., (2023). Evaluating the Role of the Communication Skills of Engineering Students on Employability According to the Outcome-Based Education (OBE) Theory. Sustainability 2023, 15(12), 9711.

Engineering Technician Education Programme Accreditation (ETAC) Standard 2020. Board of Engineers Malaysia. 2020

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Effective Continuous Quality Improvement of Poor PO Attainment in Civil Engineering Program Based on Assessment Modifications

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ABSTRACT

This paper reviews the continuous quality improvement (CQI) process in outcome-based education (OBE) implementation at Civil Engineering Studies, UiTM Cawangan Pulau Pinang. The CQI is crucial part of the OBE system and consistently practices ensuring the quality of education program. The effective CQI process executed at program level identified the issues of poor attainment for Program Outcome (PO) 11 (project management and finance) for two semesters consecutively. Short term and long-term solutions were proposed and implemented by improving the assessment components (method and weightage) and PO-course mapping respectively. The adjustment performed on assessment method was able to quickly turn around the situation with significant improvements in term of cumulative percentage and percentage of student passing minimum requirement for PO11. The analysis of data shows that percentage of student achieved at least 50% of cumulative PO11 increased from 51% (before CQI) to 98% (after CQI) respectively. Both quantity and quality of PO improvement were attained based on the database of students after the implementation of CQI. In conclusion, the effective CQI implementation play vital role in the quality assurance of OBE system.

Keywords: industrial internship, supervision, OBE, civil engineering

INTRODUCTION

Outcome-Based Education (OBE) is a transformative approach in engineering education, emphasizing measurable outcomes and continuous improvement (Koh & Chong, 2015). In line with the directives of the Ministry of Higher Education (MOHE) Malaysia and the Board of Engineers Malaysia (BEM), OBE was implemented in the Faculty of Civil Engineering, UiTM Pulau Pinang since 2004. This educational model focuses on student outcomes, enabling corrective measures to enhance course delivery methods, assessments, and student attitudes (Pauzi et. al., 2020). The set of courses is meticulously designed with specific course outcomes (COs), preparing graduates to achieve the program outcomes (POs) upon graduation. These POs were formulated in consultation with major stakeholders, including employers, alumni, and students, aligning with the demands of a dynamic and globalized workplace. The OBE framework ensures that engineering graduates are not only technically proficient but also equipped with the skills and mindset needed to thrive in a rapidly evolving world (Karman et. al.,2011).

POs is a critical aspect of OBE and represent the overall abilities expected of graduates. Each course within the program should have well-defined COs (Mat Isa et. al., (2021). These outcomes specify the knowledge, skills, and attitudes that students are expected to acquire during the course and COs must align with the broader POs of the engineering program. These are the predominant qualities that graduates should possess upon completing their program. POs represent the knowledge, technical and soft skills, and abilities that make an engineering graduate competent and adaptable.

This paper discusses the CQI process involved specifically for PO11 attainment in Bachelor of Civil Engineering program at UiTM Pulau Pinang Branch. The poor attainment of PO11 (project management and finance) by undergraduates' student was analysed, and practical solution was proposed to close the CQI process. The PO11 attainment from two intakes were considered in the analysis, i.e. March 2020 and October 2021.

RESULTS AND DISCUSSION

The designated POs of program are adopted from Engineering Accreditation (EAC) standard 2020 and the mapping of PO11(Program Outcome 11) and courses for civil engineering program at UiTM Permatang Pauh Campus is shown in Table 1 below. The distribution percentage of PO11 from each course in Table 1 plays an important role in calculating the overall PO11 attainment of the program. The calculation of each PO attainment is based on the number of students achieving at least 50% of overall PO attainment for related courses. The ideal condition is to have a minimum of three courses mapped toward each PO. However, due to unforeseen circumstances, only two courses were mapped with PO11, and this scenario led to the problem in PO11 attainment for the students. The primary contributor to the attainment of PO11 was the Construction Management Project course, accounting for 45%, as compared to the Infrastructure Design Project, which contributed 12%. This distribution underscores the

significant impact of the Construction Management Project on PO11 attainment. The calculation of overall PO11 attainment for the program is determined by averaging the performance of each individual student within each cohort.

Table 1. PO11 courses mapping and percentage distributions

No	PO statement	PO mapping	PO distribution %	
PO11	Ability to demonstrate knowledge and understanding of civil engineering management principles and economic decision-making in a team to manage projects in multidisciplinary environments.	Construction Management Project	PO1 PO9 PO11	45 10 45
		Construction Management Project	PO1 PO3 PO5 PO6 PO9 PO11	21 36 5 6 20 12

Fig. 1 presents the percentage of students passing a minimum of 50% of all POs. PO1 to PO3 and PO5 to PO10 obtained a 100% pass rate, indicating that all students passed these POs. PO4 and PO12 with 97% and 95% respectively means that almost all students passed these two POs respectively. However, the performance of PO11 at 51% compared to all other POs brings to light a worrying issue with the current PO11 attainment process. The poor PO11 performance indicates a significant challenge in achieving PO11. Thus, the faculty management team urgently seek an appropriate solution for both the short term and long term to address this concern. The short-term solution proposed was to fully assess the PO11 through assignment instead of test and final exam. The assignment weightage was increased from 10% to 40%. This adjustment ensures all students participation in PO11 assessment.

The improvement of PO11 attainment after the implementation of CQI as shown in Fig. 2 proved that the actions taken was successful. The results demonstrate the number of students passing minimum of 50% was increased significantly with 98% of students attained the minimum of 50% passing marks compared to only 51% before the CQI.

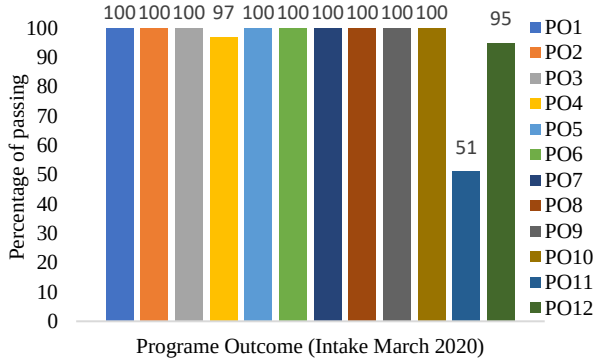

Fig. 1 Percentage of students achieved at least 50% of cumulative POs for graduate intake March 2020 (before CQI).

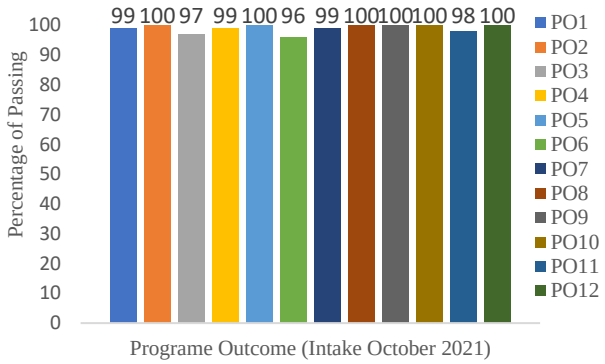

Fig. 2 Percentage of students achieved at least 50% of cumulative POs for graduate intake October 2021 (after CQI).

CONCLUSION

In conclusion, the CQI process enables issue identification, analysed, and solved. The short-term solution based on the amendment of assessment components ensure the improvement in PO11 attainment. The quick turnover was achieved based on the systematic CQI process that has been effectively practiced in the civil engineering studies' program.

REFERENCES

Koh, Y. Y., & Chong, P. L. (2015). From Outcome-Based Education (OBE) to Continual Quality Improvement (CQI): A case study of teaching mechanical engineering at University of Newcastle, Singapore. *15th Southeast Asian Association for Institutional Research (SEAAIR) Conference., 1-11.*

Pauzi, N. I. M., Che, Muda., Z., Che Omar, R., & Katman H. Y., (2020). Implementation of Outcome Based Education in UNITEN-Closing the loop (PEO). *The 3rd Regional Conference on Engineering Education and Research., 1-7.*

Karman, S., Hasikin, K., Ting H. N., Ng, S. C., Abdul Wahab, A. K., Lim, E., Hamzaid N. A. & Wan Abas, W. A. B. (2011). OBE implementation and design of continual quality improvement (CQI) for accreditation of biomedical engineering program University of Malaya. *BIOMED 2011, IFMBE Proceedings 35, 20-24.* doi: 10.1007/978-3-642-21729-6_11.

Mat Isa, C. M., Mohammad N. I. A., Saad, N. H., & Christopher N. P. (2021). Programme outcome attributes related to complex engineering problem capability: perceptions of engineering students in Malaysia. *Asian Journal of University Education. Vol 17, (4). 95-105.* doi:10.24191/ajue.v17i4.16220

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Evaluating Advanced Geotechnical Engineering Students' Performance and Course Assessment Plans (CAP) Prior to, During, and Post the COVID-19 Movement Control Order (MCO)

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ABSTRACT

The purpose of this study is to evaluate the students' performance prior to, during, and post the COVID-19 Movement Control Order (MCO) in Advanced Geotechnical Engineering course. The effects of COVID-19 on instruction and learning have been discussed in the field of education. Data analysis for 9 semesters, from March 2019 to October 2023, makes up the approach. The results demonstrate that following MCO, the students' performance fell off significantly. The CAP was updated to reflect the nature of the course which involves the computer modeling works. Positive outcomes were then attained. All in all, students are doing well on project-based learning tasks. For theoretical courses, the final test is more suitable.

Keywords: Covid-19, Course Assessment Plan (CAP), Forensic Engineering, Project-Based, Movement Control Order (MCO)

INTRODUCTION

Every aspect of society has been affected by the COVID-19 pandemic, and higher education institutions are finding it difficult to adjust to the unexpected and unprecedented issues it has brought about. Academics had to navigate the challenging process of quickly switching from traditional in-person instruction to remote and online learning environments, one of the many industries impacted. Under these circumstances, assessing student performance and the effectiveness of course assessment plans (CAP) became critical, providing insight into the flexibility and durability of educational initiatives.

Education experts have been debating and researching the effects of COVID-19 on teaching and learning (Ibrahim et al 2022; Wincci et al. 2022; Mohamed Shuhidan et al. 2022; Kamaruzaman et al. 2022). The COVID-19 epidemic has sparked conversations on learning loss, the necessity of rethinking education, and the assessment of various pedagogical approaches. The results underscore the continuous endeavors to modify and enhance education in the aftermath of the pandemic. There are disagreements on recovery tactics as well as how to diagnose and quantify COVID learning loss. Stakeholders are debating the importance of giving recovery plans priority and addressing differential learning loss. A chance to reconsider education is provided by COVID-19, with an emphasis on the where, when, and what of learning possibilities. Higher education institutions might also ponder and rethink post-COVID education.

This study examines the specialty area of advanced geotechnical engineering. Like many other courses, this course had to negotiate the choppy waters of the pandemic's uncertainty. After Malaysia imposed Movement Control Orders (MCO) on March 18, 2020, as a containment measure, educational institutions around the world were thrust into new territory and had to quickly adapt their methods for delivering courses and evaluating students. Through an analysis of data gathered prior to, during, and following the COVID-19 MCO period, this study seeks to clarify the ways in which these exceptional circumstances affected students' academic performance as well as the effectiveness of the course assessment plan.

RESULTS AND DISCUSSION

This study is based on cohort study. The CAP mapping for CO-PO achievement prior to COVID-19 is displayed in Table 1. For this course, there are three Course Outcomes (CO). Every CO deal with a single Program Outcome (PO). CO1 is about the evaluation of geotechnical problems using principles of soils mechanics. CO1 is addressing PO2 which is the ability to identify, formulate, research literature, and analyse complex civil engineering problems in reaching substantiated conclusions using principles of mathematics, natural sciences, and engineering knowledge. The level of taxonomy domain is C1-C6. The teaching and learning activity involve face-to-face lectures and blended learning. CO1 is measured in test (15%) and final exam (30%). Next, CO2 is about to develop solutions for geotechnical problems that meet

specified needs. CO2 addressing PO3 which is the ability to design systems, components, or processes for solving complex civil engineering problems that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. The level of taxonomy domain is C1-C6. The teaching and learning activity involve face-to-face lectures, blended learning, and technical talk by industrial panel. CO2 is measured in test (15%) and final exam (30%). Both CO1 and CO2 are cognitive domain. On the other hand, CO3 is about performing calculations and numerical analyses on geotechnical problems. CO3 is addressing PO12 which is the ability to recognise the need to undertake life-long learning and acquire the capacity to do so independently. The level of taxonomy domain is A1-A4. CO3 is measured in quiz (10%) which require the students to undertake an online course from Udemy.

Table 1. CAP mapping for CO-PO attainment before, during and after MCO

CO	PO	TAXONOMY DOMAIN	BEFORE				DURING					AFTER				
			ASSESSMENT				ASSESSMENT					ASSESSMENT				
			T&L	T	ASG	FE	T&L	T	QUIZ	PRO	FE	T&L	T	QUIZ	PRO	ASG
1	2	C1-C6	L, BL	9	0	36	ODL	9	0	24	12	L, BL	9	0	24	12
2	3	C1-C6	L	21	0	24	ODL	21	0	0	24	L	21	0	0	24
3	12	A1-A4	L, BL	0	10	0	ODL	0	10	0	0	L, BL	0	10	0	0

Note: L: Lecture, BL: Blended learning, T&L: Teaching & Learning, T: Test, ASG: Assignment, FE: Final Exam, PRO: Project

Table 2 shows the grade achievement for each semester. Prior to MCO on March 2020 semester, student performance was above average, and the failure rate was under 5%. The student's performance during MCO is impressive, with more than 50% of them receiving an A- and above. However, when a face-to-face cognitive evaluation was conducted following MCO, the results fell dramatically. Only one student scored A, and the failure rate skyrocketed to 21%. At this point, student performance is found to be controlled by the CAP. Thus, there has been a notable improvement in student performance since the CAP was modified in October 2021 and the project-based evaluation was introduced. The A students increased by almost 50% and the failure rate was kept below 1%. In general, the students' performance is better with the introduction of project-based assessment. Real project programming is better equipped for the students to face the challenging working environment these days which require the students to model the real geotechnical engineering problems to forecast the behaviour of the soil.

Table 2. Grade achievement for each semester

Sem	Grade achivement							
	A+, A, A-	B+, B, B-	C+, C	C-, D+, D	E	F	Total	% Fail
Mac '19	0	1	2	0	1	1	5	40%
Sept '19	1	7	12	0	0	1	21	5%
Mac '20	0	0	0	0	0	0	0	0
Sept '20	71	50	12	0	1	1	135	1%
Mac '21	1	12	25	6	4	0	48	21%
Oct '21	49	54	5	0	1	0	109	1%
Mac '22	1	1	3	0	1	0	6	17%
Oct '22	2	12	40	7	5	3	69	22%
Mac '23	23	28	2	0	0	0	53	0%
Oct '23	1	26	23	1	0	0	51	2%

CONCLUSION

The objectives are to evaluate the student's performance prior to, during, and following MCO. Every semester, the application of the CAP adjustments based on CQI was assessed. In light of the course's focus on project-based assessment, it can be said that it is better suited for advanced geotechnical engineering courses. Final examinations are appropriate for foundational courses. This yields positive outcomes and motivates the learner to study more effectively. Since engineers are usually involved in complex problems of geotechnical engineering analysis, project-based evaluation is a useful tool for developing a competent future engineer.

REFERENCES

Ibrahim, Z., Hussin, N., Wan Mokhtar, W. N. H., & Hashim, H. (2022). Assessing the Effect of Digital Social Media towards Face to Face Communication during Pandemic COVID-19 in Higher Educational Institutions. Environment-Behaviour Proceedings Journal, 7(SI10), 41–46.

Kamaruzaman, M. F., Abdul Majid, F., Md Shamsudin, N., & Khalid, F. (2022). Exploring Home-Based Learning by Using Mobile for Children with Autism During Covid-19 Pandemic. Environment-Behaviour Proceedings Journal, 7(SI7),9–14.

Mohamed Shuhidan, S., Wan Yahaya, W. A., Hashim, H., & Baharudin, M. F. (2022). Influence of Digital Literacy on Learning Engagement among Secondary Students in Malaysia. Environment-Behaviour Proceedings Journal, 7(SI10), 135–139.

Wincci, S., Sim, Y. E., Saiful Bahar, A. A., & Jamalludin, N. I. (2022). Practice Based Research on Music Artist Brand Online Music Video Production. Environment-Behaviour Proceedings Journal, 7(SI9), 559–561.

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Analyzing SuFO's Impact on Geotechnics Course Design and Its Influence on Teaching Methods and Outcomes

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ABSTRACT

The study examines the impact of students' online feedback (SuFO) on the content, teaching and learning activities and assessment methods of a geotechnics course at Universiti Teknologi MARA (UiTM) in Malaysia. It explores SuFO as an indirect measurement of course outcomes and its influence on teaching methods. The study used a questionnaire survey instrument to gather students' feedback on course information, teaching faculty, instructional methods, and university facilities. The survey consisted of 24 closed-ended questions divided into 4 sections, and the findings were measured using a performance indicator scale. The results of SuFO collected from 2019 to 2023 showed that most performance indicators for each section were "Very Good" or "Excellent," with an average mark of more than 80%. The study also compared students' satisfaction levels before, during, and after the COVID-19 pandemic, finding that post-COVID-19 students reported higher satisfaction, while satisfaction was lowest during the transition to online learning in 2020. Overall, the document highlights the importance of student feedback in evaluating teaching and learning processes and its potential to improve the quality of assessment and teaching effectiveness.

Keywords: Course Outcomes, Teaching and Learning, Geotechnics, SuFO.

INTRODUCTION

Student evaluation of teaching or student's feedback on teaching evaluation is a generalized practice in almost every institution of higher education around the world. The students' feedback is on their educational experiences, the performance of teaching staff, specific aspects of their institutions such as the facilities, infrastructures, and their courses. For UiTM students, Student Feedback Online (SuFo) has been used to evaluate the teaching and learning process. According to Ricci et al. (2018) that students are the stakeholders in assessment. Therefore, it is important for the students to evaluate the academicians and their courses since students are part of an educational institution. For the academicians, the student' feedback can be used for two main purposes which are summative and formative assessment purposes.

In addition, Gold (2001) gives more specific definition of summative purpose. It is referring to student evaluation that is used for administrative or personnel decision such as promotion, salary increment, demotion, dismissal, awards and meeting public or government accountability demands. Hence, the feedback outcome is also can be used to improve the quality of the assessment and teaching effectiveness in the classroom. The feedback also can be analysis in continuous quality improvement (CQI) for administrative purposes, especially for Quality Management System (QMS) of the course. The university's future planning heavily relies on their feedback on the current teaching and learning techniques (Nasruddin and Ariffin 2022).

This study adopted a questionnaire survey instrument to gather students' feedback regarding course information, teaching faculty, instructional methods, and university facilities. The survey consists of 24 closed-ended questions and has been divided into 4 sections. The first section has four questions including overall impression about the course questions such as the course content related to field of study and the method of assessments in this course enhance learning ability. The second section contained seven questions about lecturer professionalism such as the lecturer is approachable and accessible for discussion. The third section has eleven questions including teaching and learning (T&L) activities such as the lecturer explaining the course content and the outcomes of the course. The final section has two questions related to university's facilities such as T&L space is conducive and equipment's are adequate and functioning. All questions in four sections used four-point Likert scale related to course content outcomes and teaching approaches. The findings from the survey are measured by performance indicator in percentage scale from excellent to weak as shown in Table 1.

Table 1. Performance indicator scale

Scale (%)	Indicator
90-100	Excellent
80-89	Very Good
70-79	Good
60-69	Average
Below 60	Weak

The students were required to log in to the university's online learning management system (LMS), known as UFUTURE, in order to participate in the survey. As per the academic calendar issued by the university at the beginning of the semester, students are expected to respond to the survey between Week 11 of lecture sessions and Week 15 of study sessions, prior to the commencement of final examinations. All SuFO data from pre-COVID-19 (2019), COVID-19 (2020-2021) and post-COVID-19 (2022-2023) periods were collected online from UFTURE later were analyzed for descriptive statistical analysis by JASP version 0.18.3.0.

RESULTS AND DISCUSSION

The results of SuFo were collected from 2019 to 2023 as shown in Table 2. There are ten semesters of data gathered starting from Pre-COVID-19 till Post-COVID - 19. From Table 1, is shows that most performance of each sections are "Very Good", and the rest is "Excellent". Meaning that the average mark of each section is more than 80%. The average mark of each section for these ten semesters is as presented in Figure 1.

Table 2. Performance indicators four sections in SuFO

	Year Sem	Section A Indicator	Section B Indicator	Section C Indicator	Section D Indicator
Pre-COVID-19	2019 2	Very Good	Very Good	Very Good	Very Good
	2019 4	Very Good	Very Good	Very Good	Very Good
COVID-19	2020 2	Very Good	Very Good	Very Good	Very Good
	2020 4	Very Good	Very Good	Very Good	Very Good
	2021 2	Very Good	Excellent	Excellent	Very Good
	2021 4	Very Good	Very Good	Very Good	Very Good
Post-COVID-19	2022 2	Very Good	Very Good	Very Good	Very Good
	2022 4	Excellent	Excellent	Excellent	Excellent
	2023 2	Excellent	Excellent	Excellent	Excellent
	2023 4	Very Good	Very Good	Excellent	Very Good

If compare the students' satisfaction during pre-COVID 19 and post-COVID 19, there are more satisfaction achieved by post-COVID 19's students. While during COVID 19 (year 2020) the students' satisfaction are the lowest.

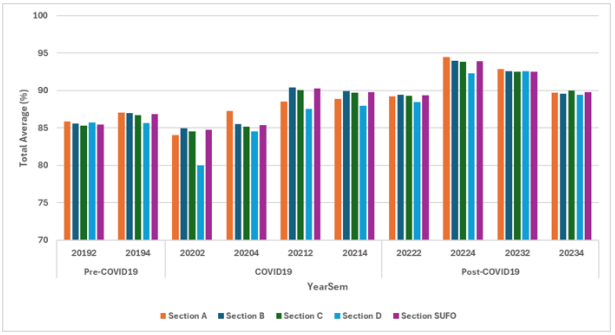

Fig. 1 Total average percentage for all sections in SuFO

It can be understood that this year was a transition period of T&L method, from face-to-face learning to online learning. During this transition, most of the students had a problem adapting of T&L especially due to lack of gadget and internet access problem (Sundarasen et al, 2020).

CONCLUSION

The analysis of 10 semesters SuFo's data concludes that majority of students that registered for the geotechnics course were in general satisfied with the content, teaching and learning activities and assessment methods. This finding is in-line with the continuous effort made by academicians and administrators of Civil Engineering Studies in continuous quality improvement (CQI) practices.

REFERENCES

Gold, R. (2001). Evaluation of instruction. *Educational Studies*, 15(1), 31-42.

Nasruddin Z.A and Ariffin N.H.M. (2022). A Student's Perspective On The Evaluation Of Teaching And Learning Using Student Feedback Online (SuFO). *2022 IEEE International Conference on Computing (ICOCO)*, Kota Kinabalu, Malaysia, 330-334.

Ricci, M., St-Onge, C., Xiao, J., Young, M. (2018). Students as stakeholders in assessment: how students perceive the value of an assessment. *Perspect Medical Education*, 7, 352–361.

Sundarasen, S., Chinna, K., Kamaludin, K., Nurunnabi, M., Baloch, M. G., Khoshaim, H. B., Abid Hossain, S. F., & Sukayt, A (2020). Psychological Impact of COVID-19 and Lockdown among University Students in Malaysia: Implications and Policy Recommendations, *International Journal of Environmental Research and Public Health*, 17(6206), 1-13. doi:10.3390/ijerph17176206.

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Performance Criteria Matrix as a Tool to Assess Programme Outcome for Community Projects in Engineers in Society Course

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ABSTRACT

This study investigates the efficacy of a Performance Criteria Matrix (PCM) as a tool for assessing two (2) programme outcomes in community-based projects within the "Engineers in Society" course. Utilizing a mixed-methods research design, data was gathered from the learning management system, u-Future, and the program outcomes system, myCOPO. The PCM assessed student performance across four key assessment tools: interim and final reports, individual presentation, and video montage. Simultaneously, myCOPO extracted broader program outcomes to evaluate engagement of engineers in society, problem-solving skills, and ethical reasoning. The integration of both systems provided a multi-dimensional analysis of how effectively the PCM quantifies both academic performance and the programme outcome attainment. Initial findings suggest that the PCM offers a robust framework for assessing diverse learning outcomes, thereby enhancing educational strategies and student engagement in socially relevant engineering projects. This research contributes to the discourse on effective assessment methodologies in engineering education, emphasizing the importance of structured evaluation tools in community-engaged learning environments.

Keywords: Community Project, Engineers in Society, Learning Outcome Assessment, Performance Criteria Matrix

INTRODUCTION

In the dynamic field of engineering education, integrating community projects into curricula is increasingly recognized as a key strategy to boost student learning and societal engagement (Smith & Jones, 2018). These projects provide essential real-world experience and foster social responsibility, crucial for the development of future engineers. However, the challenge lies in evaluating the varied objectives and outcomes of such initiatives. The adoption of a Performance Criteria Matrix (PCM) has been proposed as an effective method to structure and ensure the educational impact of these community-based projects (Brown, 2019).

This paper explores the implementation of the PCM in the "Engineers in Society" course, aimed at bridging theoretical knowledge with practical application. By employing the PCM, educators can deliver quantifiable and consistent assessments that align closely with the intended learning outcomes, thereby enhancing the educational value of community projects. The development and effectiveness of the PCM are critically analyzed, illustrating its potential to significantly contribute to the literature on educational assessment in engineering, and to improve educational strategies and student outcomes in socially engaged projects (Lee, 2019). Mat Isa et al. (2022) further validated this approach, showing how innovative assessment tools like the PCM can enhance learning outcomes in engineering courses during challenging times, thereby enriching both educational frameworks and student engagement in meaningful societal contributions.

RESULTS AND DISCUSSION

This section presents the data extracted from the u-Future LMS, focusing on four specific types of assessment tools utilized in the course: interim reports, final reports, presentations, and video montages as shown in Fig. 1, Fig. 2, Fig. 3, and Fig. 4, respectively.

Each of these assessment tools was designed to measure various aspects of the learning outcomes aligned with the course objectives. The interim and final reports assess students' ability to document and reflect on their project progress and outcomes. Presentations evaluate their communication and technical explanation skills, while video montages are aimed at assessing their creative and technical proficiency in summarizing project achievements. The analysis of the high values (4.0 - 5.0) shows that the adherence to final report requirements is consistently high, suggesting a strong alignment with the expected standards. There is a robust performance in terms of detailing the final design and discussing the proposed innovations, which could indicate a robust process in the development and finalization of designs or solutions. Based on the moderate values (3.0 to 4.0), the community or user engagement levels are moderate, suggesting some involvement but potential room for increased interaction or feedback integration. In addition, the evaluation of identified problems and ethical considerations is around the middle range, indicating

adequate attention but not a standout feature of the project. Finally, the lower values (0.5 to 3.0) indicate that identifying key problems and discussing multiple ideas are in the lower range, which may suggest difficulties in problem identification, or a lack of diverse solutions being considered. In addition, specified task engagements are lower, which might point to a need for more focused attention on certain designated tasks.

Fig. 1 Interim Report

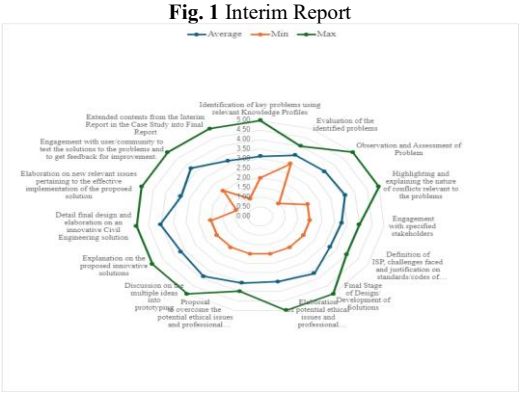

Fig. 2 Final report

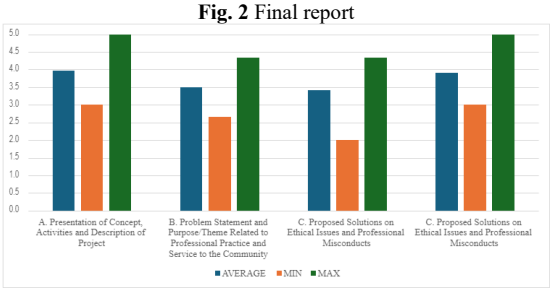

Fig. 3 Video montage

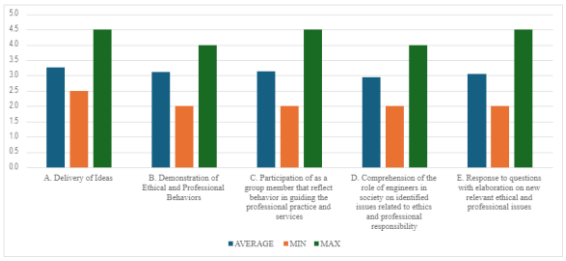

Fig. 4 Individual Presentation

CONCLUSION

This paper investigates the application of a Performance Criteria Matrix (PCM) to assess learning outcomes in community-based projects within an engineering course, focusing on the "Engineers in Society" aspects. Utilizing data extracted from the u-future and myCOPO systems, the study employed a mixed-methods approach to evaluate student performance across various assessment tools, including interim reports, final reports, presentations, and video montages. The analysis revealed high performance in areas such as adherence to final report standards and detailed innovation in project designs, indicating a strong alignment with the educational goals and effective application of technical knowledge. Conversely, moderate scores in community engagement and ethical considerations highlighted areas requiring further emphasis, suggesting the need for more interactive and community-focused learning strategies. The low performance in problem identification and diversity of solutions points to a gap in critical thinking and problem-solving skills, necessitating an enhanced focus on these aspects in the curriculum. Overall, the study underscores the value of the PCM in providing a comprehensive evaluation of student outcomes and suggests modifications to course design to better prepare students for professional and societal roles.

REFERENCES

Smith, J., & Jones, M. (2018). Community Engagement in Engineering Education: The Impact on Learning Outcomes. Journal of Engineering Education, 107(6), 823-839.

Brown, L. (2019). Assessment Techniques in Project-Based Learning Environments. Assessment & Evaluation in Higher Education, 44(3), 455-469.

Lee, C. (2019). Design and Application of Assessment Tools for Engineering Projects. International Journal of Engineering Pedagogy, 9(5), 76-90.

Mat Isa, et al. (2022). Design of an Innovative Assessment Instrument Integrating Service-Learning Malaysia University for Society Approach for Engineers in Society Course during Covid19 Pandemic. ASEAN Journal of Engineering Education, 2022(1), 50-65.

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Exploring Innovative Authentic AI-Assisted Assessment in Enhancing Student's Understanding and Skills in Chemical Engineering

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ABSTRACT

In current engineering education, traditional assessment methods often fall short in evaluating the distinct competencies required in engineering practices. This study proposes the integration of Generative Artificial Intelligence (Gen AI) tools into the assessment processes to assist the students in enhancing their understanding and skills. The objective of this research is to explore the effectiveness of Gen AI-assisted assessments in fostering a deeper understanding of engineering concepts and to develop students' abilities to use Gen AI tools critically and creatively. This study intends to establish a balanced framework for the integration of Gen AI in educational assessments that maximizes benefits while mitigating risks. This approach will contribute to the development of more effective, authentic, and ethical assessment methods in engineering education.

Keywords: Innovative assessment, Authentic assessment, Alternative assessment, Generative Artificial Intelligence, Engineering education.

INTRODUCTION

Innovative assessment methods are crucial to better gauge the complex cognitive and practical capabilities of engineering students, potentially enhancing educational outcomes and aligning them with industry needs. Recent advancements in AI provide unique opportunities to transform educational assessment methodologies. AI tools can simulate complex, real-world engineering problems, offering a platform for students to demonstrate their competencies in a more dynamic and authentic context. The incorporation of such technologies in educational assessments is nascent, with potential benefits and challenges yet to be fully explored.

However, the misuse of AI tools in educational settings can pose significant challenges. Over-reliance on these tools may lead to a decrease in critical thinking and problem-solving skills, as students might become dependent on AI for answers rather than developing their own analytical abilities (Darwin et al., 2024). There is also a risk of academic dishonesty, as these tools could potentially be used to generate answers without a proper understanding or original thought from the student. This could not only undermine the integrity of the assessment process but also diminish the learning outcomes that are crucial for preparing students for real-world engineering challenges. Therefore, it is essential to implement strict guidelines and monitoring systems to ensure that AI tools are used appropriately and effectively, enhancing learning while safeguarding academic standards.

Therefore, this study aims to critically evaluate the use of AI tools in engineering education, specifically within the chemical engineering courses, focusing on their impact on student learning and integrity in assessments. The objectives are to (i) determine how AI assists in solving engineering problems and enhances learning outcomes, (ii) cultivate students' skills in effectively leveraging AI tools for problem-solving and development of critical thinking, and (iii) ensure responsible use of AI tools, emphasizing their role in learning enhancement rather than facilitating academic dishonesty.

RESULTS AND DISCUSSION

Research suggests that AI tools can significantly impact student engagement and learning processes. Strzelecki (2023) highlighted the predictors of AI adoption in education, suggesting a model based on technology acceptance that includes behavioural intentions and use behaviour. Moreover, Qureshi (2023) identified the potential of ChatGPT to enhance student involvement and highlighted challenges related to output inconsistencies.

Fig. 1 shows the AI tools previously used by two groups of undergraduate students currently enrolled in the Food Preservation Technology elective course within the Chemical Engineering program. The figure highlights a predominant preference for ChatGPT, which is used by 53.8% of the students, indicating a significant reliance on this AI tool for their academic or project-related needs. Quillbot follows with 15.4% usage, suggesting a moderate preference among students who perhaps seek diverse functionalities or alternative AI-driven insights for rephrasing and summarizing text. Grammarly is utilized by 11.5% of the students, pointing to its application in improving writing clarity and grammatical

correctness, which is crucial for academic writing and reports.

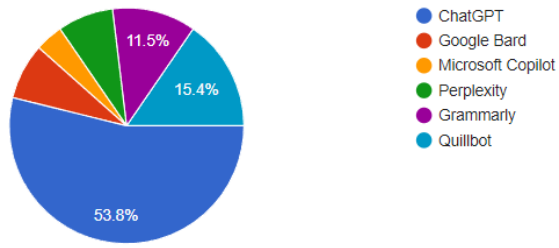

Fig. 1 Distribution of AI tools used by students in Food Preservation Technology course.

The distribution reflects the varied utility of different AI tools in educational settings, particularly within specialized fields such as Chemical Engineering, where the choice of tools can significantly influence the efficiency and quality of student learning and project execution. This also suggests a potential area for further research into the effectiveness and integration of AI tools in enhancing educational outcomes in engineering education.

The integration of AI tools in assessment is imagined transforming educational landscapes by providing a more authentic assessment of student abilities. The potential of AI to assist in complex problem-solving aligns with the growing demands of modern engineering education. However, ethical considerations, including academic integrity and the appropriate use of AI in educational settings, are crucial.

CONCLUSION

Incorporating AI tools into assessments in engineering education could reform traditional methodologies by providing a more authentic and effective evaluation of student skills and knowledge. This integration shows potential for improving educational outcomes and aligning academic assessments with the demands of the modern engineering workforce, especially in the era of IR 4.0. Further research is required to optimize these tools' integration into curricular frameworks to balance technological benefits with ethical educational practices.

REFERENCES

Darwin, Rusdi D., Mukminatien N., Suryati N., Laksmi E.D. & Marzuki. (2024). Critical thinking in the AI era: An exploration of EFL students' perceptions, benefits, and limitations. *Cogent Education* 11, 2290342.

Qureshi, B. (2023). Exploring the Use of ChatGPT as a Tool for Learning and Assessment in Undergraduate Computer Science Curriculum: Opportunities and Challenges. ArXiv.

Strzelecki, A. (2023). To use or not to use ChatGPT in higher education? Study on students' acceptance and use of technology. *Interactive Learning Environments,* 1–14.

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The Impact of Changes in the Final Exam Content on Students' Performance: A Descriptive Analysis

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ABSTRACT

Previous studies suggest that alterations in examination content may lead to a shift in grade distributions. Despite the importance of these issues, there is a lack of comprehensive research examining how specific changes in exam content affect student outcomes across different educational settings. Thus, this qualitative study examines the impacts of changes in examination content affecting students' performance by comparing grade distributions across two semesters. The analysis utilized grade distribution data which showed distinct patterns in the concentration of grades, notably a higher clustering at grade "A" in later semester compared to a more even distribution across higher grades in the earlier semester. This shift occurred alongside significant changes in examination content, including the introduction of new topics and a redistribution of marks across subjects. The findings suggest that modifications in exam content can substantially impact student performance, with the potential for both heightened achievement and increased variability in grades. The analysis highlights the importance of careful curriculum planning and the need for targeted student support when changes to assessment structures are implemented.

Keywords: Assessment Structure, Grade Distribution, Examination Content Changes, Student Performance

INTRODUCTION

Intensive mathematics courses are designed to enhance fundamental mathematics skills to prepare pre-commerce students for diploma courses. After this pre-university level, students will enroll in diploma programs such as Hotel & Management and Business Administration, where basic knowledge in mathematics is required. The intensive mathematics course contents include arithmetic operations, algebra, equations, functions, index and logarithm. It also covers sequence, statistics, and business mathematics. There has been debate among teaching lecturers whether index & logarithm should be included or excluded in the syllabus. These subtopics are classified with Course Learning Outcome and Soft skills of critical thinking and problem solving.

Formative and summative assessments are two kinds of testing that serve different purposes in evaluating student learning. In the classroom, the formative assessment takes place during the course, for example, quiz, test, and assignment. Whereas, the final exam is a classic example of summative assessment, which aims to let the teachers and students know the level of accomplishment attained (Woolfolk et al., 2008). The relevance of exam content to student performance has been explored in recent studies, which found that changes in curriculum and exam content can significantly impact student learning outcomes (Büchele & Feudel, 2023; Cybinski, 2011).

In the evolving landscape of educational assessment, the relationship between examination content and student performance remains a critical area of study. Recent educational reforms often lead to significant changes in examination content, including the introduction of new topics and the redistribution of marks across subjects. However, the impact of these changes on student performance is not fully understood. This gap in knowledge presents challenges for educators and policymakers aiming to design assessments that accurately reflect student learning and foster academic success. The primary aim of this paper is to investigate the impact of excluding certain mathematical subtopics, specifically index and logarithm, from the final exams on the academic performance of pre-commerce students, enrolled in an intensive mathematics course.

RESULTS AND DISCUSSION

A qualitative approach was used in this study based on document review to seek evidence whether simplifying the scope of the exam contents by removing these subtopics enhances the students' grade outcomes. A comparative study was carried out between two semesters of students' performance based on the different contents of the final exams. These students enrolled in a pre-commerce program in UiTM Cawangan Pulau Pinang. The first group of students (Group 1) belongs to Semester October 2020 - February 2021, while the second group (Group 2) belongs to Semester October 2021 – February 2022.

Table 1 illustrates the marks distribution of subtopics included in the final exams for the two semesters.

Table 1 Distribution of Marks in Final Examination for Two Different Semesters based on Topics.

Group 1 (October 2020 – February 2021)		Group 2 (October 2021 - February 2022)	
Equations & Function	15	Arithmetic & Algebra	20
Index & Logarithm	10	Equations & Function	20
Sequence	12	Sequence	10
Business Mathematics	8	Business Mathematics	40
Statistics	15	Statistics	10
Total Marks	60	Total Marks	100

The duration of the final exam for Group 1 was 2 hours, while for Group 2 was 3 hours. Both final exams were conducted online. Table 2 demonstrates the percentage of index & logarithm and other subtopics in the whole assessment for the two semesters, respectively.

Table 2 Distribution of % of Marks in Final Examination for Two Different Semesters based on Types of Assessment

Group 1 (October 2020 – February 2021)		Percentage %
Formative Assessment	Index & Logarithm	8
	Other subtopics	62
Final exams	Index & Logarithm	5
	Other subtopics	25
Total		100
Group 2 (October 2021 - February 2022)		Percentage %
Formative Assessment	Index & Logarithm	15
	Other subtopics	45
Final exams	Index & Logarithm	0
	Other subtopics	40
Total		100

Index & logarithm contributed as much as 13-to-15 percents of the whole assessments' contents for both semesters, reflecting a significant portion of the assessments. This might suggest a shift in instructional focus, or a pedagogical strategy aimed at improving understanding of these concepts during the course. Despite the increased focus during formative assessments for Group 2, index & logarithm were completely excluded from the final exams in this group. This could indicate a strategic decision to assess students on these topics more formative than summative, possibly to reduce pressure or because of these topics were deemed less critical for the final assessment of student capabilities in the broader curriculum context. The share of other subtopics increased in the final exams for Group 2 compared to Group 1, which could imply a broader range of topics or deeper coverage was deemed necessary for the final assessment in the latter group. Fig. 1 and Fig. 2 show the grade distribution for Group 1 and Group 2 students, respectively.

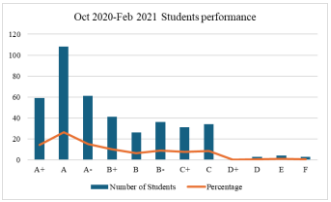

Fig. 1 Group 1 Students' Grade Performance

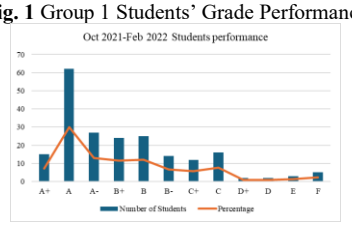

Fig. 2 Group 2 Students' Grade Performance

The percentage line in both graphs fluctuates from high grades to low grades, typical in academic performance distributions. A comparison analysis indicates that Group 1 showed a more evenly spread distribution across the grades, with a peak at "A", but significant percentages at "A+" and "A-" grades as well, while Group 2 had a more pronounced peak at "A", suggesting a higher concentration of students achieving this grade. The drop-off in percentage after "A" was sharper than in Group 1.

Overall performance shows that Group 1 had a broader distribution of higher grades, with more students achieving "A+" to "B" grades, while Group 2 showed more polarization in grades, with many students achieving high marks ("A") but also a small increase in lower grades. This could indicate a variation in the difficulty of assessments, or differences in student preparedness or instructional methods between the two groups. This comparison indicates that while Group 2 had a higher concentration of students performing at an "A" level, Group 1 showed a more evenly distributed set of outcomes across high grades. This analysis suggests that teaching methods, assessment difficulty, or even the curriculum focus shifted between these periods, potentially impacting student performance patterns.

CONCLUSION AND RECOMMENDATIONS

This paper focuses on the changes in examination contents, including the introduction of new topics and the redistribution of marks across subjects which is likely to influence students' performance. Further research is necessary to establish a causal relationship between examination content changes and student performance outcomes. This approach would enable a more definitive understanding and quantification of the impacts observed in this preliminary study.

REFERENCES

Büchele, S., & Feudel, F. (2023). Changes in Students' Mathematical Competencies at the Beginning of Higher Education Within the Last Decade at a German University. International Journal of Science and Mathematics Education. https://doi.org/10.1007/s10763-022-10350-x

Cybinski, P. J. (2011). Impacts of a Changing Student Learning Culture on Performance in an Undergraduate Business Maths Course. Retrieved from https://research-repository.griffith.edu.au/handle/10072/42433

Hendricks, W., & Adu, E. O. (2016). Impact of Teacher Self-efficacy on Learner Performance within a Changing Mathematics Curriculum: A Case for Previously Disadvantaged Schools. International Journal of Embedded Systems. https://www.tandfonline.com/doi/abs/10.1080/09751122.2016.11890554

Woolfork, A., Hughes, M., Walkup, V. (2008). Psychology in Education. Pearson Education.

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Assessment of Learning Outcomes in Solid Waste Management Course for Engineering Programme in Malaysia

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ABSTRACT

The Engineering Accreditation Council (EAC) mandates the adoption of the Outcome-Based Education (OBE) approach across all engineering programs in Malaysia, emphasizing the assessment of Course Learning Outcomes (CLOs). In Malaysia, solid waste management is a critical component of engineering education due to its direct impact on environmental sustainability and public health. In engineering programs, students learn to design, implement, and evaluate waste management systems that are efficient, sustainable, and cost-effective. This study evaluates the achievement of the CLOs specified for the Solid Waste Management course; an elective undertaken by all Civil Engineering students at a private university in Malaysia. Three key CLOs were assessed based on the course's alignment with Program Outcomes (PO) and Course Learning Outcomes (CLO) as documented in the EAC self-assessment report. The attainment of these outcomes was measured through students' performances in formative and summative assessments, particularly focusing on CLO1, CLO2, and CLO2. Results from semester 32334 indicated the highest overall attainment of CLOs, with CLO1 showing the lowest attainment ranging from 39.4% to 55.8%. Other CLOs achieved significantly higher, between 72% and 95.9%. These findings underscore the need for targeted improvements in instructional strategies to enhance learning outcomes in future offerings of the course.

Keywords: Course Outcome, Attainment, Outcome Based Education.

INTRODUCTION

In Malaysia, the Engineering Accreditation Council (EAC) is pivotal in ensuring the quality of engineering education through Outcome-Based Education (OBE) initiatives. The EAC focuses on assessing and evaluating Program Outcomes (POs) within the engineering curriculum to drive continuous quality improvement in engineering programs (Liew & Kiew, 2022; Liew et al., 2021). The implementation of OBE in teaching and learning has become a standard practice in Malaysian higher education institutions to meet the EAC's requirements. Additionally, the EAC mandates that engineering programs include courses on engineering ethics education to foster ethical awareness among engineering undergraduates.

One of the key strategies to meet EAC standards is the integration of active learning methodologies in engineering courses. Active learning has been proven to enhance students' problem-solving skills, aiding in achieving course outcomes and overall program outcomes (Hadibarata & Rubiyatno, 2019). Moreover, the EAC emphasizes the significance of industrial training to expose students to professional engineering practices, aligning to prepare graduates for the industry (Saim et al., 2021). The EAC's accreditation standards also emphasize the assessment of POs to facilitate continuous quality improvement in engineering education.

The EAC's emphasis on OBE, active learning, ethics education, and industrial training highlights its dedication to enhancing the quality of engineering education in Malaysia. By establishing rigorous standards and promoting continuous quality improvement, the EAC plays a crucial role in shaping the future of engineering education in the country.

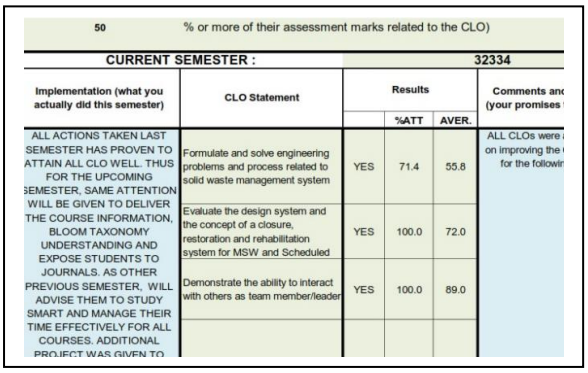
RESULTS AND DISCUSSION

A qualitative approach is adopted through document review based on data extracted from the OBE system known as MyOutcome. A longitudinal method is used to collect data from the same MyOutcome analysis for the course over an extended period of 5 semesters which are November 2020 (32034), April 2021 (12134), April 2022 (12234), November 2022 (32234) and November 2023 (32334) semesters. The longitudinal method is a research approach that involves collecting data from the same subjects repeatedly over a period to observe changes, trends, or developments. Unlike cross-sectional studies that capture a snapshot of data at a single point in time, longitudinal studies provide insights into how variables evolve and allow researchers to examine relationships, patterns, and causal effects longitudinally (Chen & Culpepper, 2020).

The achievement of CLO is facilitated through the programme's proprietary software, MyOutcome, designed in-house to streamline the educational process.

As depicted in Figure 1, MyOutcome serves as the cornerstone of our academic framework, providing a robust platform for tracking and evaluating student progress. Through its intuitive interface and sophisticated algorithms, MyOutcome empowers educators to assess the attainment of CLO, ensuring students receive targeted support and feedback tailored to their learning journeys.

Fig. 1 shows as a summary of the assessment results of Course Learning Outcomes (CLOs) for a Solid Waste Management course during the 32334 semester in relation to the current semester's activities and plans.



50 % or more of their assessment marks related to the CLO)

CURRENT SEMESTER : 32334

Implementation (what you actually did this semester)	CLO Statement	Results			Comments and (your promises
			%ATT	AVER.	
ALL ACTIONS TAKEN LAST SEMESTER HAS PROVEN TO ATTAIN ALL CLO WELL. THUS FOR THE UPCOMING SEMESTER, SAME ATTENTION WILL BE GIVEN TO DELIVER THE COURSE INFORMATION, BLOOM TAXONOMY UNDERSTANDING AND EXPOSE STUDENTS TO JOURNALS. AS OTHER PREVIOUS SEMESTER, WILL ADVISE THEM TO STUDY SMART AND MANAGE THEIR TIME EFFECTIVELY FOR ALL COURSES. ADDITIONAL PROJECT WAS GIVEN TO	Formulate and solve engineering problems and process related to solid waste management system	YES	71.4	55.8	ALL CLOs were on improving the for the followi
	Evaluate the design system and the concept of a closure, restoration and rehabilitation system for MSW and Scheduled	YES	100.0	72.0	
	Demonstrate the ability to interact with others as team member/leader	YES	100.0	89.0	

Fig. 1 Course Outcome attainment interface reflected in the MyOutcome

Fig. 2 shows each CLO attainment for 5 consecutive semesters.

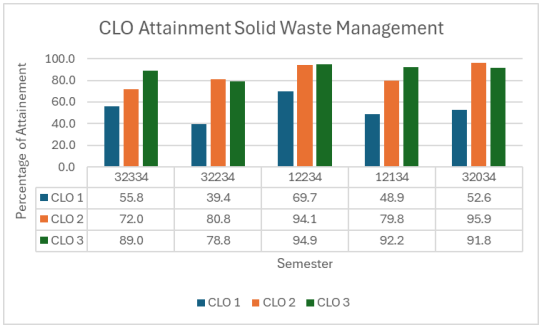


Fig. 2 Course Outcome for 5 semesters for Solid Waste Management

For CLO1, the attainment varies significantly across semesters. The lowest attainment is in semester 32234 (39.4%), and the highest is in semester 12234 (69.7%). This indicates inconsistency in students' ability to formulate and solve engineering problems related to solid waste management systems, suggesting potential fluctuations in course delivery, assessment standards, or student cohorts. Second, CLO 2, which focuses on the evaluation of design systems and concepts for waste management, generally shows higher attainment, peaking in semester 12234 (94.1%) and remaining fairly high in the latest semester, 32034 (95.9%). This suggests a strong grasp of evaluative and design skills among students, which may be due to effective teaching methods or curriculum design. Finally, CLO 3 relates to the ability to interact within a team as a member or leader. Attainment for this outcome is consistently high, with a peak in semester 12234 (94.9%) and the lowest in semester 32234 (78.8%). This indicates that while teamwork and leadership skills are generally well developed, there may be room for improvement, particularly in supporting semesters with lower scores.

CONCLUSION

In summary, the study of Course Learning Outcome (CLO) attainment for Solid Waste Management over the course of five (5) semesters has provided valuable insights into the effectiveness of our educational approach. Through the tracking and analysis of three key CLOs, a comprehensive understanding of student proficiency and progress can be observed in this field. Across the observed semesters, trends in CLO attainment have illuminated areas of strength and opportunities for improvement within our curriculum and instructional methods. These findings serve as a foundation for ongoing refinement and enhancement of our educational practices, ensuring that we continue to cultivate competent and skilled professionals equipped to address the challenges of solid waste management effectively.

REFERENCES

Hadibarata, T. and Rubiyatno, R. (2019). Active learning strategies in the environmental engineering course: a case study at curtin university malaysia. Jurnal Pendidikan Ipa Indonesia, 8(4). https://doi.org/10.15294/jpii.v8i4.19169

Liew, C. and Kiew, P. (2022). Sustainable assessment: the inevitable future of engineering curriculum. Asean Journal of Engineering Education, 6(1), 23-32. https://doi.org/10.11113/ajee2022.6n1.74

Saim, N., Noor, N., Alias, R., & Rosli, S. (2021). Evaluation of programme outcomes under the psychomotor and affective domain for diploma civil engineering students through industrial training: a statistical study from employers' perspective in malaysia. International Journal of Engineering Pedagogy (Ijep), 11(5), 70. https://doi.org/10.3991/ijep.v11i5.22369

Chen, Y. and Culpepper, S. (2020). A multivariate probit model for learning trajectories: a fine-grained evaluation of an educational intervention. Applied Psychological Measurement, 44(7-8), 515-530. https://doi.org/10.1177/0146621620920928

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Evaluation of Program Outcome addressing Cognitive Domain for Prestressed Concrete Design Course in Civil Engineering

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ABSTRACT

In the evolving landscape of engineering education, incorporating higher cognitive skills into curricula is essential for preparing students to meet complex real-world challenges. This study investigates the program outcomes attainment with Bloom's cognitive learning taxonomy, in a pre-stress concrete design course by analyzing data from three cohorts (2021 to 2023). The focus is on Program Outcome 3 (PO3), which involves the design and development of engineering solutions addressing the cognitive skills from learning taxonomy. In addition, a document analysis was used to analyse the quantitative data from the university's course analysis system, including final exam, test, assignments, and project grades to determine the effectiveness in assessment of PO3. The findings reveal a decline in the program outcome direct attainment, with scores decreasing from 95.8% in 2021 to 93.3% in 2023. Meanwhile, indirect attainment, which gauges broader skills and industry perceptions, showed fluctuations, with a drop from 86.0% in 2021 to 81.0% in 2022, followed by a rebound to 84.1% in 2023. This variability may be linked to the introduction of C6 in 2023, indicating a higher level of cognitive skill requirements. Although this could account for the decline in direct attainment, it also suggests increased focus on creativity and innovation.

Keywords: Prestressed Concrete Design, Program Outcome 3, Design/Development of Solution, Quantitative Studies.

INTRODUCTION

Pre-Stressed Concrete Design course is a critical component of civil engineering education, providing students with the knowledge and skills needed to understand and apply pre-stress technology in various engineering projects (Mante et al., 2022). This course is designed to equip future engineers with the ability to analyze, design, and develop structural solutions that incorporate pre-stress techniques. As part of a broader engineering curriculum, this course aims to foster engineering knowledge, encourage innovative design solutions, and develop effective communication skills.

Program Outcome 3 (PO3) is a critical component in engineering education, emphasizing the design and development of solutions (Ahmed Ghaly, 2020). To evaluate PO3 effectively, Bloom's Learning Taxonomy (BLT) provides a framework that organizes cognitive skills into six levels: C1 (Remembering), C2 (Understanding), C3 (Applying), C4 (Analyzing), C5 (Evaluating), and C6 (Creating). These levels reflect a progression in students' learning and comprehension capabilities. PO3 aligns with these stages by encouraging students to not only remember and understand engineering concepts, but also to apply them in practical scenarios, analyze complex problems, evaluate solutions, and eventually create innovative designs (Mulla et al., 2022). By using LT to assess PO3, educators can measure students' abilities across this spectrum, ensuring they develop a robust skill set in design and problem-solving. This structured approach helps to identify strengths and weaknesses in educational programs, guiding improvements and teaching methods to foster deeper learning and innovation in engineering.

This paper explores the effectiveness of a pre-stressed concrete design curriculum by evaluating PO3 in course outcome (CO). By analyzing quantitative data from multiple batches of students, this study aims to assess the course's impact on achieving its program outcomes and identify opportunities for improvement.

RESULTS AND DISCUSSION

A qualitative approach through document review is used to evaluate the PO3 direct attainment based on data extracted from the university's course analysis system for three (3) cohorts of students (2020, 2021, 2022). The data includes grades from examination, test, project, and assignment related to PO3. The evaluation criteria are grounded in CO assessment, LT, and CO attainment.

From Fig. 1, the weightage for PO3 in a prestressed concrete design course across three student batches from 2021 to 2023 shows notable variation, with figures at 84.7%, 91.0%, and 81.3%, respectively.

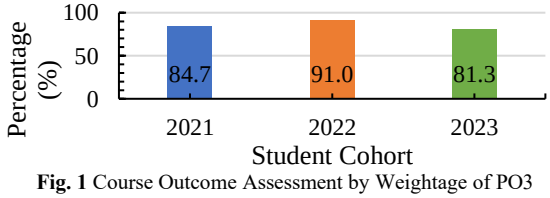

Fig. 1 Course Outcome Assessment by Weightage of PO3

This could reflect changes in curriculum focus, variability in student cohorts, or differences in assessment methods. The higher weightage in 2022 might suggest greater emphasis on design and development of solutions or superior student performance, while the other two years indicate a lesser focus or lower performance. These fluctuations prompt a review of the curriculum and teaching methods to ensure consistency and effectiveness. It might also require deeper analysis to understand factors contributing to these shifts, such as changes in instructional approaches, course materials, or external influences. Ultimately, addressing these variations is key to maintaining a high standard of engineering education and fostering consistent outcomes for students.

The course outcome assessments for a pre-stress design course over three batches from 2021 to 2023 show varying emphases across LT levels. The data reveals minimal focus on lower levels (C1 and C2), with most assessments centering on C3, C4, and C5 skills as shown in Fig. 2.

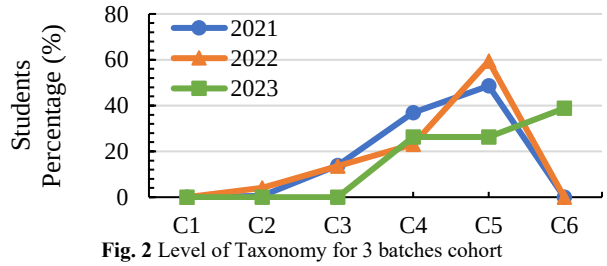

Fig. 2 Level of Taxonomy for 3 batches cohort

In 2021, analyzing and evaluating dominated, while 2022 saw an increase in evaluating (59.4%) but a drop in applying and analyzing. The most significant change occurred in 2023, where there was no emphasis on applying, lower focus on evaluating (26.3%), but a substantial shift toward creating (C6), which accounted for 38.8% of assessments. This transition suggests a new focus on creativity and design in 2023, highlighting potential changes in curriculum or teaching methods. However, the fluctuations across batches suggest the need for a more consistent approach to course outcome assessments, ensuring that students have opportunities to develop a balanced range of cognitive skills throughout the course.

Fig. 3 shows the program outcome attainment data for batches 2021, 2022, and 2023 shows a slow decrease in direct attainment, with scores of 95.8%, 95.5%, and 93.3%, respectively. In contrast, indirect program outcome attainment fluctuated, with 86.0% in 2021, 81.0% in 2022, and 84.1% in 2023. The addition of C6 in 2023, requiring higher-level creative tasks, might have contributed to the decline in direct attainment, reflecting increased course difficulty. This focus on creativity could also lead to positive outcomes, fostering innovation and skills valued by employers, potentially explaining the rebound in indirect attainment in 2023. The data suggests a need for consistent assessment methods, balanced curriculum focus, and external feedback to ensure that the course meets program objectives while adapting to the demands of a changing educational environment.

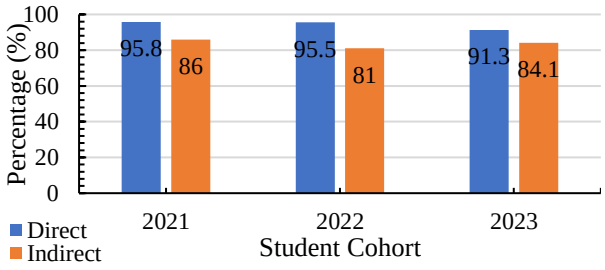

Fig. 3 Program Outcome Attainment Directly and Indirectly

CONCLUSION

The findings indicate a shift in the performance and curriculum effectiveness of the pre-stress concrete design course over the years 2021 to 2023. While direct program outcome attainment decreased, indirect attainment fluctuated. The introduction of higher-level cognitive skills (C6 - Create) in the curriculum in 2023 has likely contributed to the observed decline in direct attainment, suggesting that students may be facing challenges with the increased complexity of the course. This shift in PO3 direct attainment emphasizes the need to potentially reevaluate and adjust teaching methodologies to better support student learning at these higher cognitive levels. However, the rebound in indirect attainment suggests a potential benefit in fostering innovation and creativity. Future recommendations include standardizing assessment methods, balancing the curriculum across LT, providing additional support for higher-level skills, seeking external feedback from industry stakeholders, and ensuring continuous course improvement. These steps can help maintain a consistent and effective educational program, ensuring that students are well-prepared for their engineering careers.

REFERENCES

Ahmed Ghaly, S. M. (2020). Indirect Evaluation of Program Educational Objectives and Student Outcomes for Engineering Programs: A Case Study. Engineering, Technology and Applied Science Research, 10(5), 6209–6213.

Mante, D. M., Isbiliroglu, L., Hofrichter, A., Barnes, R. W., & Schindler, A. K. (2022). Expected compressive strength in precast, prestressed concrete design: review and discussion of regional practice. PCI Journal, May-June.

Mulla, A. A., Jadhav, H. S., & Shah, A. P. (2022). A Case Study on Course Outcome & Program Outcome Mapping Levels Based on Competency & Performance Indicators. Journal of Engineering Education Transformations, 36(Special Issue 2), 326–331.

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Sustainable Micro-Learning Modules in Chemical Engineering Separation Processes Course

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ABSTRACT

The rapidly changing landscape of the chemical engineering industry demands adaptive and innovative educational strategies that align with modern professional requirements. This study explores the implementation of sustainable micro-learning modules in chemical engineering separation processes. It aims to evaluate the effectiveness of these modules in enhancing student understanding and retention of key concepts and investigates their impact on student engagement and satisfaction compared to traditional teaching methods. A significant challenge in chemical engineering education lies in developing flexible and effective learning methodologies that address evolving industry demands. Conventional approaches, especially in separation processes, may fall short in engaging students and providing them with real-world problem-solving skills. This study hypothesizes that micro-learning modules, integrated through an LMS, can offer a sustainable, efficient, and student-centered learning approach. However, the effectiveness and best practices for integrating these modules into chemical engineering curricula are not well understood. Through a comparative analysis of student performance, engagement, and satisfaction, this research seeks to uncover the potential of micro-learning in fostering a deeper comprehension of separation processes. The findings are expected to provide valuable insights into the development and implementation of scalable and sustainable educational frameworks that cater to the future needs of chemical engineering education.

Keywords: Micro-Learning, Chemical Engineering Education, Separation Processes, Learning Management System (LMS), Sustainable Teaching Method

INTRODUCTION

The integration of sustainable learning methods like micro-credentialing is pivotal in chemical engineering, particularly for complex topics such as separation processes. Traditional educational techniques often struggle to engage students fully or deepen their understanding of essential concepts. In contrast, micro-credentials, which compartmentalize information into concise units, have gained recognition for their effectiveness across various educational settings. These programs offer specialized learning that aligns with current industry demands and advancements, providing flexibility to balance education with other commitments. This focused approach allows learners to gain relevant skills and knowledge efficiently.

Micro-learning not only addresses cognitive overload by providing bite-sized learning units focused on key concepts and skills, but it also enhances comprehension and retention, making learning objectives more achievable (Samala *et al.*, 2023). This technique is well-suited to the demands of today's learners who desire short and focused knowledge, particularly in complex disciplines such as chemical engineering. intricate This need is particularly pronounced in complex disciplines where concepts require precision in both delivery and comprehension. Students increasingly seek modular, digestible content that allows for efficient mastery of skills while maintaining flexibility for individual learning paces. By structuring content modularly, micro-learning facilitates targeted repetition and self-paced review. This modular approach allows chemical engineering students to revisit challenging topics as needed, leading to higher retention and more profound understanding over time. In this way, micro-learning addresses diverse learning preferences and helps students achieve key competencies.

In the realm of engineering education, micro-learning has been effectively integrated into various courses to improve engagement and outcomes (Sirwan *et al*., 2018). This approach has been shown to enhance student performance and satisfaction, suggesting its applicability in chemical engineering education (Carine *et al.*, 2024). Furthermore, the micro-credential movement, which includes the delivery of short, focused training modules, is gaining traction in higher education. These credentials are especially prevalent in fields like business and technology but are also recognized in chemical engineering. They offer flexible, modular learning that can adapt to the needs of chemical engineering students, supporting their professional and academic growth (Meyer Th. *et al*.,2022)

METHODOLOGY

The research aimed to explore the impact of micro-learning modules on student engagement and understanding in chemical engineering separation processes, compared to traditional teaching methods. First, concise and engaging lecture videos were prepared, focusing on key topics like liquid-liquid extraction, incorporating multimedia and simulation tools. These modules were deployed via a Learning Management System (LMS) for seamless curriculum integration, with clear instructions and timelines provided to students. Surveys using a Likert scale measured engagement, satisfaction, and understanding. Finally, statistical analysis of pre- and post-test results quantified learning outcomes, highlighting differences between micro-learning and traditional methods, offering insights for educational improvement.

RESULTS AND DISCUSSION

As shown in Figure 1, students have different preferences for the four learning methods: face-to-face (FTF), peer-to-peer (P2P), hybrid learning (HLM), and flexible learning (FLM). It also shows that the Hybrid Learning Method (HLM) is the most popular, with 39% of all votes. Face-to-Face (FTF), on the other hand, came in second with 29%. Twenty percent of students like peer-to-peer (P2P) learning, while only twelve percent like the flexible learning method (FLM).

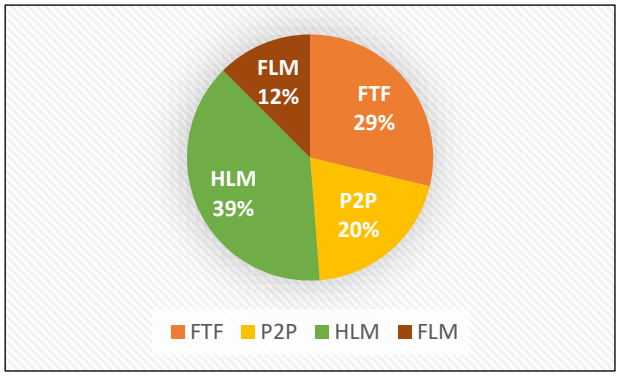

Fig. 1 Distribution of Learning Method Preferences among students

The dominance of HLM suggests that students appreciate the combination of traditional in-person instruction with online components, which offers flexibility while maintaining the benefits of direct interaction. The strong preference for FTF learning reflects the value students place on direct engagement with instructors and peers, which is often associated with higher levels of understanding and retention. The moderate preference for P2P learning indicates that collaborative learning environments are beneficial but may not be as highly valued as more structured methods. Finally, the lower preference for FLM could imply that students find this method less effective or less engaging compared to other approaches.

This trend aligns with findings in the literature, where hybrid learning has been recognized for its ability to enhance learning outcomes by leveraging the strengths of both online and face-to-face instruction. As educational environments continue to evolve, understanding these preferences can guide the development of more effective learning strategies.

CONCLUSION

The result reveals a clear preference among students for the Hybrid Learning Method (HLM), which combines online and face-to-face instruction, reflecting the demand for flexible yet structured learning experiences. Face-to-Face (FTF) learning remains a strong choice, indicating the continued value placed on direct interaction in educational settings. Peer-to-Peer (P2P) learning holds moderate appeal, suggesting that while collaborative environments are beneficial, they are not the top choice for most students. The lower preference for the Flexible Learning Method (FLM) highlights that students may find it less effective or engaging compared to more structured approaches. Overall, these insights suggest that a balanced, hybrid approach that incorporates the benefits of both traditional and modern learning methods may be the most effective strategy for meeting diverse student needs in today's educational landscape.

REFERENCES

Sirwan Mohammed, G., Wakil, K., & Sirwan Nawroly, S. (2018). The Effectiveness of Microlearning to Improve Students' Learning Ability. *International Journal of Educational Research Review*, 3(3), 32-38.

Carine Menezes Rebello, Gabriela Fontes Deiró, Hanna K. Knuutila, Lorena Claudia de Souza Moreira, Idelfonso B.R. Nogueira (2024). Augmented reality for chemical engineering education. *Education for Chemical Engineers*, 47, 30-44.

Meyer Th., E. Schaer, J. Abildskov, H. Feise, J. Glassey, M. Liauw, C. Ó'Súilleabháin, M. Wilk (2022). The importance/role of education in chemical engineering, *Chemical Engineering Research and Design*, 187, 164-173.

Samala, A. D., Bojic, L., Bekiroğlu, D., Watrianthos, R., & Hendriyani, Y. (2023). Microlearning: Transforming Education with Bite-Sized Learning on the Go—Insights and Applications. *International Journal of Interactive Mobile Technologies*, 17(21), 4–24.

Paving the Way: Unveiling the Key Influences on Women's Empowerment in Construction

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ABSTRACT

This paper examines the factors affecting Malaysian women's participation in the construction industry. It reviews literature on women's involvement, challenges they face, and strategies to retain them. A questionnaire was conducted with various samples, including construction organizations, students, and professional women. The study found that women can build successful careers in the construction industry, but barriers such as gender-based discrimination, harsh work environments, lack of education, and lack of successful role models hinder their progress. The percentage of females working in the industry is lower than males. The study used a random sampling technique and distributed a structured questionnaire to 200 female construction workers. The collected data was analyzed using SPSS version 29. The study found that internal and external factors influence women's employment choices in the construction industry. The findings can be relevant to Malaysian policymakers and suggest that implementing strategies to address these factors could lead to increased opportunities for women in the industry.

Keywords: Women, Barriers, Construction Industry, Retain, Strategies.

INTRODUCTION

The construction industry in Malaysia is a significant employer, with women playing a crucial role in driving national progress. However, there are numerous obstacles that women face, including a lack of in-depth knowledge and skills, professional interactions, and workplace rules. Risk and conflict are the main issues faced by women working in the sector, along with the range of jobs available to them. Key elements causing difficulties include masculinity and femininity in engineering, gender discrimination, sexual harassment, the working environment, working hours, and intellectual and physical aptitude.

Malaysian women face challenges related to their personal lives and work, which reflect a larger societal issue of gender inequality. Addressing systemic barriers and biases is essential for women's access to equal opportunities and supporting their personal and professional growth. By creating an inclusive environment that values women's aptitude and provides them with necessary resources, Malaysia can harness the full potential of its female population for overall societal advancement. (Firdaus Anuar, Khairul, et al, 2017)

Despite these challenges, there are now more women working in the construction industry than ever before, with the construction sector being the largest industrial employer globally. However, societal stereotypes and limited opportunities for women to access training and education contribute to this gender disparity. (Jimoh, Richard Ajayi, et al, 2012)

Efforts to encourage more women to pursue careers in construction include scholarships, mentorship programs, and promoting gender diversity in the workplace. (Barnabas, Annette, et al, 2009)

This study aims to address the gap in the literature by examining factors influencing women's participation in Malaysian construction companies and providing insights and recommendations for promoting gender equality and increasing female participation in the industry.

METHODOLOGY

The early phase of the research began by reviewing the literature review of published articles, journals, reports, and text and other reliable source of data to get an overview of the factors affecting Malaysian women's participation in the construction industry. The data was also obtained from the distributed questionnaire survey to the respondents via online questionnaire medium form such as Google Form and will be analyzed accordingly. The questionnaires were distributed to 200 respondents, and 111 respondents has returned their responses and feedback by answering all the question sets. The percentage of return questionnaire is 55%. A total of 200 sets of questionnaires were being distributed to the construction players in Malaysia through a random sampling. All the research findings analysis established based on the data collected from the respondents that cooperated in answering the survey. The data obtained, then analysed by using SPSS software analysis. Therefore, each questionhas been analysed and explained

in sequence. The data obtained were then transferred into tables to simplify the findings.

RESULTS AND DISCUSSION

The analysis reveals that women indeed have a role to play in the construction industry and can build successful careers within it. However, the presence of multiple barriers, including gender-based discrimination, challenging work environments, limited educational opportunities, and a lack of role models, significantly impedes women's participation and advancement in the industry. Moreover, the study uncovers evidence of discrimination and sexual harassment, further exacerbating the challenges faced by women in construction.

These factors collectively hinder the progress of women in the construction industry, contributing to the lower percentage of females compared to males in the sector. Efforts to address these barriers and create a more inclusive environment for women in construction are crucial to increasing diversity and equality within the industry. By implementing policies that promote gender equality, providing support systems for women, and raising awareness about these issues, progress can be made towards achieving greater representation of women in construction.

CONCLUSION

In conclusion, this paper provides valuable insights into the factors influencing Malaysian women's participation in the construction industry. By addressing the identified challenges and barriers, stakeholders can work towards creating a more conducive environment for women to thrive in construction. Ultimately, fostering gender diversity and inclusivity within the industry not only benefits individual women but also contributes to the overall growth and sustainability of Malaysia's construction sector. It helps to break down barriers and stereotypes, promoting a more equal and inclusive workplace for all. By creating a more diverse and inclusive industry, we can ensure that all voices are heard and valued. This will ultimately lead to better decision-making and innovation within the sector. This will ultimately lead to better decision-making and innovation within the sector, benefiting not only the employees but also the organization as a whole. This will create a more inclusive and collaborative work environment. This will also attract a wider pool of talent and improve employee retention rates. Embracing diversity and inclusion in the construction sector can lead to increased productivity and competitiveness in the global market.

REFERENCES

Afolabi, Adedeji, et al. “Balancing the Female Identity in the Construction Industry.” Journal of Construction in Developing Countries, vol. 24, no. 2, 31 Dec. 2019, pp. 83–104, https://doi.org/10.21315/jcdc2019.24.2.4. Accessed 3 Jan. 2024.

Barnabas, Annette, et al. “A Study on the Empowerment of Women Construction Workers as Masons in Tamil Nadu.” India. Journal of International Women’s Studies, vol. 11, no. 2, 2009, pp. 121–141. Accessed 3 Jan. 2024.

Firdaus Anuar, Khairul, et al. “The Barriers and Challenges Of Women’s Involvement In The Construction Industry Within Klang Valley Area.” International Journal of Industrial Management (IJIM) ISSN, vol. 3, 2017, pp. 127–564. Accessed 3 Jan. 2024.

Gayani Fernando, Nirodha, et al. “The Career Advancement of the Professional Women in the UK Construction Industry.” Journal of Engineering, Design and Technology, vol. 12, no. 1, 25 Feb. 2014, pp. 53–70, https://doi.org/10.1108/jedt-04-2012-0018. Accessed 3 Jan. 2024.

Hasan, Abid, et al. “Scientometric Review of the Twenty-First Century Research on Women in Construction.” Journal of Management in Engineering, vol. 37, no. 3, May 2021, https://doi.org/10.1061/(asce)me.1943-5479.0000887. Accessed 3 Jan. 2024.

Haupt, Theo, and Ferdinand Fester. “Women-Owned Construction Enterprises: A South African Assessment.” Journal of Engineering, Design and Technology, vol. 10, no. 1, 23 Mar. 2012, pp. 52–71, https://doi.org/10.1108/17260531211211881. Accessed 3 Jan. 2024.

Jimoh, Richard Ajayi, et al. “Women Professionals’ Participation in the Nigerian Construction Industry: Finding Voice for the Voiceless.” Organization, Technology and Management in Construction: An International Journal, vol. 8, no. 1, 1 Dec. 2016, pp. 1429–1436, https://doi.org/10.1515/otmcj-2016-0005. Accessed 3 Jan. 2024.

Kamaruddeen, Ahmed, et al. Factors Influencing Females’ Work in The Construction Companies. Vol. 16, no. 3, pp. 1823–884. Accessed 3 Jan. 2024.

Beyond Spreadsheets: An Intuitive, Flexible OBE-Compliant Assessment Mark Management Tool

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ABSTRACT

Outcome-Based Education (OBE) presents unique challenges for educators, particularly in managing complex assessment data. Traditional tools like spreadsheets often fall short in meeting OBE's specific requirements. To address this, an intuitive, flexible, and OBE-compliant assessment mark management tool was developed using Excel VBA. This tool streamlines the assessment process by automating calculations, enabling customizable rubrics, and supporting weighted grading. It also enhances data visualization through graphs, charts, and tables, facilitating data-driven decision-making and targeted interventions. By combining user-centric design with the power of Excel VBA, this tool empowers educators to efficiently manage assessment marks and focus on fostering meaningful learning experiences for students.

Keywords: Assessment Mark Management, Outcome-Based Education, Excel VBA, Constructive Alignment, Data Visualization.

INTRODUCTION

Outcome-Based Education (OBE) has become a widely adopted framework in engineering education, emphasizing the achievement of specific learning outcomes over traditional input-based models. While OBE offers numerous benefits, such as improved student-centered learning and alignment with industry needs, it also presents unique challenges for educators, particularly in the realm of assessment mark management.

The complex nature of OBE, with its emphasis on multiple assessment criteria, diverse learning outcomes, and continuous improvement cycles, often necessitates the use of specialized tools to effectively manage assessment marks. Traditional tools like spreadsheets, while versatile, often fall short in meeting the specific demands of OBE. They can be cumbersome to use, prone to errors, and lack the flexibility required to accommodate the diverse assessment practices employed across different engineering programs. Moreover, as Spady (1994) notes, "OBE requires a shift in thinking about assessment, from a focus on measuring what students know to a focus on measuring what they can do." Spreadsheets, designed primarily for numerical calculations, do not inherently support this shift.

While computerized solutions exist in the education sector, many require complex data processing and manipulation before meaningful entry is possible. This creates an additional layer of complexity for educators who may not have the time or expertise to navigate such systems. There is a clear need for a tool that allows for basic data entry, with the software handling the subsequent calculations and transformations required for OBE compliance and reporting.

To address these challenges, an intuitive, flexible, and OBE-compliant assessment mark management tool has been developed. This innovative tool leverages the power of Excel VBA to streamline the assessment process, reduce administrative burden, and empower educators to focus on what matters most: facilitating meaningful learning experiences for their students. By combining the familiarity of Excel with the automation capabilities of VBA, this tool provides a user-friendly solution that bridges the gap between traditional tools and the specific requirements of OBE.

METHODOLOGY

The development of this tool followed a user-centric design approach, prioritizing the needs and workflows of educators. This aligns with the principles outlined by Norman (2013), who emphasizes the importance of designing for the user's mental model and ensuring ease of use in any human-computer interaction. Excel VBA was chosen as the technological foundation due to its widespread availability in educational institutions, familiarity among educators, and powerful automation capabilities.

RESULTS AND DISCUSSION

The tool offers a comprehensive suite of features designed to streamline the assessment process and empower educators within an OBE framework. This approach aligns with the principles of "constructive

alignment" advocated by Biggs & Tang (2011), where assessment tasks are directly linked to intended learning outcomes, ensuring a cohesive and effective learning experience.

The tool's user-friendly interface simplifies the input of assessment marks, eliminating the need for complex calculations or cumbersome data manipulation. As shown in Figure 1, the entire input interface is conveniently contained within a single sheet, allowing educators to easily enter raw scores, letter grades, or even qualitative feedback for various assessment tasks. This seamless transition from traditional grading methods facilitates the tool's adoption within existing workflows.

Furthermore, the tool automates the calculation of essential OBE metrics such as attainment, achievement, and progress towards learning outcomes. By eliminating the need for manual calculations, the tool reduces the risk of human error and saves educators valuable time, promoting efficiency and accuracy in assessment practices. A portion of the computational output, placed on a separate sheet, is illustrated in Figure 2.

To enhance flexibility and adaptability, educators can create and customize rubrics and assessment criteria that align precisely with their specific program outcomes. This feature allows for tailored assessments that accurately reflect the unique learning objectives of each course or module, ensuring that assessments are valid and reliable measures of student achievement.

Recognizing the diverse nature of assessment tasks, the tool supports weighted grading, enabling educators to assign varying weights to different assignments, exams, or projects based on their relative importance in achieving the overall learning outcomes. By automatically aggregating marks based on these pre-defined weights, the tool provides a comprehensive and nuanced overview of student performance, facilitating a holistic evaluation of their progress throughout the course.

Finally, the tool leverages data visualization to enhance the interpretability and usability of assessment results. As depicted in Figure 3, it generates a variety of visualizations, including graphs, charts, and tables, that present assessment data in an easily digestible format, also placed on a separate sheet. Educators can further customize these reports to focus on specific learning outcomes, student groups, or assessment periods, facilitating data-driven decision-making and enabling targeted interventions to support student learning and improve overall program effectiveness.

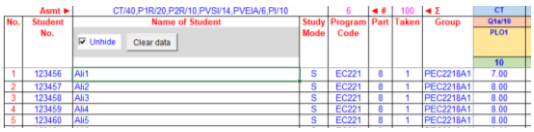

Fig. 1 Intuitive data entry and management

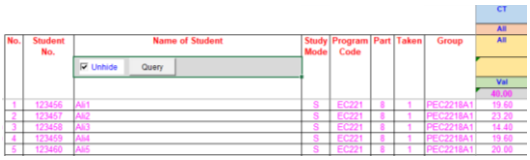

Fig. 2 Automated calculation of OBE metrics

No.	Marks	Attainment Coun	Percent	Grade	Grade Poin	Status
1	90-100	0	0.00	A+	4.00	Excellent
2	80-89	0	0.00	A	4.00	Excellent
3	75-79	6	5.61	A-	3.67	Excellent
4	70-74	26	24.30	B+	3.33	Distinction
5	65-69	36	33.64	B	3.00	Distinction
6	60-64	12	11.21	B-	2.67	Distinction
7	55-59	14	13.08	C+	2.33	Pass
8	50-54	9	8.41	C	2.00	Pass
9	47-49	0	0.00	C-	1.67	Fail
10	44-46	0	0.00	D+	1.33	Fail
11	40-43	0	0.00	D	1.00	Fail
12	30-39	4	3.74	E	0.67	Fail
13	0-29	0	0.00	F	0.00	Fail
	Total	107	100.00			

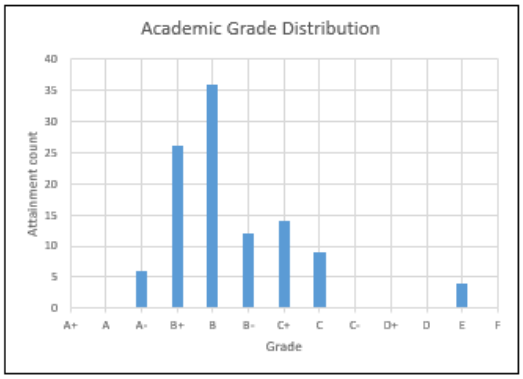

Fig. 3 Comprehensive data visualization and reporting

CONCLUSION

In conclusion, the developed assessment mark management tool presents a significant advancement in addressing the complexities of mark management within Outcome-Based Education. By leveraging a user-centric design and the capabilities of Excel VBA, this intuitive and flexible tool empowers educators to efficiently manage assessment data, streamline workflows, and gain valuable insights into student learning. This ultimately enables them to dedicate more time and energy to fostering a rich and effective learning environment for their students.

REFERENCES

Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university* (4 (ed.)). Open University Press.

Norman, D. A. (2013). *The design of everyday things: Revised and expanded edition*. Basic Books.

Spady, W. G. (1994). *Outcome-based education: Critical issues and answers*. American Association of School Administrators.

Exploring the Impact of Student Preferences on Course Learning Outcome Performance of Civil Engineering Course

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ABSTRACT

This paper is developed to analyze the performance of Final Year students taking the Principles of Prestressed and Precast Design course in UiTM Cawangan Pulau Pinang in relation to their learning preferences. The results of the students are based on two semesters; i.e. Semester Mac – August 2023 and October – February 2024 covering a total of 247 students. This study examines the correlation between students' preferences, course outcomes, and instructional methods in engineering education. The data on students' preferences are derived from teaching evaluation surveys conducted at the end of the semester, while course outcomes attainment was obtained from the i-RAS system. Despite a preference for calculation-based learning, the lower attainment observed in CO2 compared to CO3 highlights the complexity of student performance. The study also considers the influence of students' prior industrial training and hands-on experience in construction, highlighting their ability to apply general knowledge from external sources. These findings underscore the importance of aligning instructional methods with desired learning outcomes and offer insights for enhancing engineering education pedagogy.

Keywords: Course Outcomes, Outcome-based Education, Civil Engineering Students, Prestressed Concrete Design

INTRODUCTION

This study aims to investigate the influence of student preferences on the course outcomes performance of Principles of Prestressed and Precast Concrete Design Course course students, a compulsory course for the CEEC221 Program (Bachelor of Engineering (Hons) Civil (Infrastructure) in UiTM Cawangan Pulau Pinang. Focusing on the interrelation between student topic preferences, learning methods (face-to-face or online), and course content (theoretical and calculation-based), this research endeavors to analyze how these factors collectively shape the students' academic achievements in this prestressed and precast concrete design course. Understanding students' preferences in engineering education is essential to tailor teaching strategies, enhance students' motivation, promote student-centered learning, and improve the overall learning outcomes.

This study involves 247 students taking the CES525 course from two semesters; i.e. Semester March – August 2023 and October – February 2024. There are three course outcomes measured for this course as shown in Table 1. These course outcomes are assessed based on the four topics taught and mapped to the three course outcomes as presented in Table 2.

Table 1. Course outcomes for this course

CO	Description
CO1	Propose the relevant principles of the prestressed and precast concrete to suit their applications.
CO2	Design the prestressed concrete element
CO3	Conclude the design principles of precast and prestressed elements, joints and connections between members, and the general practices in precast-prestressed concrete construction

Table 2. Topics in this course

Topic	Title
Topic 1	Introduction and principles of prestressed and precast concrete structures (CO1)
Topic 2	Analysis and design of prestressed concrete sections (CO2)
Topic 3	Design principles of precast elements and joints (CO3)
Topic 4	General practices and handling of precast-prestressed components (CO3)

The students' preferences for this research were collected through a comprehensive survey administered to students enrolled in this CES525 course and the students' performance data were obtained from the i-RAS system.

RESULTS AND DISCUSSION

The findings of the study are presented in this section, providing insights into the influence of students' preferences on the course outcomes of CES525. Three pie charts (Fig 1 to Fig 3) depict students' preferences across various dimensions, offering a visual representation of their inclination towards specific topics, learning methods (face-to-face or online), and content types (theoretical or calculation-based). Additionally, Table 1 presents the average attainment of course outcomes, allowing for a quantitative assessment of students' academic performance within the context of their preferences.

The analysis of students' preferences reveals a notable inclination towards calculation-based learning methods over theoretical approaches, with 67% of the students expressing a preference for calculations. This preference aligns with the majority selection of Topic 2, focused on the analysis and design of prestressed concrete sections, which gained 40% preferences. Following closely behind, Topic 1, by 29%, while Topics 3 and 4 trailed with smaller percentages. These findings resonate with the characteristic preferences of engineering students, who often exhibit a preference for hands-on problem-solving and application of concepts over memorization and theoretical exposition.

Fig 3 presents additional insights into students' preferences regarding teaching delivery methods, revealing that a significant majority, comprising 85 percent of respondents, favor face-to-face learning over online instruction. Table 3 displays students' average performance across course outcomes, indicating higher achievement in CO3 compared to CO1 and CO2.

The analysis of CES525 course outcomes reveals that, although students mostly prefer calculation-based learning, CO3 (theoretical content) shows higher attainment compared to CO2 (calculation-focused). This suggests a potential mismatch between student preferences and performance, possibly because theoretical content demands deeper cognitive engagement and also the requirement of external knowledge.

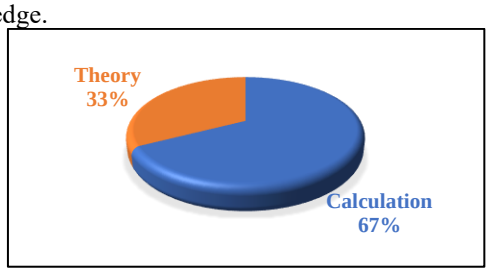

Fig. 1 Course content

Table 3. Average course outcome performance

Course outcomes	March – Aug 2023	Oct 2023 – Feb 2024	Average attainment
CO1	53%	73%	63%
CO2	70%	59%	65%
CO3	73%	70%	72%

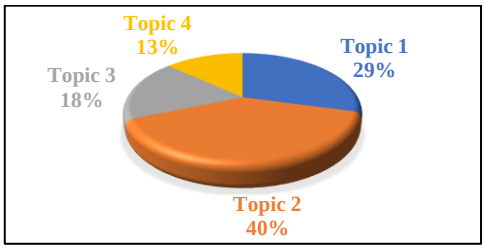

Fig. 2 Topic preference

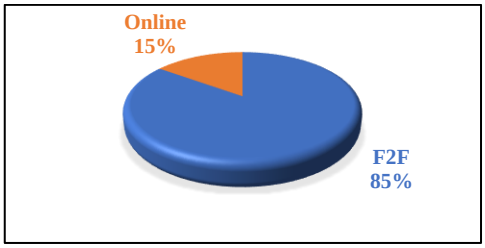

Fig. 3 Learning methods

CONCLUSION

In conclusion, it's evident that students' preferences do not always align with course outcomes. Despite a preference for calculation-based learning, the lower attainment observed in CO2 compared to CO3 highlights the complexity of student performance. Calculation-based assessments may require more fundamental knowledge, while theoretical-based assessments can draw upon basic understanding and on-site experience, particularly relevant given the students' completion of industrial training.

REFERENCES

Ng, E. M. W., & Wang, X. (2021). Understanding student preferences for learning experiences in engineering education: A latent class analysis. European Journal of Engineering Education, 46(2), 301-320.

Mena, J. A., González-González, C. S., & Paredes, L. (2021). The importance of considering the students' opinions in higher education. International Journal of Educational Research and Innovation, 16, 122-136.

Duru, E. K., & Yurdakul, B. (2021). Understanding student preferences and perceptions of interactive online learning during the COVID-19 pandemic: A case study in higher education. Journal of Computing in Higher Education, 33(2), 338-357.

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Continual Quality Improvement Contributing to Programme Learning Outcomes in Geotechnical Engineering Course in Malaysia

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ABSTRACT

This study investigates the effectiveness of Continual Quality Improvement (CQI) processes in aligning Course Learning Outcomes (CLOs) with Programme Learning Outcomes (PLOs) within a Geotechnical Engineering course in a Malaysian engineering program. Utilizing a qualitative methodology, the research analyzes data collected longitudinally over six semesters from the Outcome-Based Education (OBE) system, specifically focusing on CO-PO mapping. The study distinctly addresses two core PLOs: PLO1, which emphasizes Engineering Knowledge, and PLO4, which focuses on Investigation skills. Through comprehensive document analysis, this paper evaluates how targeted improvements in CLOs influence the attainment of these PLOs over time. The findings reveal that specific CQI interventions tailored to each PLO significantly enhance their respective learning outcomes. For PLO1, enhancements in teaching methodologies and curriculum alignment were most effective, while for PLO4, integrating research-based projects and improving experimental learning opportunities showed substantial benefits. The study proposes a refined CQI framework that offers strategic recommendations for curriculum development, assessment practices, and faculty development. These recommendations aim to bridge the gap between accreditation standards and industry demands, ultimately enhancing student preparedness and the quality of engineering education.
Keywords: Continual Quality Improvement, Course Learning Outcomes, Engineering Programme, Programme Learning Outcomes.

INTRODUCTION

In Malaysia, engineering programmes have employed various analytical tools for assessing students' attainment of course and programme learning outcomes, yet these tools often fail in promoting meaningful continual quality improvement (CQI). Best practices demonstrate a more practical approach where educators focus on effective outcome assessments, which is critical for CQI and aligns with accreditation standards (Liew et al., 2022). An integration of Course Learning Outcomes (CLOs) and Programme Learning Outcomes (PLOs) serves as a cornerstone in engineering education, providing a structured blueprint towards achieving educational objectives. Despite the structured framework provided by accreditation bodies and educational institutions, there remains a critical gap in assessing how effectively CLO improvements contribute to the attainment of PLOs, particularly in specialized engineering courses. A case study on the MyCOPO system used in the Faculty of Civil Engineering at Universiti Teknologi MARA for outcome measurement found high satisfaction among staff and students, highlighting the system's effectiveness in quality management and CQI (Mohamad et al., 2021). The implementation of Outcome-Based Education (OBE) in Integrated Design Projects within civil engineering demonstrates effective mapping of course and program outcomes, ensuring graduates meet the challenges of Industry 4.0 (Basir et al., 2019). Incorporating student feedback into curriculum revisions can significantly enhance course content and contribute to the CQI process, ensuring the alignment of learning outcomes with program objectives (Koh and Chong, 2019).

There is a gap in understanding how improvements in CLOs effectively contribute to the attainment of PLOs, especially in specialized engineering courses. This gap affects the strategic alignment between course-specific achievements and overarching program goals. Thus, the objectives of this paper are to analyze the current practices of CQI based on the CLOs and PLOs performance in an engineering course and to evaluate the impact of CLO improvements on the attainment of PLOs, providing empirical insights into their effectiveness and areas needing enhancement. By addressing these objectives, this paper aims to contribute to the body of knowledge in engineering education, supporting the advancement of teaching practices and curriculum development that are responsive to both academic and professional demands.

METHODOLOGY, RESULTS AND DISCUSSION

This study employs a qualitative approach to assess the quality improvement of Course Learning Outcomes (CLOs) contributing to Programme Learning Outcomes (PLOs) in a Malaysian geotechnical engineering course. This study relies on the Outcome-Based Education (OBE) system's Course Outcomes to Programme Outcomes

(CO-PO) mapping method. Data is collected longitudinally over six semesters: August 2021, January 2022, August 2022, January 2023, August 2023, and January 2024. This method tracks and analyses the same cohort's performance against the CLOs and PLOs over time. Cross-sectional analysis cannot examine patterns, trends, and probable causal linkages across time; hence a longitudinal study design is essential. CO-PO mapping data from the OBE system is examined in document analysis. This analysis shows which parts of CLOs are helping PLOs and where changes are needed. The longitudinal data allows the study to track intervention progress and efficacy over selected semesters.

Table 1 shows course CLO-PLO mapping. This course has four course learning outcomes (CLOs) and two programme learning outcomes (PLOs) that match its teaching, learning, and assessment approach.

Table 1. CO-PO mapping for Geotechnical Engineering

Course learning Outcome:	Programme learning Outcome
CLO1 - Analyse lateral earth pressure and design of earth retaining structures. CLO2 - Analyse ground settlement as a function of time due to consolidation. CLO3 - Analyse and determine the stability of slopes.	PLO1: Engineering Knowledge - Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialisation as specified in WK1 to WK4 respectively to the solution of complex engineering problems.
CLO4: Identify and determine suitable soil improvement methods for weak soils.	PLO4: Investigation - Conduct investigation of complex engineering problems using research-based knowledge (WK8) and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusion.

Continual Quality Improvement at Course and Programme Levels given the decline in performance for both CLOs and PLOs, as well as the specific mapping of these outcomes, several improvement suggestions were implemented at course and program levels.

Table 2 shows the CLOs and PLOs for different semesters, along with the CQI suggested and conducted and its execution status. Each semester's CQI action focused on the weakest CLOs, often involving increased examples, tutorials, or guest lectures. For example, in 2021 August Semester, both CLO4 and PLO4 achieved 65.7% which is considered as low achievement as compared to other CLOs. Thus, the CQI suggested was to invite a guest lecturer for a class session. The closing of loop shows that the CQI action was successful, as both CLO4 and PLO4 had improved from 65.70% to 74.90%.

Each semester showed improvement in the targeted CLOs after CQI actions, indicating effective interventions while some CLOs (e.g., CLO1 in recent semesters) consistently underperform, suggesting a need for more sustained or varied interventions Overall, the analysis reveals that while CQI actions generally lead to improvements in CLOs, there is a recurring issue with PLOs not showing the same level of improvement or even declining in some cases.

Table 2: CQI for 6 semesters

Semester	CQI Conducted	Is/Are CQI successfully executed?
2021August	Concentrate on course outcome 4, which is ground improvement. A guest lecturer who is an expert in this topic will be called for a talk session.	N/A
2022January	I will focus on CO1. Students will be given more examples of these chapters. (Retaining Wall)	Yes, CLO4 improved from 65.70 to 74.90
2022August	This semester, students seem to have a problem with CO3, which slopes. I will conduct more tutorials and examples during the class.	Yes, the percentage for CO1 increased to 70%.
2023January	I will focus on CO2. I will provide students with additional examples from these chapters. The slot for tutorials will increase by 20%.	Yes. CO3 increased from 60.10 to 64.00.
2023August	I will focus on CO1. Two guest lecturers will be invited to conduct a talk session	Yes. CO2 increased from 63.00 to 65.00.
2024January	Even CO1 has improved; however, compared with other COs, it is still the lowest, so additional exercise and slots (maybe) for this topic will be increased.	Yes

CONCLUSION

The findings of this study show the role of continual quality improvement (CQI) processes in aligning Course Learning Outcomes (CLOs) with Programme Learning Outcomes (PLOs) within the Geotechnical Engineering course in an engineering programme in Malaysia. The evaluation revealed that targeted improvements in CLOs significantly enhance the attainment of PLOs, fostering a better educational framework that is responsive to both the EAC standard and industry demands.

REFERENCES

Liew, C. P., Lim, L. L., Chor, W. T., Yu, L. J., & Tan, J. (2022). Evaluation practices of learning outcomes that promote culture of continual quality improvement. In AIP Conference Proceedings (Vol. 2433, No. 1). AIP Publishing. https://doi.org/10.1063/5.0095086.

Mohamad, M., Lian, O. C., Zain, M. R. M., Yunus, B. M., & Sidek, N. H. (2021). Student Attainment Measurement System in Civil Engineering Undergraduate Programme: A Satisfaction Survey. Asian Journal of University Education, 17(2), 191-202.

Basir, N., Lian, O. C., & Shaharin, H. (2019). Assessment of outcome-based integrated design project. JOTSE, 9(1), 77-84.https://doi.org/10.3926/jotse.541

Koh, Y. Y., & Chong, P. L. (2019). Incorporating student feedback into curriculum review according to outcome-based education philosophy. Journal of Engineering Science and Technology, 14(2), 541-556.

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Bridging the Gaps in Transitioning from ETAC Standard 2020 to 2024

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ABSTRACT

Higher education accreditation nowadays has played a crucial role in the global recognition of engineering training, and sustainability of graduates. In order to meet with the current situation, there are paradigm shift in engineering education systems as part of international engineering education accreditation The current standard consist of 12 graduates attributes but then has been reduced to the 11 graduates attributes with the additional element of sustainable development goals (SDGs).To address this issue, this paper focuses on how the program able to fulfil the gap between the current standard with the new standard thus able to meet the requirement set by the international engineering education.

Keywords: Accreditation, Engineering Education, Graduate Attributes, Gap Analysis

INTRODUCTION

Accreditation is an important for ensuring the quality of academic programs in a higher education institution (Hegji, 2020). Previous researcher has explored accreditation in the context of higher education, but the findings have been inconsistent. Some studies have identified a positive impact of accreditation on various aspects of higher education (Kumar et al., 2020), while a few have reported negligible or negative effects on teaching, learning, and the quality of HEIs (Jalal et al., 2020). However, most of the existing research on accreditation is qualitative, resulting in a lack of conclusive empirical evidence regarding its impact on higher education performance. The International Engineering Alliance (IEA) plays a crucial role in enabling the global recognition of engineering competencies developed through higher education in various countries which has been established in 1998 (Zhang et al., 2023). The IEA is a coalition of multiple international agencies responsible for accrediting engineering education and the main goals include enhancing the professional quality and skills of engineers, promoting the development and implementation of global engineering education standards, and maintaining the quality and reputation of engineers worldwide. The IEA's accreditation system includes three major agreements: the Washington Agreement, the Sydney Agreement, and the Dublin Agreement. These agreements aim to promote mutual recognition in international engineering education and ensure that graduates achieve globally recognized engineering qualifications.

In response to the current situation, on the implementation of the Sustainable Development Goals (SDG) (UNESCO, 2019) in Graduate Attribute has taken in place. The standards are aligned to IEA GAPC 2021-Version 3 with the 12 Graduate Attribute to the 11 Graduate Attributes by Combining “The Engineer and Society (PO6)” and “Environment and Sustainability (PO7)” under the heading “The Engineers and the World (PO6 –Standard 2024)”. Besides, it also highlighted the Critical thinking, innovation, emerging technologies, and lifelong learning requirements (PO11-Standard 2024) together emphasis on Knowledge and awareness of ethics, diversity, inclusion (PO7 –Ethics –Standard 2024).

By having these changes, it is has the necessity, to address the gap between the current graduate attribute with 11 graduate attributes. This paper is highlight the gap analysis that the engineering program need to adjust and improve in order to meet the new requirement by international engineering accreditation.

RESULTS AND DISCUSSION

Gap analysis is a strategic assessment process that involves comparing and evaluating the differences between the current standard 2020 in the program and a desired future standard 2024. It commonly used in education program transitions, to facilitate decision making, planning and improvement. The gap analysis should be address clearly by emphasizing in the curriculum through projects or assessment and students work. Besides, on the public safety and sustainable development, the gap may be fulfil through the remapping of the some courses by introducing the topic which addressing the sustainable development.

In order to address the gap, these are the following steps need to be taken

1) Identify the specific gaps or differences between 2020 and 2024 standard by determine which element need to modify or improve.
2) Use the systematic approach to evaluate or compare each criterion (OBE, academic curriculum, students, staff, facilities and QMS.
3) Begin the implementing the changes outline in action plan. Have to make sure all the stakeholders (faculty, external stakeholders-IAP/EE) are informed and provided with the resources and training required for the transition.
4) Continuously monitor the progress of the program in meeting the new standard requirements. Regularly report progress to relevant accreditation bodies or stakeholder
5) Keep detailed records of the changes made and their impact on the program (PO tray/boxes/folders courses contributed to the 12POs assessment details to support achievement of PO, other students' learning assessment activities and details, samples of students' work
6) Quality assurance: use the results of your monitoring and evaluate to make adjustment and improvement as needed

Fig. 1 indicates the constructive alignment that need to be accounted when the adjustment and improvement has been taken into account.

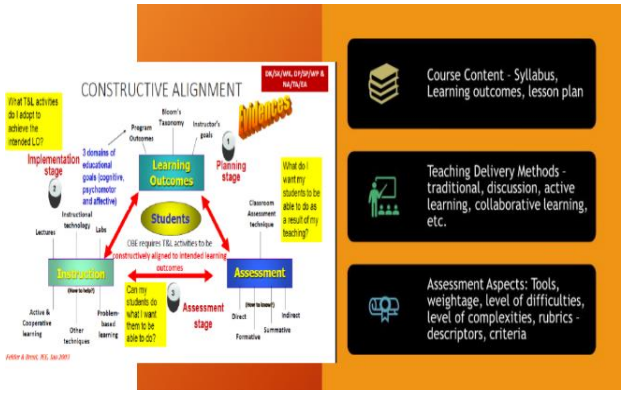

Fig 1. Systematic constructive alignment

It illustrates the concept of constructive alignment, emphasizing the interconnectedness of learning outcomes, teaching methods, and assessments. By ensuring these elements are aligned, educators can create a more effective and coherent learning experience for students. This model is essential for developing curricula that are student-centered and outcome-based, ensuring that all instructional activities and assessments are purposefully designed to meet the defined educational goals.

CONCLUSION

The findings from the study will provide the valuable insights for sustainability of engineering programs in order to meet with the recent international accreditation standards. Future research should be focusing on implementation of the gap analysis and the performance of the program with the new standard thus this would able to foster the continuous improvement in engineering education.

REFERENCES

Hegji, A. (2020). *An Overview of Accreditation of Higher Education in the United States* Vol. R43826, Issue 9. https://crsreports.congress.gov

Jalal, H., Buzdar, M. A., & Naoreen, B. (2020). Effectiveness of Accreditation in Assuring the Quality of Teacher Education Programs: Exploring the Case of an Underdeveloped Country. *Global Social Sciences Review (GSSR)*, *V*(I), 84–94.

Kumar, P., Shukla, B., & Passey, D. (2020). Impact of accreditation on quality and excellence of higher education institutions. *Investigacion Operacional, 41(2),* 151-167

UNESCO. (2019). *Roadmap for Implementing the Global Action Programme on Education for Sustainable Development*. Available online: https://unesdoc.unesco.org/ark:/48223/pf0000230514

Zhang, J., Yuan, H., Zhang,D., Li, Y., & Mei, N. (2023). International Engineering Education Accreditation for Sustainable Career Development: A Comparative Study of Ship Engineering Curricula between China and UK. *Sustainability 15(15),* 11954. https://doi.org/10.3390/su151511954

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A Systematic Constructive Alignment Addressing the EAC Standard 2024 in Engineers in Society Course

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ABSTRACT

Using a systematic constructive alignment, the Engineers in Society course (ECC589) is designed to align with the Engineering Accreditation Council (EAC) Standard 2024. This paper explores the steps in constructive alignment that includes planning, implementation, and assessment within the course context. In the planning stage, learning outcomes (LOs) are developed to align with program objectives, Bloom's Taxonomy, and sustainable development goals (SDGs). These LOs encompass cognitive, psychomotor, and affective domains, ensuring a comprehensive educational approach. The implementation stage focuses on diverse teaching and learning activities i.e. collaborative teaching, flipped learning, active, cooperative learning, community-based projects, design thinking etc. These activities are designed to foster critical thinking, teamwork, and practical skills, aligning with the intended LOs. The assessment stage employs various techniques, including formative and summative assessments, direct and indirect assessments. An alternative assessment approach known as EiS-Dt was developed to ensure that assessments are constructively aligned with the LOs, providing a comprehensive evaluation of student competencies. Overall, the constructive alignment in ECC589 addresses the EAC Standard 2024 by ensuring coherence between learning outcomes, teaching activities, and assessment tasks. This approach equips students with the necessary knowledge, skills, and attitudes to prepare them as future engineers and contribute to sustainable development.

Keywords: Constructive Alignment, Engineers in Society. Learning Outcomes

INTRODUCTION

Constructive alignment, a principle emphasizing the harmony between learning outcomes, teaching activities, and assessment tasks, is important to achieve programme outcomes (POs) towards achieving programme educational objectives (PEOs) required by the EAC Standard 2024. The sixth programme outcome (PO6) required by the EAC Standard 2024 to be addressed in the engineering programme is known as Engineers and the World. This graduate attribute plays a crucial role in civil engineering education, adhering to the EAC Standard 2024, which necessitates constructive alignment to ensure the learning outcomes and educational objectives are met. Constructive alignment enhances learning outcomes, teaching activities, and assessment tasks, a principle for achieving targeted learning outcomes.

Despite its recognized importance, the engineering course that incorporates PO6 faces challenges in effectively implementing constructive alignment. The alignment of curricular components with institutional vision and performance indicators, as highlighted by Abejuela et al. (2022), remains insufficiently addressed. Furthermore, there is a need for the current Engineers in Society course or ECC589 to better integrate course intentions with student experiences, as discussed by Kumar et al. (2022), particularly through community-based projects that have a real-world impact. While Japhet (2023) offers a framework for designing and assessing learning outcomes, its practical application within the curriculum planning, and assessment stages requires further exploration. Additionally, the alternative assessment method developed by Mat Isa et al. (2022) integrating the SULAM approach, though relevant to engineers and the world's attribute adaptation to community service requirements under pandemic conditions, has yet to be fully operationalized and improved. Therefore, this paper presents on how to address these gaps to ensure it achieves its educational objectives in alignment with EAC Standard 2024. A document analysis was carried out on the process to develop the constructive alignment framework for the course, known as Engineers in Society (ECC589).

RESULTS AND DISCUSSION

Fig. 1 shows the constructive alignment framework used for ECC589 course. It is divided into three (3) stages as described in the following sub-sections.

1. Planning Stage

The planning stage sets the foundation for achieving constructive alignment in ECC589. The primary focus is

on defining Learning Outcomes (LOs) aligned with the course's objectives, Bloom's Taxonomy, complexity levels, and the instructor's goals.

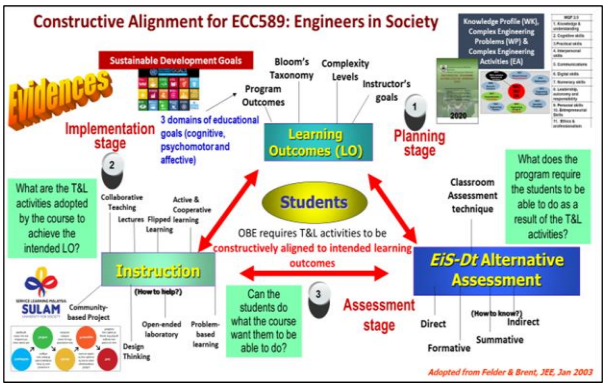

Fig. 1: Constructive Alignment Framework for ECC589

These LOs are framed to address the cognitive, psychomotor, and affective domains of educational goals, ensuring a comprehensive development of students' knowledge, skills, and attitudes. The integration of SDGs into the LOs reflects the commitment to global sustainability and social responsibility, crucial aspects of modern engineering education.

2. Implementation Stage

The implementation stage involves the execution of Teaching and Learning (T&L) activities designed to meet the intended LOs. ECC589 employs a diverse range of pedagogical strategies, including (1) Collaborative teaching and lectures to promote knowledge sharing and interactive learning, (2) Flipped learning to encourage students to engage with course material before class, fostering active participation during lectures, (3) Active and cooperative learning to enhanced teamwork and problem-solving skills through group activities, (4) Community-based projects to integrate SULAM initiative with real-world community service, emphasizing the social impact of engineering, (5) Design Thinking and Problem-based learning to cultivate innovative and critical thinking skills through practical problem-solving exercises. These activities are designed to ensure students can achieve the LOs effectively, fostering a deep understanding of the subject matter and its applications.

3. Assessment Stage

This evaluates whether students have achieved the intended LOs through various assessment techniques, including (1) Formative and summative assessments to providing ongoing feedback and evaluating overall learning outcomes, (2) Direct and indirect assessments to measure students' knowledge and skills through practical tasks and self-assessments, (3) Classroom assessment techniques by implementing diverse assessment methods to gauge student performance and learning progress. The EiS-Dt alternative assessment approach ensures that the assessments are constructively aligned with the LOs, providing a holistic evaluation of student competencies.

CONCLUSION

Constructive alignment in the ECC589 course effectively addresses the EAC Standard 2024 by ensuring a coherent connection between learning outcomes, teaching activities, and assessment tasks. The integration of SDGs and the comprehensive approach to educational domains foster a well-rounded engineering education. By employing diverse pedagogical strategies and robust assessment techniques, ECC589 equips students with the necessary knowledge, skills, and attitudes to excel in their engineering careers and contribute to sustainable development.

REFERENCES

Abejuela, H. J. M., Castillon, H. T., & Sigod, M. J. G. (2022). Constructive alignment of higher education curricula. *Asia Pacific Journal of Social and Behavioral Sciences.Vol.20.49-72.*

S. S. Kumar, M. James and J. Case. 2022. "Engineering Design for Community Impact: Investigating Constructive Alignment in an Innovative Service-Learning Course," 2022 IEEE Frontiers in Education Conference (FIE), Uppsala, Sweden,pp. 1-5.

Lawrence, J. E. (2023). The application of constructive alignment theory in designing a curriculum unit in information systems. *The Educational Review, USA, 2023, 7(4), 471-482.*

Mat Isa C.M., Oh Chai Lian, Liew Chia Pao (2022), Design of an Innovative Assessment Instrument Integrating Service-Learning Malaysia University for Society Approach for Engineers in Society Course during Covid19 Pandemic, *ASEAN Journal of Engineering Education, 6(1), 58-68.*

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The Application of Mnemonic Keyword Approach And Its Impact On Formative Assessment - A Case Study

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ABSTRACT

This case study investigates how individuals with a left-brain orientation comprehend and manage information overload using the Mnemonic Keyword Approach, focusing on students enrolled in the ENT300 course (Fundamentals of Entrepreneurship). The research aims to evaluate the impact of mnemonic techniques on academic performance in formative assessments. By analyzing student performance, the study seeks to determine the effectiveness of the Mnemonic Keyword Approach in enhancing understanding and information retention among left-brained individuals. The Mnemonic Keyword Method, which encodes information into easily retrievable and memorable formulas, was applied in teaching and learning activities. Using the Sommer-Sommer Brain Test, students were categorized by brain orientation to tailor the mnemonic techniques accordingly. Results indicated a significant improvement in knowledge retention, with assessment scores ranging from 75.5% to 97.75%. This improvement is attributed to the method's ability to provide meaningful coding and abbreviation formulas, enabling students to construct answers based on keywords. The study concludes that the Mnemonic Keyword Approach is a highly effective strategy for memorizing and retaining knowledge, as it facilitates the encoding and retrieval of information in a structured manner, thereby enhancing students' understanding and performance in formative assessments.

Keywords: Mnemonic Keyword Approach, Formative Assessment, Brain Dominance, Left-Brain-Oriented & Brain-Based Learning

INTRODUCTION

Several theories suggest that learners utilize different mental processes as they learn. A scaffolding framework and just-in-time information presentation effectively manage cognitive load and enhance complex learning, crucial for left-brain-oriented individuals (Merrienboer, Kirschner, & Kester, 2003). Educators should tailor teaching methods to students' learning preferences and brain dominance. Ismail, S., Shafie, N., and Rahman, N., (2022) found a significant relationship between knowledge retention and teaching tools via student feedback.

This study investigates how left-brain-oriented individuals manage information overload using the Mnemonic Keyword Approach in ENT300 course (Fundamentals of Entrepreneurship). It assesses the approach's effectiveness in improving academic performance, understanding, and retention of business concepts while exploring the link between brain dominance and learning. Students' ability to recall content was evaluated through quizzes, and brain dominance was assessed using a tool available at https://braintest.sommer-sommer.com/en/. Scores of 88.9% and above classified individuals as Left-Brainers, with a cutoff at 51% of the evaluation points. Quiz answer sheets were then examined to identify the keywords used.

THE MNEMONIC KEYWORD METHOD

Atkinson (1975) formalized the most adaptable mnemonic method, primarily researched in language learning. However, limited studies focus on its application in non-technical or theoretical subjects. Many studies have been conducted to assess the application of the keyword method on learners' performance to comprehend the contents of the subject learned (Siriganjanavong, V., 2013).

THE APPLICATION OF THE MNEMONIC KEYWORD APPROACH

Mnemonic training enhances memory by optimizing brain networks (Dresler et al., 2017). The Mnemonic Keyword Method, used in ENT300, improves comprehension and retention, aiding in explaining entrepreneurship principles (CLO1) and identifying business opportunities (CLO2).

DATA COLLECTION AND EVALUATION PROCESS

The study involved 59 final-semester Science and Technology students from UiTM Pulau Pinang's Mechanical Engineering Faculty, enrolled in the ENT300 course from October 2023 to February 2024.

RESULTS AND DISCUSSION

Quiz analysis showed 87.5% of students used keyword formulations to identify definitions, competencies, motivational components, and BMC elements, using themes, repetitive characters, and phonological patterns as mnemonic devices. Some of the formulas used by the students are;

Definitions of Entrepreneurship by Philosophers
- Adam Smith: Agent (Ad = Ag)
- John Stuart Mill: Prime Mover (Mill = Mover)
- Ibnu Khaldun: Knowledgeable Person (Kh = Kn)

Motivation
- The Need for Achievement (n Ach), Power (n Pow), Affiliation (n Aff)
- Mo = n (APA)

Business Model Canvas (BMC)
- Customer Segments (C), Relationships (R), Value Propositions (V), Key Resources (KR), Activities (KA), Partnerships (KP), Channels (Ch), Cost Structure (Cs), Revenues (R)
- BMC = CRV + K(PAR) + CCR

The quiz results obtained by students are in a range of 75.75 – 97.75/100 (20%). It is further supported by the students' feedback or SUFO (Students' Online Feedback) for item evaluation No. 18 (The lecturer delivers the content interestingly) No. 19 (The lecturer's delivery style challenges the mind) and No. 21 (The lecturer helps students master the learning contents) with the overall performance indicator showed an "Excellent" category.

Table 1. Samples of Quiz Results

CLO :	CLO1
PLO :	PLO1
1. 2021863004 - 'AMMAR NA'IM BIN BORHAN	56.7
2. 2021880506 - ABDUL HAYY BIN MOHD AMER	54
3. 2021650128 - ADAM DANISH BIN AHMAD JAIS	56.7
4. 2021200622 - AHMAD AIMAN BIN JURI	57
5. 2021602054 - AHMAD HAKEEM EZRA BIN AHMAD FADZIL	57.6
6. 2021896356 - AL AKMAL SIRHAN BIN MOHAMAD SUHAIMI	54.6
7. 2021453404 - ALEEF HAKIMI BIN AZMI	56.1
8. 2021463318 - ANIQ ARSYAD BIN MOHD FAISOL	55
9. 2021800786 - DANISH DURRANY BIN ZULFAHMY	57.6
10. 2021871942 - LUQMAN HAFIZ BIN HASRUL EFFENDI	53.1
11. 2021872118 - MOHAMAD NORHAKIMIE BIN MOHD NORZAIMIE	50.7
12. 2021203318 - MUHAMMAD ADAM ISKANDAR BIN MUHAMAD YUSRI	52.2
13. 2021611164 - MUHAMMAD ADHAM HAZIQ BIN SYAMSUL HERMAN	48.6
14. 2021893134 - MUHAMMAD AFIF MIRZA BIN MOHD LATIF	55.5
15. 2021872658 - MUHAMMAD AFIQ LUKMAN BIN AHMAD ROSLI	54.6
16. 2021883448 - NUR ANIS ADLINA SYAFIAH BINTI AIDIL SAFRI	56.4

Table 2. SUFO Results

18	Kaedah penyampaian pensyarah sangat menarik. *The lecturer delivers the content interestingly.*	0	0	5	12	92.65	3.71
19	Kaedah penyampaian pensyarah sangat mencabar minda. *The lecturer's delivery style challenges the mind.*	0	1	4	12	91.18	3.65
20	Pensyarah memberi maklumbalas bagi setiap penilaian/tugasan/ujian/projek. *The lecturer provides feedback for each assessment/assignments/tests/projects.*	0	0	6	11	91.18	3.65
21	Pensyarah membantu pelajar menguasai kandungan pembelajaran. *The lecturer helps students master the learning content.*	0	0	5	12	92.65	3.71
22	Secara keseluruhannya, saya seronok dengan pengajaran pensyarah ini. *Overall, I enjoyed the teaching style of this lecturer.*	0	0	5	12	92.65	3.71
Jumlah Purata Keseluruhan ***Grand Average Total***							
	JUMLAH PURATA KESELURUHAN :	0	1	124	283	92.10	3.69
	PRESTASI ((SECTION B + SECTION C) / 2) :	0	1	89	216	92.66	3.71
	PETUNJUK PRESTASI (PERFORMANCE INDICATOR) :	Excellent					

CONCLUSION

The Mnemonic Keyword Method helps left-brained students manage information overload and retain content. This study explores its effectiveness for non-technical subjects, showing that matching teaching methods with brain dominance improves learning. Educators can enhance outcomes by tailoring methods accordingly.

REFERENCES

Atkinson, R. C. (1975). Mnemotechnics in second-language learning. American psychologist, 30(8), 821-828.

Dresler, M., Shirer, W., Konrad, B., Müller, N., Wagner, I., Fernández, G., Czisch, M., & Greicius, M. (2017). Mnemonic Training Reshapes Brain Networks to Support Superior Memory. Neuron, 93, 1227-1235.e6. https://doi.org/10.1016/j.neuron.2017.02.003.

Ismail, S., Shafie, N., & Rahman, N. (2022). Learning Styles, Brain Dominance and Teaching Techniques: A Case Study Approach. Responsible Education, Learning and Teaching in Emerging Economies. https://doi.org/10.26710/relate.v4i1.2405.

Siriganjanavong, V. (2013). The Mnemonic Keyword Method: Effects on the Vocabulary Acquisition and Retention. English Language Teaching, 6(10), 1-10.

Merrienboer, J., Kirschner, P., & Kester, L. (2003). Taking the Load Off a Learner's Mind: Instructional Design for Complex Learning. Educational Psychologist, 38, 5 - 13. https://doi.org/10.1207/S15326985EP3801_2.

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Continuous Quality Improvement in Malaysian Engineering Programme: Assessing Traffic Engineering Course Learning Outcomes

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ABSTRACT

The Engineering Accreditation Council (EAC) mandates the Outcome Based Education (OBE) approach for all engineering programs in Malaysia, focusing on evaluating Course Learning Outcomes (CLOs). This study assesses the effectiveness of continual quality improvement (CQI) processes on CLO achievement in the Traffic Engineering course at Universiti Teknologi PETRONAS (UTP). The comparative analysis involved 21 first-year students from January 2024 and 37 from May 2023, assessing three key CLOs through students' performances on group projects, mid-term tests, and final exams. Results indicate that January 2024 students achieved 100% pass rates in CLO1 and CLO2 but only 95% in CLO3, whereas May 2023 students achieved 100% across all CLOs. The findings suggest the need for targeted interventions to enhance CLO3 achievement, including improved tutoring, instructional methods, and additional practice materials to consistently achieve 100% pass rates.

Keywords: CQI, Civil Engineering programme, Traffic Engineering, CLO

INTRODUCTION

In Malaysia, the Engineering Accreditation Council (EAC) mandates that all engineering programmes adopt Outcome-Based Education (OBE) approach. Underpinning this approach is the principle of Continual Quality Improvement (CQI), which focuses on the systematic enhancement of educational quality through iterative assessment and refinement of teaching methods and curricula. Challenges persist in the practical application of OBE and CQI, particularly in maintaining consistent student achievement across all learning outcomes. For instance, Gungat et al. (2011) highlight the difficulties in creating reliable and practical assessment methods, noting that direct assessment methods can often yield more reliable outcomes compared to indirect methods. Additionally, Tshai et al. (2014) and Jakhale & Attar (2015) discuss the importance of integrating stakeholder inputs and utilizing learning outcome data to drive programme improvements, underscoring the complexities involved in aligning educational strategies with CQI requirements.

Thus, this study seeks to elucidate the impact of CQI on student achievement in CLOs, proposing enhancements to teaching methodologies and assessment strategies to optimize learning outcomes in OBE frameworks. By addressing these challenges, the study contributes to the broader discourse on refining outcome-based assessment practices in engineering education, ensuring they are both effective and reliably administered.

Traffic Engineering course is offered during the first year of study. 37 May 2023 intake students pursued the syllabus known as VEB1072 while 21 January 2024 intake students pursued a refined syllabus known as VFB1072. Three CLOs are required to be achieved by the students who took VEB1072 are as follows: CLO1: Acquire, produce, and apply the fundamental of traffic flow in solving complex traffic related problems, CLO2: Analyze and propose improvement on the performance of transportation infrastructures and CLO3: Propose effective mitigation measures to address complex traffic issues and challenges.

However, the verbs used in the CLO1 and CLO2 have been refined during the CQI of the course. The following are the updated CLOs for the VFB1072:CLO1: Solve complex traffic related problems through fundamental traffic engineering knowledge, CLO2: Propose improvements to the performance of transportation infrastructures and CLO3: Propose effective mitigation measures to address complex traffic issues and challenges. Another CQI made for this course is the CLO-PO mapping, as shown in Table 1:

Table 1. Comparison of CO-PO Mapping

VEB 1072	VFB1072
CLO1-PO1	CLO1-PO1
CLO2-PO3	CLO2-PO3
CLO3-PO3	CLO3-PO4

The change was made to CLO3 where previously the course learning outcome was mapped to PO3 which contributes to design or development of solutions. However, after CQI process, the CLO3 is mapped to PO4; to conduct investigation of complex problems.

RESULTS AND DISCUSSION

The Traffic Engineering course (VFB1072) was chosen for this study due to its recent CQI process, which aimed to enhance teaching methodologies and assessment strategies. The assessment focused on three CLOs, aligned with the Programme Outcomes (POs). The students' performance was evaluated based on a written group project report, a mid-term test, and final examination results.

CLO1: Solve complex traffic related problems through fundamental traffic engineering knowledge.
In May 2023 Semester, students demonstrated a 100% pass rate in CLO1 with a majority at C+ grade. The primary challenge observed was a lack of depth in theoretical understanding, which affected the quality of the group project reports. In January 2024 Semester, which is the post-CQI, maintaining the 100% pass rate for CLO1, the majority grade has improved to B. Enhanced teaching techniques, including interactive simulations and case studies, contributed to a deeper understanding of traffic flow theories. Students' written reports reflected a more comprehensive grasp of the subject matter, with clearer articulation of concepts and practical applications.

CLO2: Propose improvements to the performance of transportation infrastructures.
May 2023 Semester: The pass rate for CLO2 was 100% with a high number of As. From conversation with students and Final Examination results, the questions provided were not challenging to answer.
In January 2024 Semester, after implementing CQI measures, the pass rate maintained at 100%. However, the majority grade is C and the highest grade achieved by the student is A-. The inclusion of more practical data analysis exercises and real-world road safety scenarios in the complex-problem project significantly tested the students' analytical skills.

CLO3: Propose effective mitigation measures to address complex traffic issues and challenges.
In May 2023 Semester, students achieved 100% pass rate in CLO3. Mid-term test scores reflected good problem-solving abilities in a dedicated timeframe.
For January 2024 Semester, after CQI interventions in the CLO-PO mapping, the passing rate dropped to 95%. The introduction of PO4 in complex-problem projects tested students' competencies in conduction investigation of traffic management systems problems.
The comparison of results between the two semesters clearly indicates that the CQI process had an impact on students' achievement of CLOs as shown in Fig1 and Fig2. The January 2024 cohort exhibited a 100% pass rate in CLO1 and CLO2, but 95% pass rate in CLO3 after PO4 is introduced, compared to 100% pass rate across all CLOs in the May 2023 cohort. This intervention underscores the effectiveness of the CQI measures in enhancing both teaching methodologies and student learning outcomes.

Fig 1. Summary of May 2023 CLO Attainment

Fig. 2 Summary of January 2024 CLO Attainment

CONCLUSION

The study demonstrates that continual quality improvement significantly enhances student performance in the Traffic Engineering course. The comprehensive CQI process, which included refining teaching methods, integrating practical exercises, and employing advanced tools, resulted in improved understanding, analysis, and design capabilities among students. The findings highlight the importance of ongoing evaluation and enhancement of educational practices to ensure that engineering graduates meet the high standards required by the EAC. However, there is the need for targeted interventions to enhance CLO3 achievement after PO4 is introduced.

REFERENCES

Gungat, L., Asrah, H., Bolong, N., & Makinda, J. (2011). Comparison study on the assessment approach of course outcomes. 2011 IEEE International Conference on Engineering Education (ICEED), 80-84.

Tshai, K., Jung-Hwan Ho, E. Yap, & H. K. Ng. (2014). Outcome-based Education – The Assessment of Programme Educational Objectives for an Engineering Undergraduate Degree. Engineering Education, 9, 74-85.

Jakhale, A. R., & Attar, A. (2015). A Novel Approach Towards Outcome Based Engineering Education for Continuous Quality Improvement: A Case study. Journal of Engineering Education Transformations, 29, 133-137.

Namasivayam, S., & Fouladi, M. H. (2018). Utilisation of Learning Outcome Attainment Data to Drive Continual Quality Improvement of an Engineering Programme: A Case Study of Taylor's University, Malaysia. International Journal of Engineering Education, 34, 905-914.

Accreditation of a Photonic Engineering Programme: A Successful Experience

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ABSTRACT

This article describes the Photonic Engineering Programme offered by School of Microelectronic Engineering (SoME), Universiti Malaysia Perlis (UniMAP) with its implementation process based on Outcome-Based Education (OBE) as well as its accreditation outcome by Malaysian Engineering Accreditation Council (EAC). Extensive attainment based on OBE of the programme was conducted to illustrate the success of the programme. The findings in the implementation of Photonic Engineering Programme have demonstrated a successful engineering program execution in the field of Photonics with the program successfully being accredited by the Malaysian EAC. However, despite the accreditation success, the university has decided to shut the program down due to low intake of students. There is no affirmation that the programme could continue if student intakes are not up to the requirement which in this case most likely due to the low interest and unfamiliar name of Photonics among the upcoming generation of potential undergraduate engineering students.

Keywords: Photonic education, Engineering education, Outcome-based education, Continuous quality improvement

INTRODUCTION

In the ninth Malaysian plan (The Economic Planning Unit 2006), Malaysian government has identified photonics as one of the country's priority sectors for development. Following this, UniMAP took the initiative to offer a new engineering degree programme known as the Bachelor of Engineering (Honours) (Photonic Engineering) in 2008 with the first enrolment of 23 students. According to accredited programme published by EAC, there are 72 electronic engineering-based degree programmes that are currently being offered by public and private universities in Malaysia. To the best of our knowledge, UniMAP is the only public university that offers the Photonic Engineering programme apart from one other private university, which is Multimedia University (MMU). However, after nine successive years of the programme offering, it has been decided that the Photonic Engineering programme in UniMAP will cease to be offered as the number of students intake seems to be on the descending trend year after year. This paper describes our experience in managing this programme, which includes the accreditation process and the quality assurance system it abides to during this process. The determination of the programme's objectives and outcomes, and the results of applying the continuous improvement process are also further explained in this paper.

RESULTS AND DISCUSSION

Curriculum Structure

The Bachelor of Engineering (Honours) (Photonic Engineering) Programme is positioned under the Electronics discipline as stated in the EAC manual. The curriculum structure consists of 125 credit hours for subjects based on the Electronic Engineering field including mathematics, communications, IT skills and engineering management. The core engineering subjects consisted of 104 credit hours. The remaining 19 credit hours catered the general education components such as Engineers in Society, languages, Ethnic Relation, Islamic and Asian Civilization, Thinking Skills and co-curriculum. The students were first introduced to photonic subjects during their second year of study. Students were required to have a fundamental understanding of electronics and mathematics before proceeding with photonic subjects. The third and final year of the programme focused on the advanced and specific courses of the Photonic Engineering Programme which included Photonic Fabrication Engineering and Optoelectronic System. The photonic niche area was clearly presented where there were 10 courses specializing in photonic area contributing to 31 credit hours or 29% of the core engineering courses.

Programme Educational Objectives

The result for PEO1 (Fig. 1) (career advancement) displays a significant increase compared to the previous graduates, where the target of 20% was achieved. Even though the performance indicator of PEO1 was achieved,

the school constantly conducted analysis to the CQI strategies in order to maintain the attainment of the PEOs. For PEO 2, the target has been revised to 30% and the result in PEO 2 (professional society) has displayed the increment over the targeted value of 30% for 2014 compared to the graduating classes of 2015 and 2016.

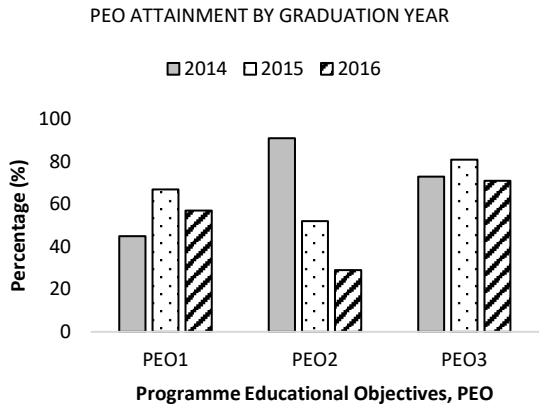

Fig. 1 PEO attainment of Photonic student by year of graduation.

Programme Outcome

All POs have been achieved with at least 60% attainment. This shows that the graduated cohort has successfully achieved the targeted PO set for the Photonic Engineering Courses. However, the achievement of each PO was varied. In average, the lowest PO attainment recorded was for PO8, which is defined as the ability to understand the professional and ethical responsibilities and commitment to the community. Similar to PO6 and PO7, PO8 is measured through coursework which relates to project, and examination. Topics on professionalism, ethics, and commitment towards the community are also covered and assessed in EUT 440 Engineers in Society and EMT443 Engineering Management courses. Students were able to comprehend the concepts of engineering ethics and demonstrate the understanding through assignments write up and exams. Nevertheless, there are still areas of improvement that could be undertaken.

Accreditation History

Throughout the accreditation process, the programme has received numerous feedbacks from the EAC panel. Each accreditation report entails the strengths, weaknesses, concerns, and opportunities for improvement of the programmes. The Photonic Engineering programme had initially attained a two-year accreditation from EAC for cohorts 2008 and 2009 (graduates of 2012 and 2013). Then, a three-year accreditation for cohorts 2010 – 2012 (graduates of 2014 – 2016) was granted by EAC in 2014. In 2017, a new submission for a new cycle accreditation for cohorts 2013 and onwards (graduates of 2017 and onwards) was made. This resulted in a 3-year accreditation for the students graduating from 2017 to 2019.

Students Intake and Graduate Employability

Throughout the 10 years the programme being offered, the average student intake per academic semester is only 46. The highest students' intake was in the academic year of 2011/2012, where a total of 77 students enrolled for the programme. From 2013 to 2014 and 2015, the number of students were 55, 53 and 54, respectively. This was then followed by another decrease of 41% in 2016. Finally, in 2017, only 24 students registered for the Photonic Engineering programme offered by the university. Based on Fig. 2, over 60% of graduates managed to secure a job in the Photonics and Optoelectronics sector. Among the optical giant companies that hire Photonics engineers are OSRAM, Philips Lumileds, Al-Nair Photonics and Venture Electronic.

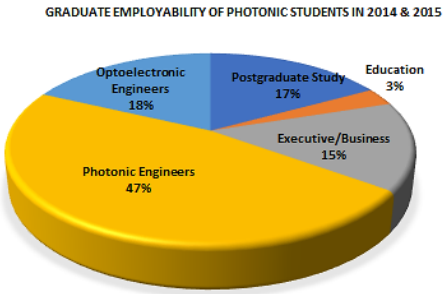

Fig. 2 Distributions of Photonics Students Employability in 2014 & 2015

CONCLUSION

In Malaysia, Universiti Malaysia Perlis (UniMAP) is the only public university that offered Photonic Engineering as part of an undergraduate engineering degree programme. However, after seven years, this programme is no longer being offered despite the rising photonics-based industries which highly demand engineers with a photonic education background. The lack of interest from the students was evident based on the number of student intake throughout the seven years that this programme was being offered. The programme accreditation history is also briefly elaborated along with the graduate employability statistics. Although the university has stopped offering Photonic Engineering as part of its undergraduate engineering program, the knowledge of photonic is still being pursued by the postgraduate students at this university.

REFERENCES

Brackin, P. (2002). Assessing Engineering Education: an Industrial Analogy. Int. J. Engng Ed. Vol. 18, No. 2, 151-156.

Davis, D.C., Gentili, K.L., Trevisan, M.S. and Calkins, D.E. (2002). Engineering Design Assessment Processes and Scoring Scales for Program Improvement and Accountability. Journal of Engineering Education, 91: 211-221.

Spady, W. G. (1994). Outcome-Based Education: Critical Issues and Answers. American Association of School Administrators

Continuous Enhancement of Quality for Diploma in Civil Engineering Programme During and After the Covid-19 Pandemic

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ABSTRACT

The COVID-19 pandemic has led to significant changes in the field of education, resulting in a shift towards traditional approaches in the aftermath of the crisis. This research looks at the continuous quality improvement of the Course X in Diploma of Civil Engineering programme during and after the COVID-19 era. The assessment covers various aspects, including academic performance measured by diagnostic tests, course and programme outcomes, and student feedback, all of which inform the formulation of continuous quality improvement strategies. In this study, student performance is assessed using quantitative data analysis, specifically descriptive statistics. The results show that student performance during the pandemic was commendable, followed by continued success as conditions improved. The data collected provides a solid foundation for ongoing improvements in the teaching and learning process. This research makes an important contribution to the field of education by highlighting the challenges and opportunities that arose during the pandemic and the subsequent transition to traditional teaching methods.

Keywords: COVID-19, Continual Quality Improvement, Course X, Civil Engineering, Academic Performance

INTRODUCTION

In 2019, *COVID-19* was deemed to be a global pandemic by the World Health Organization on 11 March 2020 (WHO, 2020). The impact of the pandemic on education has been profound and has affected programme outcomes (POs), accreditation standards and the overall quality of programmes, particularly for graduate engineering programmes accredited by the Engineering Technology Accreditation Council (ETAC). Yong et al. (2022) investigated the impact of the *COVID-19* pandemic on the engineering degree programme, particularly on academic quality. They found that satisfaction with the degree programme decreased during the pandemic, which affected the performance of POs.

Like the various engineering accreditation bodies within the Washington Accord, ETAC highlights the importance of engineering programs aiming for accreditation to focus on continuous improvement. These standards incorporate outcome elements in the engineering technology curriculum to foster a culture of Continuous Quality Improvement (CQI) in alignment with the principles of Outcome-Based Education (OBE) (ETAC, 2020). The CQI is important because it promotes a culture of continuous learning, adaptation and innovation in organisations. By systematically identifying areas for improvement, collecting and analysing data and implementing changes, CQI enables companies to continuously improve their processes, products and services.To ensure a thorough assessment of CQI, it is necessary to examine not only the overarching POs, but also the specific COs for each individual course within the programme. Biggs and Cipher (2024) have examined COs for Hispanic and non-Hispanic nursing students. They found that COs and associated characteristics specific to Hispanic students allow nursing programmes to identify and intervene in problem areas that could impact student success and improve student equity.

In summary, examining the POs and Cos programme outcomes provide an overview of the overall effectiveness of a programme, while the assessment of course outcomes is essential for a more nuanced understanding of how each course contributes to the achievement of programme objectives. This study aims to contribute to the ongoing discourse on improving the quality and relevance of engineering programmes. The results of this study would contribute to the existing body of knowledge on CQI in education. By identifying the challenges and opportunities presented by the pandemic, educational policymakers and institutions can develop evidence-based strategies to improve student achievement and ensure a resilient education system.

RESULTS AND DISCUSSION

In Figure 1 the CO-PO attainment in different semesters showed interesting trends. In 20214, CO1-PO1 attainment was 86% and CO2-PO2 attainment was 71%. However, there was a significant drop in CO-PO attainment in face-to-face assessments in semesters 20224 and 20234. CO1-PO1 attainment decreased to 54% in semester 20224 and further declined to 53% in semester 20234. Similarly, CO2-PO2 attainment dropped to 61% in semester 20224 and slightly increased to 62% in semester 20234. CO1-PO1 performance in 20214 was "excellent," but declined to "good" in semesters 20224 and 20234. CO2-PO2 performance in 20214 was also "excellent," with a slight decline in semesters 20224 and 20234, remaining in the "good" range.

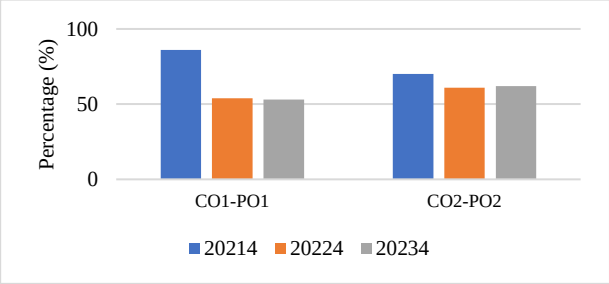

Fig 1. Overall CO-PO attainment

Figure 2 analyzed student grades for Course X. In the 20214 semesters, conducted online without a final exam, around 50% of students achieved an A grade and the remaining 50% received a B grade. However, in the subsequent semesters (20224 and 20234) with traditional teaching and strict assessments, there was a noticeable shift in grade distribution. The percentage of students earning an A grade decreased to 18% in 20224 and 11% in 20234, while the percentage of students receiving a B grade increased. Additionally, a significant percentage of students earned a C grade or passed, and some failed the course.

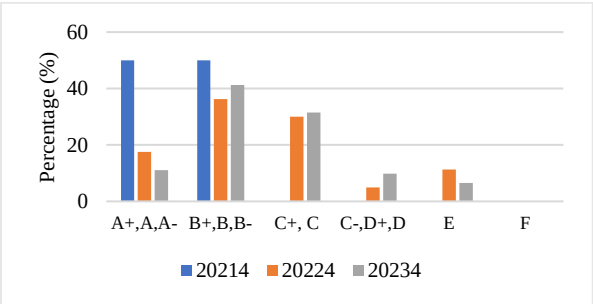

Fig 2. Student's grade achievement for Course X

Analyzing the disparity between diagnostic test results and overall student performance, specifically in terms of failure rates provides valuable insights into student progress and areas of improvement, enabling lecturers to monitor performance and identify areas of weakness. In support of this statement, Fan et al. (2021) highlight that diagnostic assessment can assist teachers in understanding learner's strength and weakness, ultimately supporting student educational process. Figure 3 illustrates the failure rates for three semesters. In the 20214 semester, which involved online evaluation through Open and Distance Learning (ODL), the diagnostic test revealed a 20% failure rate, while the overall failure rate was 0%. In the subsequent semesters conducted through face-to-face conventional assessment methods (20224 and 20234), the diagnostic test failure rates increased to 21% and 34%, respectively, while the overall failure rates remained at 16% for both semesters.

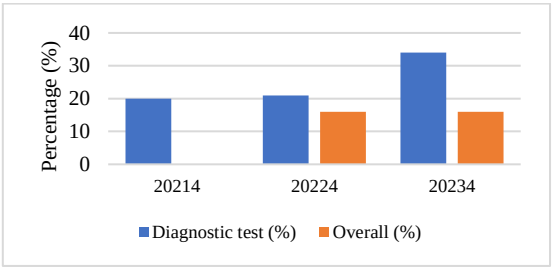

Fig 3. Comparison of failure rates between diagnostic test and overall course

CONCLUSION

This study evaluated the academic performance of students in course X, comparing ODL and conventional teaching methods. Results showed impressive performance during the online semester, with high percentages and no failures. However, CO-PO attainment in the conventional classroom setting indicated room for improvement. Data from diagnostic tests, CO-PO attainment, and grade achievement informed the CQI process. The future of teaching lies in flexible methods and student-centered approaches. This study emphasizes the importance of CQI, COPO evaluation, and student performance analysis in enhancing course quality.

REFERENCES

ETAC. (2020). *Engineering Technology Programme Accreditation Standards*. Engineering Technology Accreditation Council Malaysia.

Fan, T., Song, J., & Guan, Z. (2021). Integrating diagnostic assessment into curriculum: A theoretical framework and teaching practices. *Language Testing in Asia*, *11*(1), 1-23.

Malaysian Ministry of Higher Education. (2020). Press release by the Malaysian Ministry of Higher Education. Retrieved from https://www.nst.com.my/education/2020/06/599586/overseas-dream-put-hold

World Health Organization. (2020). WHO Director-General's opening remarks at the media briefing on COVID-19.

Yong, S. T., Chong, S. Y., Tiong, K. M., Tan, T. K., & Matthews, R. (2022). The Impact of the COVID-19 Pandemic on Engineering Foundation Student Course Experience. *International Journal of Virtual and Personal Learning Environments (IJVPLE), 12*(1), 1-16.

Assessing Student Interest in Civil Engineering Course: A Comprehensive Evaluation

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ABSTRACT

The Malaysian government is concerned about the declining interest in engineering subjects among young people. Engineering schools aim to equip students with essential skills, but fostering intellectual growth remains a significant challenge. School of Civil Engineering Universiti Teknologi MARA caw. Pulau Pinang (UiTMCPP) has adopted a new approach to enhance teaching and learning. This study assesses the interest of first-year students in the Bachelor of Engineering (Hons.) Civil (Infrastructure) (EC221) program at UiTMCPP. With concerns about graduates' preparedness and the need for problem-solving skills, innovative thinking, and ethical awareness, this research aims to understand student engagement in civil engineering courses. A comprehensive survey examined student interest in areas such as Structures, Geotechnics (Geotren), Water Resources and Environmental Systems (WRES), and Construction and Building Project Management (CBPM). Data analysis using SPSS software revealed that clear learning objectives and effective teaching methods significantly boost student interest and academic performance. While high mean scores indicated positive student experiences, variations in course content organization and workload suggest areas for improvement. The study underscores the importance of aligning teaching methods with student interests, providing insights for curricular reforms and teaching strategies to produce competent and motivated engineering professionals.

Keywords: Civil Engineering Education, Student Interest, Engineering Curriculum, Educational Assessment, Learning Objectives

INTRODUCTION

Universiti Teknologi MARA (UiTM) strives to provide exceptional education, aligning with the goals of other Malaysian higher learning institutions. UiTM focuses on quality assurance to produce professional graduates through a learner-centered approach, shifting from traditional content-driven education. Concerns about engineering graduates' preparedness have led to various curricular reforms. Researchers emphasize the need for engineering education to foster problem-solving skills, innovative thinking, and awareness of social and ethical implications (Olewnik et al;, 2023).

Despite numerous methods to assess quality in higher education, there has been a lack of studies specifically addressing students' interest in civil engineering courses at UiTMCPP. Understanding student engagement is essential for improving comprehension and educational outcomes. Most research has focused on teaching quality and learning experiences rather than students' interest levels in specific subjects (Adam & Collin,2019). This study aims to fill this gap by analyzing the interest of first-year students in the Bachelor of Engineering (Hons.) Civil (Infrastructure) (EC221) program at UiTMCPP. By evaluating the factors contributing to students' interest and its impact on their intellectual growth and academic performance, the study seeks to provide insights into improving civil engineering education. The objective is to enhance the understanding of student engagement in civil engineering courses, contributing to the overall quality of higher education at UiTM.

To achieve the objectives, questionnaires were distributed to first-year civil engineering students enrolled in the EC221 program at UiTMCPP. The questionnaire was designed to measure students' interest in different areas of the program, including Structures, Geotechnics (Geotren), Water Resources and Environmental Systems (WRES), and Construction and Building Project Management (CBPM). Additionally, it sought to identify factors contributing to their interest, such as the clarity of learning objectives and the quality of teaching. The data collected through the survey were analyzed using SPSS software to derive meaningful insights.

RESULTS AND DISCUSSION

The analysis revealed that students exhibit varying levels of interest across different areas of the EC221 program. The clarity of learning objectives emerged as a significant factor influencing students' interest. The study found that courses with well-defined learning outcomes and objectives tend to engage students more effectively, thereby promoting their intellectual growth and academic performance. Furthermore, the study highlighted the importance of aligning teaching methods

and course content with students' interests to enhance their learning experiences.

Table 1 Aspect Contributed to the Interest in Courses of EC221

	N	Minimum	Maximum	Mean	Std. Deviation
Learning objectives were clear	46	3.00	5.00	3.9130	.69366
Course content was organized and well planned	46	1.00	5.00	3.9348	.82737
Course workload was appropriate	46	2.00	5.00	3.8043	.77802
Course organized to allow all students to participate fully	46	3.00	5.00	3.9565	.75884
Instructor was an effective lecturer/demonstrator	46	3.00	5.00	4.0217	.77428
Presentations were clear and organized	46	2.00	5.00	3.8478	.75916
Instructor stimulated student interest	46	2.00	5.00	3.8696	.77771
Instructor was available and helpful	46	2.00	5.00	4.0217	.80247
The difficulty of the exam question is within the range of the student year	46	3.00	5.00	3.7609	.70505
Grading was prompt and had useful feedback	46	3.00	5.00	3.8261	.70881
Valid N (listwise)	46				

The results from Table 1 provide a comprehensive overview of student perceptions of the civil engineering course at UiTMCPP. The consistently high mean scores across most categories reflect a generally positive student experience, particularly in areas related to instructor effectiveness and availability. These findings underscore the importance of clear learning objectives and well-organized content in enhancing student satisfaction and engagement. However, the variability in responses regarding course content organization and workload appropriateness suggests that there may be room for improvement in these areas. The lower minimum score for course content organization highlights that some students may have found the course structure lacking, which could impact their overall learning experience.

The high scores for instructor effectiveness and availability indicate that the instructor's role is crucial in fostering a positive learning environment. Effective teaching and accessibility are key factors in student satisfaction and can significantly enhance their educational experience (Broberg et al;,2023). Overall, this study highlights the need for continuous assessment and improvement of course delivery methods to ensure that they meet student needs and expectations. By focusing on areas with lower satisfaction scores, UiTMCPP can further enhance the quality of its civil engineering program, ultimately leading to better educational outcomes for its students.

CONCLUSION

This study highlights the critical role of student interest in the success of engineering education programs. The insights gained from this study can inform future curricular reforms and teaching strategies at UiTMCPP and other similar institutions. By prioritizing students' interests and engagement, educational institutions can ensure the development of competent and motivated engineering professionals. Direct studies on students' interest in civil engineering courses at UiTMCPP might be sparse, but efforts are being made within the curriculum to enhance student engagement through innovative teaching approaches and course designs. Understanding and addressing student interests remains essential for improving comprehension and educational outcomes in higher education.

REFERENCES

Adam R.P, And Colin L. (2019) Assessing Civil Engineering Students Perceptions of Their Problem Solving Ability, *International Journal of Engineering Education*, Vol. 35, No. 5, pp. 1551–1560, 2019

Broberg, M. R., & Capa Salinas, J., & Wagner, D. N. (2023), A Pre-College Civil Engineering Course: Fostering Interest in Engineering Among High School Students and Developing Future Engineering Educators, *ASEE Annual Conference & Exposition,*. https://doi.org/10.18260/1-2—42460

Olewnik, A., Chang, Y. & Su, M. Co-curricular engagement among engineering undergrads: do they have the time and motivation. IJ STEM Ed 10, 27 (2023). https://doi.org/10.1186/s40594-023-00410-1

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Collaborative Teaching in the Engineers in Society Course: An Industry-Academia Partnership

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ABSTRACT

Engineering students frequently lack exposure to the real-world legal, ethical, and regulatory challenges they will face in their professional careers. Furthermore, the limitations of conventional classroom settings can restrict access to industry experts, hindering the delivery of contemporary and relevant knowledge. This paper addresses the need for an innovative educational strategy that integrates industry expertise through a collaborative teaching model in Engineers in Society course. The current study seeks to understand and document the best practices of these collaborative models to maximize their educational impact in engineering courses. It also seeks to evaluate the effectiveness of this approach in enhancing students' understanding and preparedness for their future roles as engineers. By using online platforms, the course aims to provide students with insights from professionals actively engaged in the field to enhance students' awareness and knowledge in key areas. The collaboration involves experts delivering course contents related to the Malaysian Legal System, Roles, and Responsibilities of Engineers, Local and Federal Authority Regulations, and the Occupational Safety and Health Act, all conducted through online platforms.

Keywords: collaborative teaching, engineers in society

INTRODUCTION

The traditional approach to teaching engineering courses related to engineering practices to safeguard society often falls short in bridging the gap between theoretical knowledge and practical application. Thus, the Engineers in Society course is designed to equip engineering students with a comprehensive understanding of their professional and ethical responsibilities within the societal context. Recognizing the importance of real-world insights, a collaborative teaching model involving industry experts was introduced. In addition, to effectively bridge the gap between theoretical knowledge and practical application in the Engineers in Society course, a collaborative, online educational approach is being evaluated for its impact on enhancing student preparedness. This method aligns with findings that collaborative online international learning (COIL) significantly develops student outcomes across diverse competencies essential for global engineering practice (Lara-Prieto et al., 2023). Additionally, previous studies suggest that COIL programs foster intercultural competence and project performance compared to traditional methods (Appiah-Kubi & Annan, 2020). Furthermore, during periods of physical isolation, such as during the COVID-19 pandemic, collaborative learning models have demonstrated their effectiveness in maintaining high levels of student engagement and learning outcomes (Chan & Zhang, 2020). These models are especially pertinent to online software engineering education, where they mitigate the challenges of remote collaboration and enhance learning through structured team projects (Neill, DeFranco & Sangwan, 2017).

The current study seeks to understand and document the best practices of these collaborative models to maximize their educational impact in engineering courses. It also seeks to evaluate the effectiveness of this approach in enhancing students' understanding and preparedness for their future roles as engineers. The problem at hand is determining how best to structure and deliver such a collaborative, online educational experience to maximize its impact on student learning outcomes.

METHODOLOGY, RESULTS AND DISCUSSION

A qualitative approach was used based on document review for the course and supported by a quantitative approach using survey to obtain students' feedback on the learning outcomes attainment for the course. The course content is structured under four main areas namely, (1) Malaysian Legal System where experts from the legal sector provide insights into the Malaysian legal framework, emphasizing laws and regulations relevant to engineering practice, (2) Roles and Responsibilities of Engineers, Code of Ethics and Professional Conduct for Engineers. The industry professionals discuss the ethical standards and professional conduct expected of engineers, highlighting real-life scenarios and case studies, (3) Local and Federal Authority Regulations. Representatives from local and federal authorities present the regulatory landscape affecting engineering projects, focusing on

compliance and best practices and (4) Occupational Safety and Health Act. An expert from certified by the Department of Occupational Safety and Health (DOSH), National Institute of Occupational Safety and Health (NIOSH), and Construction Industry Development Board (CIDB) discuss safety regulations and the roles of their respective organizations.

The delivery of content is carried out through online lectures, webinars, and interactive sessions, providing flexibility and accessibility to students as shown in Fig.1 to Fig. 5.

Fig. 1 Webinar on Occupational Safety and Health Act by Dr Mazlina Zaira Mohamad (OSHA Officer)

Fig. 2 Webinar on Local and Federal Authority Regulations by Ir Salmizi Ja'afar (Consultant)

Fig. 3 Webinar on Code of Ethics and Professional Conduct for Engineers by Ir. Dr Jayanthi (PEPC, Consultant)

Fig. 4 Webinar on Malaysian Legal System by Pn Siti Zawiyah Abdul Zain (Lawyer)

Fig. 5 Webinar on Roles of Engineering Professional Bodies by Ir Dr. Salmaliza Salleh (Academician & Consultant)

Based on the student feedback via entrance-exit survey to assess the two (2) course outcomes for the EIS course, it indicates a positive reception of the collaborative teaching model. Students reported a better understanding of the practical implications of legal and regulatory frameworks, as well as a heightened awareness of ethical considerations in their professional conduct. The online format facilitated engagement with industry experts, enabling students to interact and seek guidance on various topics. The integration of industry expertise in the Engineers in Society course has proven beneficial in enhancing the educational experience. The online delivery method has further enabled a diverse range of professionals to contribute to the course, enriching the learning environment. However, challenges such as scheduling conflicts and technological issues were noted and are being addressed to improve future iterations of the course.

CONCLUSION

Collaborative teaching in the Engineers in Society course has successfully provided engineering students with valuable industry insights, fostering a deeper understanding of their roles and responsibilities. The online platform has enabled greater flexibility and accessibility, though continuous improvements are necessary to address logistical challenges. This approach represents a significant step towards more integrated and practical engineering education.

REFERENCES

Appiah-Kubi, P., & Annan, E. (2020). A Review of a Collaborative Online International Learning. International Journal of Engineering Pedagogy (iJEP), 10(1). doi:10.3991/IJEP.V10I1.11678.

Chan, R. Y., & Zhang, Y. (2020). Collaborative Learning in Engineering Students under Social Distancing: An Action Research. Frontiers in Education Conference. doi:10.1109/FIE44824.2020.9274005.

Lara-Prieto, V., Ruiz-Cantisani, M. I., Membrillo-Hernández, J., Caratozzolo, P., García-García, R., Mejía-Manzano, L. A., & Vázquez-Villegas, P. (2023). The Role of Collaborative Online International Learning (COIL) as a Tool to Meet Engineering Accreditation Student Outcomes. IEEE Global Engineering Education Conference. doi:10.1109/EDUCON54358.2023.10125186

Neill, C. J., DeFranco, J. F., & Sangwan, R. S. (2017). Improving collaborative learning in online software engineering education. European Journal of Engineering Education. doi:10.1080/03043797.2016.1203293.

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Review On Students' Performance in Design Project Course throughout 2020 to 2023 Based on Outcome-Based Education (OBE)

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ABSTRACT

Outcome-based education (OBE) is an effective goal-driven method to measure the outcomes of a curriculum. Its implementation in Design Project course ensures the integrity of the assessments on various components of the course and improving the course delivery methods and student's expected attributes. Implementation of DP course throughout 2020 to 2023 coincided with tumultuous years of 2020 and 2021 where COVID19 restrictions impacted many learning activities. Thus, a review on students' performance throughout this period was conducted based on the course outcome (CO) and programme outcome (PO) which were mapped to various components of the course. Students' performance based on CO and PO attainments were not significantly different throughout 2020 to 2023 period. Furthermore, these attainments exceeded minimum target of 50% across the entire CO/PO attributes, with only one instance in 2020 where a CO/PO score did not meet the minimum threshold. Additionally, students' own assessment through questionnaires strongly suggested their attainments in all COs. In conclusion, steady performance of students during implementation of the DP course throughout 2020 to 2024 demonstrated the robustness of OBE assessment method.

Keywords: Outcome-based Education, Design Project, Course Outcome, Programme Outcome.

INTRODUCTION

Outcome-based education (OBE) has been widely adopted by higher learning institutions as a robust method to measure student's achievement (Kumar et al., 2021). OBE outlines specific attributes known as programme outcome (PO) that are distributed across various subjects in the curriculum. Students' attainment to these attributes ensures their adequate competency to the programme, relevant skill set for employment and nurturing positive attitudes to society (Mahbubul et al., 2022).

Design Project (DP) course (CEV663) is a capstone, project-based course which is undertaken by final year student of EH225-Degree of Chemical Engineering (Environment) programme at Universiti Teknologi MARA (UiTM) Pulau Pinang Campus. DP course carries the highest credit hour (four credit hour) with multiple PO(s); PO3 (design ability), PO6 (safety, health and legal assessment), PO9 (communication), PO10 (teamwork), PO11 (independent learning) and PO12 (project management).

COVID19 breakout in 2020 was a challenging period for conducting learning activities due to 'lockdown' or 'stay at home' order which took effect in March 2020. The restrictions imposed during this period impacted many learning activities especially project-based courses such as DP which relied on various forms of physical communications. Throughout year 2020 to 2021, most of these activities were carried out online.

In this study, robustness of OBE assessment tools in the implementation of DP course was evaluated by reviewing the students' performance throughout the year 2020 to 2023. The study also shed light on the overall OBE implementation in our chemical engineering programme (EH225) from which specifics OBE elements in DP course were transpired. During this period, the performance of four batches of students, each consisted of 119(2020), 54 (2021), 49(2022) and 56(2023) number of students, respectively who undertook the course in March-August semester were collected. Special attention was given to the performance during the period with COVID19 restriction (2020-2021) in comparison to normal times (2022-2023).

Assessment of student's achievement in course was carried out directly based on course outcome (CO) which reflected acquisition of tangible knowledge and skills by the student during the course undertaking. These COs were also mapped to aforementioned POs which served as constructive alignment tool for the DP course. The CO attainment was contributed by written reports, presentation, attitude and peer evaluation based on the fulfillment of criteria articulated by the respective assessment rubric sheet. CO and PO attainments of DP course were conferred to individual PO score of at least 50%. Average value of these individual scores was later calculated to reflect the average CO/PO attainment of a particular CO/PO. In addition, the frequency of individual CO/PO score of at least 50% was calculated as CO/PO

density. For example, 40 of 50 students who obtained at least 50% of CO1/PO3 corresponds to 80% of CO1/PO3 density at which EH225 set its own minimum target of 75%.

Another assessment was carried out using entrance-exit survey which made up of questionnaires related to course outcomes and students' own assessments to their achievement to the COs of the DP course.

RESULTS AND DISCUSSION

Average programme outcome (PO) and course outcome (CO) throughout 2020 to 2023 generally achieved more than 50% minimum target as shown in **Fig. 1**.

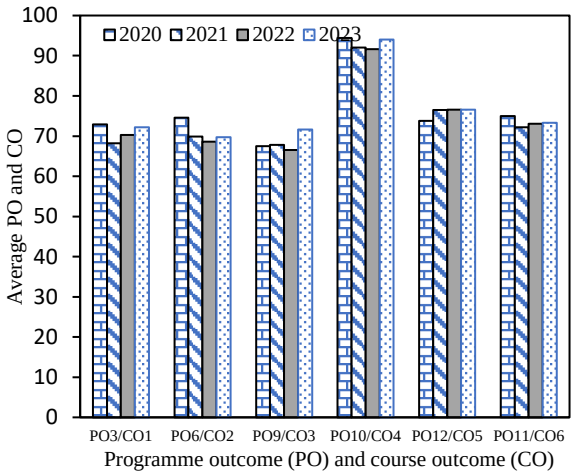

Fig. 1 Average programme outcome (PO) and course outcome (CO) throughout 2020 to 2023 period

In addition, there was no drastic change in PO and CO attainments throughout this period despite COVID19 restrictions in 2020 and 2021. This achievement was later translated into 100% CO/PO density which was consistently recorded throughout 2020 to 2023 (data not shown), with an exception in 2020 where an individual CO/PO score was less than 50%. Interestingly, elements of teamworking stipulated by CO4/PO10 earned the highest score of more than 90% including the year 2020 and 2021 during which much of the COVID19 physical restrictions were in place. On other hand, elements pertaining to presentation (CO3/PO10) showed the least score of less than 70% in 2020, 2021 and 2022 among other POs and COs, except in 2023 where the score was slightly above 70%.

Student demonstrated very high level of approval rating (>4) towards their own attainments in all course outcomes (CO) as shown in indirect assessment in Fig. 2. This trend was consistent throughout 2020 to 2023. Despite possible negative impacts of COVID19 restrictions to learning activities especially in 2020 and 2021, there was no significant change in student's overall perception towards their CO.

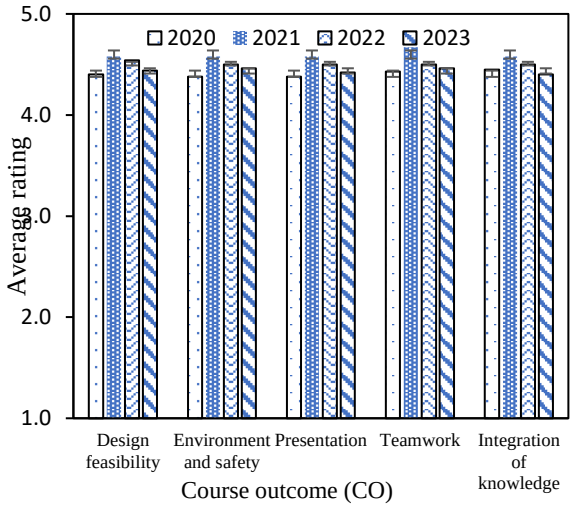

Fig. 2 Average rating for course outcomes (COs) throughout 2020 to 2023

CONCLUSION

Robustness of OBE assessment tools was demonstrated by consistent performance of CO and PO attainments throughout 2020 to 2023. All areas of CO and PO achieved much higher score than minimum target of 50% average CO/PO throughout this period, despite COVID19 restrictions in 2020 and 2021. Furthermore, students also agreed their own attainments to course outcomes based on their average ratings to questionnaires.

REFERENCES

Ananda Kumar K S, Bekele Worku, Sisay Muleta Hababa, Balakrishna R, Prasad A Y (2021) Outcome-Based Education: A Case Study on Course Outcomes, Program Outcomes and Attainment for Big data Analytics Course, *Journal of Engineering Education Transformations*, 35(2), 63.

Mahbubul Syeed, M. M., Shihavuddin, A. S. M., Uddin, M. F., Hasan, M., & Khan, R. H. (2022). Outcome Based Education (OBE): Defining the Process and Practice for Engineering Education. *IEEE Access*, 10, 119170–119192.

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A Review of Engineering Education in flux: Adapting to Change and Confronting Challenges

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ABSTRACT

This review discusses engineering pedagogy challenges and opportunities. This study examines how digital transformation improves education and prepares students for a rapidly changing job market. Furthermore, the paper explores the relationship between academic curricula and industry demands, highlighting the importance of integrating hands-on experiences and industry partnerships into educational structures. In addition, it promotes fairness and inclusivity in engineering education by reducing inequalities and increasing underrepresented group participation. This paper employs a methodology that relies on reviewing and analysing existing literature to offer insights into the current state of engineering education and proposes strategies for future adaptation. The objective is to establish a framework that fosters innovative pedagogical approaches, enhances students' employability, and promotes diversity and inclusivity in the field of engineering. This paper emphasises the need for ongoing engineering education adjustment and cooperation to meet 21st-century challenges and opportunities.

Keywords:
Digital Transformation, Engineering Pedagogy, Industry Demands, Workforce Needs, Engineering Education

INTRODUCTION

The field of engineering education is experiencing significant and rapid changes in the 21st century. The conventional models and approaches that previously characterised engineering education are being questioned due to a combination of factors, including technological progress and changing societal demands. This review intends to thoroughly analyse the present condition of engineering education, pinpoint the main factors that are causing change, and investigate the approaches taken by educational institutions to adjust and succeed in this ever-changing environment.

The development of engineering education can be traced back to the Industrial Revolution, during which the main emphasis was on providing technical skills and knowledge to meet the needs of growing industries. As we continue to move forward in the digital era, marked by remarkable progress in areas like artificial intelligence, robotics, and renewable energy, engineers now need to possess more diverse and intricate skill sets(Javaid et al., 2022).

Furthermore, the process of globalisation and the interconnectedness of the contemporary world have resulted in a change in the expectations placed on engineering graduates. Employers currently desire professionals who exhibit not only technical expertise but also showcase exceptional communication abilities, flexibility, and a comprehension of various cultural contexts (ter Hoeven & van Zoonen, 2023). This requires a reassessment of conventional curricula and teaching methods to guarantee that graduates are sufficiently equipped to handle the difficulties of a constantly evolving global marketplace.

At the same time, the composition of engineering students is changing, with a growing focus on diversity, fairness, and inclusivity. The endeavour to draw in and keep underrepresented groups, such as women and minorities, is altering the makeup of engineering classrooms and propelling a movement towards more inclusive educational methods(McCue, 2020). Paying attention to matters of diversity not only promotes originality and ingenuity, but also guarantees that the engineering field mirrors the diverse fabric of the society it caters to.

This review aims to provide a comprehensive analysis of the main topics of digital transformation, industry relevance, and inclusivity and equity in engineering education.

LITERATURE REVIEW

Engineering institutions worldwide are adopting innovative teaching methods and restructuring their programmes to promote creativity, critical thinking, and lifelong learning in response to these complex challenges (Waeber et al., 2023). Educators are transforming engineering education by implementing project-based learning initiatives, providing experiential learning opportunities, and fostering interdisciplinary collaborations. These changes aim to equip students with the necessary skills and mindset to effectively address the intricate challenges of the future. The current state of engineering education is experiencing significant changes

due to the rapid progress of digital technologies, the changing demands of the workforce, and an increasing need for fairness and inclusivity. Fig. 1 shows the infographic of the transformation application of digital technology. The application of digital technology has completely transformed conventional methods of teaching and learning, providing unparalleled possibilities to improve the effectiveness of teaching methods, create innovative learning environments, and equip students with the necessary skills for the challenges of modern engineering practice. Simultaneously, the engineering field is experiencing rapid changes in the requirements of the industry, which requires a reassessment of educational curricula and teaching methods to ensure they are in line with the changing needs of the workforce. Furthermore, the importance of fairness and the inclusion of all individuals in engineering education highlights the necessity to tackle structural obstacles and encourage diversity in terms of gender, race, ethnicity, and socio-economic background. This will result in a more comprehensive and diverse engineering workforce. The purpose of this literature review is to thoroughly examine:

A. The utilization of digital technology to revolutionize the teaching and learning methods in engineering education.

B. Confronting Workforce Requirements and Industry Demands

C. Equity and inclusiveness in engineering education

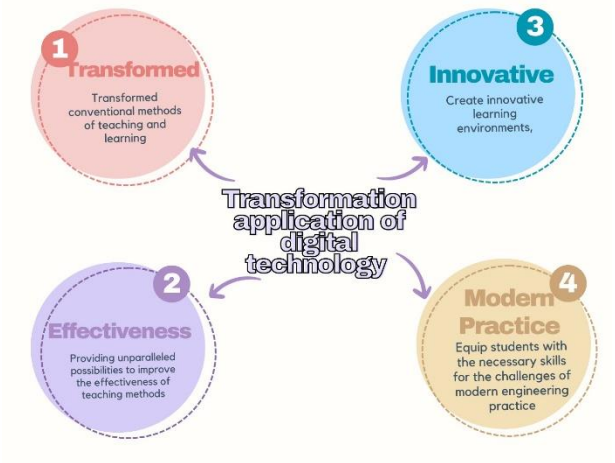

Fig. 1 The infographic of the transformation application of digital technology

CONCLUSION

The field of engineering education is currently experiencing a substantial change due to the rapid progress of digital technologies, the changing needs of the workforce, and the need for fairness and inclusivity. Our review emphasises the crucial importance of digital transformation in completely changing teaching and learning methods, creating a more interactive and captivating educational experience that matches with modern technological progress. Simultaneously, engineering education must adjust to fulfil the rigorous demands of contemporary industry, guaranteeing that curricula are in sync with practical applications and that graduates possess the essential skills to excel in a dynamic job market.

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REFERENCES

Javaid, M., Haleem, A., Singh, R. P., Suman, R., & Gonzalez, E. S. (2022). Understanding the adoption of Industry 4.0 technologies in improving environmental sustainability. *Sustainable Operations and Computers*, *3*, 203–217. https://doi.org/https://doi.org/10.1016/j.susoc.2022.01.008

McCue, L. S. (2020). The portia hypothesis: Mechanical engineering student perceptions of qualifications. *ASEE Annual Conference and Exposition, Conference Proceedings*. https://doi.org/10.18260/1-2--35357

ter Hoeven, C. L., & van Zoonen, W. (2023). Helping Others and Feeling Engaged in the Context of Workplace Flexibility: The Importance of Communication Control. *International Journal of Business Communication*. https://doi.org/10.1177/2329488419898799

Waeber, P. O., Melnykovych, M., Riegel, E., Chongong, L. V, Lloren, R., Raher, J., Reibert, T., Zaheen, M., Soshenskyi, O., & Garcia, C. A. (2023). Fostering Innovation, Transition, and the Reconstruction of Forestry: Critical Thinking and Transdisciplinarity in Forest Education with Strategy Games. In *Forests* (Vol. 14, Issue 8). https://doi.org/10.3390/f14081646

Programme Outcomes Attainment in a Malaysian Public University Engineering Design Course: A Comparative Analysis

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ABSTRACT

This study evaluates the attainment of Program Outcomes (POs) in the Reinforced Concrete Design course conducted at a Malaysian public university over three academic periods (20234, 20232, and 20224). By analysing student performance data and survey responses, the effectiveness of the course in meeting PO2 (Problem Analysis) and PO3 (Design/Development of Solutions) were investigated. The results indicated significant trends and variations in PO attainment across the semesters. There was an upward trend in PO3 attainment, suggesting successful strategies in improving students' design skills. Overall, this study provides valuable insights for improving educational strategies and student support mechanisms in engineering design courses.

Keywords: Program Outcomes (POs), Educational Assessment, Reinforced Concrete Design, Accreditation Standard

INTRODUCTION

In Malaysia, since 2006, the implementation of outcome-based education (OBE) is emphasized by the Engineering Accreditation Council (EAC), Board of Engineers Malaysia (BEM) aiming at enhancing the quality and efficacy of engineering programmes. In the evolving landscape of engineering education, the focus on Programme Outcomes (POs) is important to ensuring graduates are well-equipped to meet industry standards. The EAC Standard 2020 under the purview of BEM introduces twelve (12) specific programme outcomes that emphasize not only the technical competencies but also soft skills crucial for engineers, such as communication, leadership, and critical thinking (EAC Standard, 2020). These outcomes are critical in maintaining compliance with the standards, which align with the globally recognized Washington Accord, ensuring international standards in engineering education. This holistic approach in educational frameworks is supported by studies indicating its significance in fostering educational experiences that extend beyond traditional learning paradigms (Liew et al., 2021). Additionally, integrating holistic sustainability competences within undergraduate engineering programmes further emphasises the necessity for a well-rounded educational approach in achieving sustainable development goals.

This paper focuses on a course, known as Reinforced Concrete Design, which are mapped to PO2 (Problem Analysis) and PO3 (Design & Development of Solutions). It is a core and specialised engineering course in civil engineering programs, aiming to equip students with essential skills in structural analysis and design.

RESULTS AND DISCUSSION

This study adopts a mixed method, using a qualitative and quantitative approaches. A qualitative approach was carried out based on document review to compare performance of students across three semesters (20234, 20232 & 20224). A quantitative approach is used based on the feedback given by the students at the beginning and at the end the course to indicate their level of understanding and achievement of the learning outcomes. This paper presents the assessment of the attainment of two POs mapped to two COs, respectively which are CO1: Analyse structural elements and material characteristics in designing reinforced concrete structural elements (PO2) and CO2: Design reinforced concrete structures in accordance with relevant standards (PO3).

The following discusses the attainment of both POs in terms of the students' true attainment based on the direct assessment throughout each semester. There are three (3) assessment tools used which are common test, mini project and final examination as shown Table 1.

Table 1 Raw Data on PO attainment for 3 Semesters

	20234		20232		20224	
	PO2	**PO3**	**PO2**	**PO3**	**PO2**	**PO3**
Common Test	32.61	62.78	46.47	58.31	58.80	45.17
Mini Project	83.54	82.75	83.99	84.15	87.73	88.41
Final Exam	39.13	50.68	52.69	46.88	52.13	35.48

True PO attainment – Direct Assessment Tools

PO attainment is analysed based on the percentage average and percentage passed as shown in Fig. 1 and Fig. 2, respectively.

Average PO Attainment

Fig. 1 shows data on the average attainment percentages for PO2 and PO3 across three different semesters (20234, 20232, and 20224). Overall, the average PO2 attainment shows a decreasing trend from Semester 20224 to Semester 20234. On the other hand, PO3 attainment shows an increasing trend, starting low in Semester 20234, then equalising in Semester 20232, and finally highest in Semester 20224. Thus, the data suggests that while PO2 attainment has generally evidenced some flucuation over the periods, but PO3 attainment has seen improvements. This could imply that efforts to improve the PO3 are succeeding, while PO2 might need more focused attention to achieve consistent improvement.

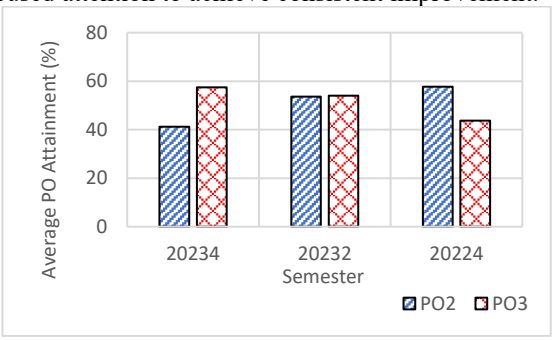

Fig. 1 Average PO attainment for 3 consecutive semesters

Percentage Passes for PO Attainment > 50%

Fig. 2 displays the percentage of students scoring more than 50% in PO2 and PO3 across three different semesters: 20234, 20232, and 20224.

Overall, there is a significant upward trend in the percentage of students scoring above 50% in PO3, from 29.47% in period 20224 to 87.04% in Semester 20234. This indicates successful strategies and interventions in improving students' design skills (PO3). However, there was a fluctuation in PO2. The percentage of students scoring above 50% in PO2 shows significant variation, with a peak of 73.68% in period 20224, followed by a slight decline to 64.52% in period 20232, and a sharp drop to 18.52% in period 20234. Study conducted by Chan et al. (2022) also showed a lower number of students scoring above 50% for PO attainment in PO2 in comparison to other PO in their study.

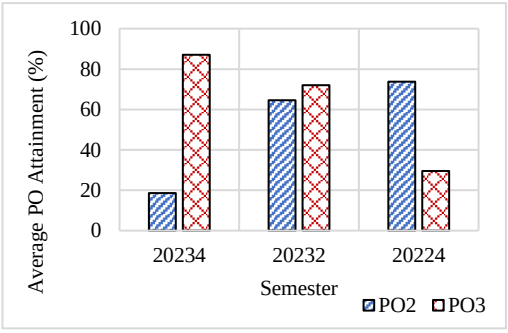

Fig. 2 Percentage Passes for PO Attainment Across 3 Semesters

Indirect PO attainment for Entrance – Exit Survey

Fig. 3 displays the results of an entry-exit survey gap analysis for all the three different semesters. The survey measures the difference between students' self-assessed competencies upon entry and exit from a course to reflect the perceived improvement or gap in achieving the POs.

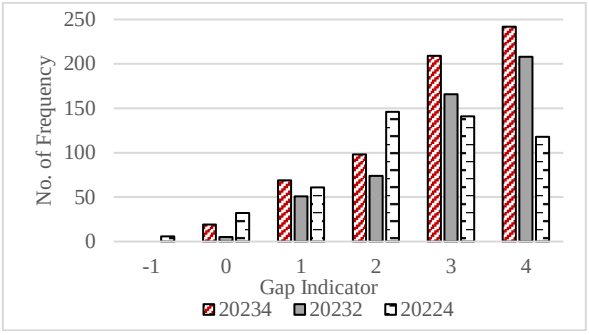

Fig. 3 Entrance-Exit Survey Gap Analysis for both POs

The survey results showed a positive perceived improvement in competencies related to both POs. Period 20232 displayed balanced improvements, with 55% of students reporting significant gains in both PO2 and PO3. However, period 20224 highlighted challenges in PO3 attainment, with only 25% of students perceiving significant improvement.

CONCLUSION

As a summary, the results suggest that while the course is effective in improving design solution capabilities (PO3), but there are inconsistencies in problem analysis skills (PO2). Conversely, the decline in PO2 attainment in the most recent semester (20234) indicates the need for targeted support and enhancements in teaching methodologies related to problem analysis. Future efforts should focus on maintaining consistent performance across all POs and addressing the specific challenges identified in PO3.

REFERENCES

Chan, M. K., Wang, C. C., & Arbai, A. A. B. (2022). Development of dynamic OBE model to quantify student performance. *Computer Applications in Engineering Education,* 30(5), 1293-1306.

Engineering Accreditation Council. (2020). Engineering Programme Accreditation Standard 2020 (2020th ed.). Engineering Accreditation Department, Board of Engineers Malaysia.

Liew, C. P., Puteh, M., Mohammad, S., Omar, A. A., & Kiew, P. L. (2021). Review of engineering programme outcome assessment models. European Journal of Engineering Education, 46(5), 834-848.

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Evaluation of Program Outcome Attainment Based on Accumulative Model and Culminating Model Analysis

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ABSTRACT

Program Outcomes (POs) are essential components that imply a graduate's attribute and ability to demonstrate competencies and practice at appropriate levels. Generally, POs are derived from the Graduate Attributes (GA) specified by accrediting bodies such as the Engineering Accreditation Council (EAC). The attainment of POs is assessed through various methods, including direct and indirect assessment tools. This study evaluates the effectiveness of PO attainment analysis and measurement based on accumulative model compared to culminating courses model approaches. POs attainment data analysis was performed on graduated student cohort September 2017 (20174) consisting of 115 student's databases. Finding from comparative analysis indicated both models provide reasonably accurate POs attainment.

Keywords: Program attainment, graduate attribute, accreditation, OBE.

INTRODUCTION

Outcome-Based Education (OBE) has been implemented in Universiti Teknologi MARA (UiTM) specifically at Civil Engineering Studies, College of Engineering to promote student-centered learning by aligning the educational objectives with the desired program graduate outcomes. Additionally, the OBE system aids in the Continuous Quality Improvement (CQI) process, enhancing teaching and learning through systematic analysis and also stakeholders' feedback (Kumar & Singh, 2019).

Based on the Criterion 2 derived from the Graduate Attributes (GA) of Engineering Accreditation Council Standard 2020, the program outcomes (POs) outline the knowledge, skills, and behaviors that engineering students are expected to acquire by the time they graduate (Abbas et. al., 2023). These outcomes specify what students should be able to know and do as a result of completing the program. For the Civil Engineering students in UiTM Cawangan Pulau Pinang, the program outcomes of the students are measured from the attainment of students from various courses and cumulatively calculated towards the end of their studies. Twelve POs are considered based on the EAC Standard 2020 which involves all three domains, i.e. cognitive, psychomotor and affective.

In general, there are three types of Programme Outcomes Assessment Models, i.e. culminating model (considers a few courses in the final year of study), dominating model (selected core courses) and accumulating model (considers all courses) that is used by various institutions. Another assessment model is also practiced which is the comprehensive culminating model as reviewed by Liew et. al., (2021). All assessment models are accepted for accreditation by the Board of Engineers Malaysia depending on the decision by the institution themselves (Sundararajan & Gopalan, 2020). Selection of the program outcomes assessment models will be able to drive the CQI process effectively with sustainable effort.

This paper will be focusing on the comparison of two types of POs assessment models which are the culminating model and the accumulating model. Three courses are considered for the culminating model, i.e. Integrated Design Project (CEC594), Final Year Project (CEC591 and CEC592) and the Industrial Training (CEC593). This analysis is carried out to compare the final PO attainment of students at the time of graduation.

RESULTS AND DISCUSSION

The analysis of data in Figure 1 shows the average PO attainment for student cohort September 2017 – January 2018 (20174). This cohort was in final semester in Mac 2020. The POs attainment presented was based on accumulative model and culminating model respectively.

The bar chart shows a better overall PO attainment percentage for adapting the culminating model compared to the accumulative model (Lee & Lee, 2022). The increases in average attainment for PO1, PO2, PO4, PO5, PO7, PO8 and PO11 are between 2% to 8%. The attainment for PO9 and PO10 remains the same for both models. However, a slight decrease was observed for PO3, PO6 and PO12 attainment based on culminating model compared to accumulative model.

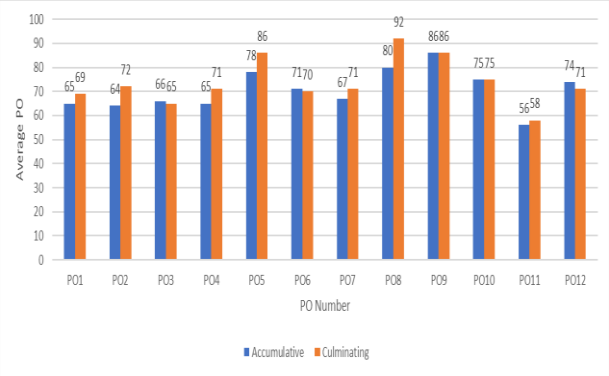

Fig. 1 Average POs Attainment for cohort 20174

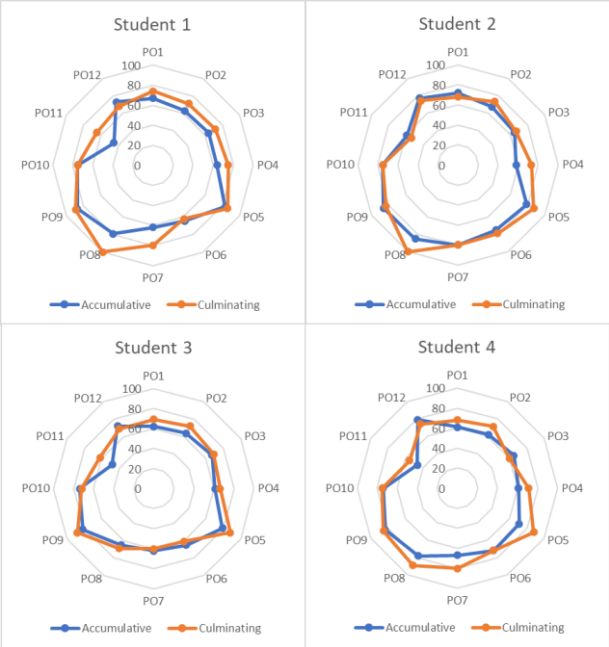

Fig. 2 Individual Student Spider web on PO Attainment

Both models are practically able to capture graduates' POs attainment for the program. Figure 2 shows examples of individual student spider web on their PO attainment. Culminating model shows better overall results with slight differences compared to the accumulative model. By comparing the accumulative model with culminating model in PO attainment analysis, it can strengthen the accomplishment of the program in producing graduates with the necessary attributes as stated in the accreditation manual or standard. (Lee & Lee, 2022)

CONCLUSION

The analysis of POs attainment data based on the accumulative courses model and culminating courses model data concludes that both methods are equally capable of capturing the graduate attributes of graduated students at the end of their study. Both models produce consistent results with small differences in certain POs attainment percentage are acceptable. This finding is in-line with the continuous effort made by academicians and administrators of Civil Engineering Studies in continuous quality improvement (CQI) practices of OBE system.

REFERENCES

Abbas, J., Kumari, K., Shah, M. A., & Golam, M. (2023). Graduate Attributes for Accreditation of Engineering Programs: Challenges and Strategies. Journal of Engineering Education, 112(1), 1-14.

Kumar, P., & Singh, V. (2019). Continuous Quality Improvement in Engineering Education: Implementation and Evaluation. Quality Assurance in Education, 27(3), 311-329.

Lee, H., & Lee, J. (2022). Enhancing Engineering Students' Competencies through Program Outcome Assessment. International Journal of Engineering Education, 38(2), 523-532.Gold, R. (2001). Evaluation of instruction. Educational Studies, vol 15 No 1, pp 31-42.

Liew, C. P., Puteh, M., Mohammad, S., Omar, A. A., & Kiew, P. L. (2021). Review of engineering programme outcome assessment models. In European Journal of Engineering Education (Vol. 46, Issue 5, pp. 834–848). Taylor and Francis Ltd. https://doi.org/10.1080/03043797.2020.1852533

Sundararajan, K., & Gopalan, V. (2020). Comparative Analysis of Different Assessment Models in Outcome-Based Education. Journal of Engineering Education Transformations, 34(4), 5-14.

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Implementation of CDIO Approach in Reinforced Concrete Building Design Project for a Diploma Programme in Malaysia

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ABSTRACT

The integration of the "Design-Build" methodology within the CDIO (Conceive-Design-Implement-Operate) approach fosters a hands-on, experiential learning environment for students in the Diploma of Civil Engineering program. This paper presents the implementation of the "Design-Build" concept in the Civil Engineering Design Project course, offered in the fifth semester. Students engage in project cycles, from identifying problems and gathering requirements to creating structural plans and performing detailed structural analysis and design per Eurocode 2 standards. The implementation phase involves using design software in modeling and optimizing the design. In the operation phase, students develop detailed plans, schedules, and budgets, culminating in a report and presentation to industry panels. Assessment using evaluation rubrics and feedback from industry panels showed that students' problem-solving, investigation, and communication skills exceeded 60% attainment. Industry feedback indicated satisfaction with the project's execution and students' understanding of building by-laws and software utilization. Students expressed enthusiasm for using design software, finding 3D rendered drawings invaluable for visualizing structural frameworks and reinforcement placements. Future improvements to incorporate sustainability and smart building features are recommended. This approach emphasizes the practical application of theoretical knowledge, equipping students with essential skills for real-world engineering projects.

Keywords: CDIO, Design & Build, Design Project.

INTRODUCTION

In traditional engineering education, students often struggle to bridge the gap between theoretical knowledge and practical application. The conventional classroom setting, which heavily emphasizes textbook learning and theoretical concepts, does not adequately prepare students for real-world engineering challenges. This disconnects results in graduates who may possess strong theoretical foundations but lack the hands-on experience necessary to design, implement, and manage engineering projects effectively. Consequently, there is a pressing need for educational approaches that integrate practical, real-world applications into the curriculum to enhance students' competencies and readiness for the engineering profession. The CDIO (Conceive-Design-Implement-Operate) approach offers a solution to this problem by providing a structured framework that emphasizes active, hands-on learning and the practical application of engineering principles. By involving students in the entire lifecycle of engineering projects—from conception through design and implementation to operation—the CDIO approach aims to bridge the gap between theoretical knowledge and practical skills, thereby producing graduates who are better equipped to meet the demands of the engineering industry. In the last decade, the CDIO (Conceive-Design-Implement-Operate) approach has been implemented in various engineering programs (Al-Obaidi, 2021; Kulkarni et al., 2020; Martseva et al., 2021; Jambari et al., 2018). "Design-Build" in the CDIO refers to a hands-on methodology where students actively engage in the creation and realization of engineering projects. This method emphasizes the practical application of theoretical knowledge by allowing students to experience the full cycle of engineering projects, from conception through design and implementation to operation. The purpose of this paper is to examine the implementation and effectiveness of the "Design-Build" methodology within the CDIO (Conceive-Design-Implement-Operate) framework in the Civil Engineering Design Project course for Diploma of Civil Engineering programme.

METHODOLOGY, RESULTS AND DISCUSSION

This study adopts a qualitative approach by reviewing the documents related to Civil Engineering Design Project course. In addition, feedback from industry panels and students were also obtained to highlight the benefits and areas for future improvement. The review of the CDIO implementation shows that initially, the students are required to find a set of architecture drawings for a double storey reinforced concrete building, perform structural analysis and design of the selected elements of the building, and produce a project schedule for the construction stage of the building. This “Design-Build

activity involves creating a digital model of the building, allowing students to verify the coherence and accuracy of their design.

A systematic implementation of CDIO approach in the project is described as follows: (1) **Conceive Phase**: Students begin by identifying the problem statement and gathering stakeholder requirements, including local authority by-laws, building design standards, and suitable construction materials for their respective building. They compile all information and design parameters into the introductory section of their report, (2) **Design Phase**: Students create structural plans for the building, specifying the positions of slabs, beams, and columns on each floor. They determine permanent and variable loads on these elements, estimate initial sizes, calculate actions, perform structural analysis, and conduct design calculations based on Eurocode 2. (3) **Implement Phase**: Students use design software to model the building. They iterate and amend sizes to resolve issues identified by the software, optimizing the design for efficiency and compliance and (4) **Operate Phase**: Finalized plans, sizes, parameters, and reinforcements are used to create detailed drawings and outputs for construction. Students plan construction stages, develop schedules using Microsoft Project, and create budgets. They compile their work into a report and present findings to industry panels at the semester's end. Examples of outputs from the design software are shown in **Fig. 1** and **Fig. 2** respectively. **Fig. 3** shows a picture of a student preparing a project schedule using Microsoft Project.

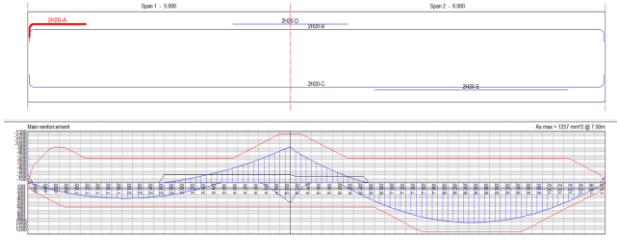

Fig. 1 Beam moment reinforcement output

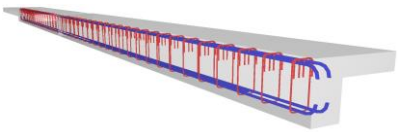

Fig. 2 3D reinforcement diagram of a flanged beam

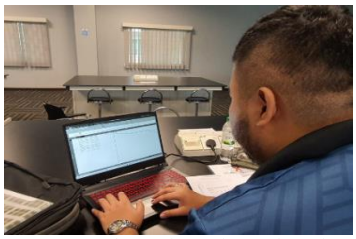

Fig. 3 A student using Microsoft Project

Students were assessed using evaluation rubrics. Feedback from industry panels was gathered. **Fig. 4** shows the learning outcome attainments of students. Average students' attainment for Problem Solving, Investigation and Communication skills are higher than 60%, showing that students attained the respective skills in completing and presenting this project.

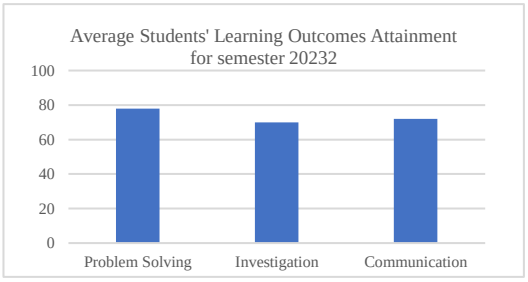

Fig. 4 Students' learning outcome attainments

Industry panels unanimously agreed with the project's execution and expressed satisfaction that students were immersed in understanding building by-laws and software utilization. Such exposure is poised to significantly enhance students' competency in relevant skills. Students also expressed enthusiasm about the opportunity to utilize design software in the project.

CONCLUSION

Through this project, students develop practical skills in designing a reinforced concrete building with the use of design software. The iterative nature of the design-build process encourages continuous refinement and improvement of structural design. Future improvement to incorporate elements of sustainability and smart building features to the project is recommended.

REFERENCES

Al-Obaidi, A. S. M. (2021). CDIO initiative: A guarantee for successful accreditation of engineering programmes. Indonesian Journal of Science and Technology, 6(1), 81-92.

Jambari, H., Razali, N. A., Taman, I., Noh, N. H., Osman, S., Ahmad, J., ... & Rameli, M. R. M. (2018). Conceive-design-implement-operate (CDIO) approach for an innovative capstone project. Journal of Technical Education and Training, 10(2).

Kulkarni, S., Patil, S., & Pawar, R. (2020). Adoption of the Conceive-Design-Implement-Operate approach to the Third Year Project in a team-based design-build environment. Procedia Computer Science, 172, 559-567.

Martseva, L. A., Movchan, L. H., Vakaliuk, T. A., & Antoniuk, D. S. (2021, June). Applying CDIO-approach at technical universities. In Journal of physics: Conference series (Vol. 1946, No. 1, p. 012013). IOP Publishing.

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Implementation of Complex Engineering Problem (CEP) and Complex Engineering Activities (CEA) in Malaysian Engineering Undergraduate Programmes

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ABSTRACT

Complex problem-solving skills are crucial for engineering graduates to succeed in the workforce. In Malaysia, the Engineering Accreditation Council (EAC) Standard 2020 mandates that complex engineering problem (CEP) solving skills and complex engineering activities (CEA) be included as graduate attributes in engineering programs. However, many programs struggle to understand and implement these requirements, impacting students' ability to tackle real-world problems. This paper evaluates the awareness and implementation of CEP and CEA skills in Malaysian engineering programs through a survey of 120 academicians from 24 institutions. Results show that project-based courses, such as final year projects and design-related courses, are commonly used to address CEP and CEA. Assessments are typically conducted through project-based methods on a semester basis. Problem-based learning (PBL) is the most popular teaching strategy, promoting active student participation, critical thinking, and real-world problem-solving. Further research could examine the effectiveness of these strategies in enhancing students' problem-solving skills and their ability to apply CEP and CEA principles in professional settings.

Keywords: complex engineering problem, complex engineering activities, undergraduate engineering programmes, assessment tools.

INTRODUCTION

Complex engineering problem solving was emphasized in the International Engineering Alliance's (IEA) programme outcomes (IEA, 2013) and the Engineering Accreditation Council, Malaysia's (EAC) accreditation standard (EAC, 2020). EAC requires that engineering degree programmes which seek accreditation must prepare graduates for future technological and societal changes, and able to acquire new knowledge through new problems (EAC, 2020). Due to the importance of this skill, IEA released the attributes of complex engineering problems to guide the signatory countries of the Washington Accord in their implementation of complexity in engineering curriculum in 2013. These attributes can be used by the Higher Learning Institutions (HLIs) to mirror the problems in the classrooms with those in the industry.

Previous studies investigating the level of awareness, strategies, and effectiveness of implementation of complex problem solving (CEP) and complex engineering activities (CEA) showed that the most common approaches taken by the HLIs to address CEP and CEA are Final Year Project (FYP), Integrated Design Project (IDP) and design-related courses (Azmin et al., 2024 and Mat Isa et al., 2021). Teaching and learning strategies used to foster CEP and CEA include problem-based learning, case studies, and projects (Nor et al., 2023, Azmin et al., 2024).

Undergraduate engineering programmes in Malaysia aims to incorporate CEP and CEA effectively to meet the requirements set by the EAC, in addition to ensure that students are well-prepared and equipped with the necessary skills and knowledge for a successful engineering education. Most engineering programmes in Malaysia prioritize the incorporation of CEP within assignments or projects rather than in final examinations or mid-term tests (Tapsir and M. Puteh, 2018). It is also integrated into a SULAM (Service-Learning Malaysia-University for Society) course, which engages students in service and collaborative learning to address complex issues and challenges identified in the society (Mat Isa et al., 2022). The main objective of this paper is to study the

current implementation of CEP and CEA in Malaysian engineering programmes.

RESULTS & DISCUSSION

This study utilized a qualitative approach aimed to gather comprehensive data from the respondents, i.e., 120 academic staff from 24 HLIs in Malaysia. A Cronbach reliability test was carried out during the pilot study for only 3 questions that require respondents' opinion. The result shows that the Cronbach's Alpha for the 3 item is 0.8 (>0.7 as recommended by Nunally (1970), thus considered as reliable. Fig.1 shows the courses designed to assess CEP and CEA in the engineering curriculum and Fig.2 shows the teaching and learning strategies in implementing CEP and CEA in courses across the HLIs affiliated to our respondents.

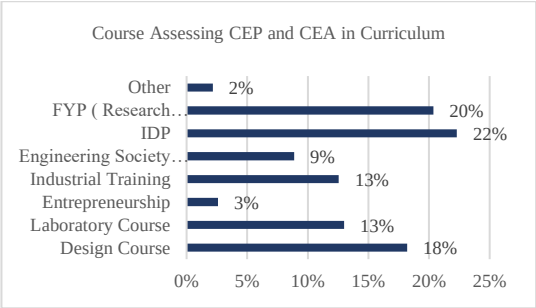

Fig. 1 Courses Assessing CEP and CEA in Curriculum

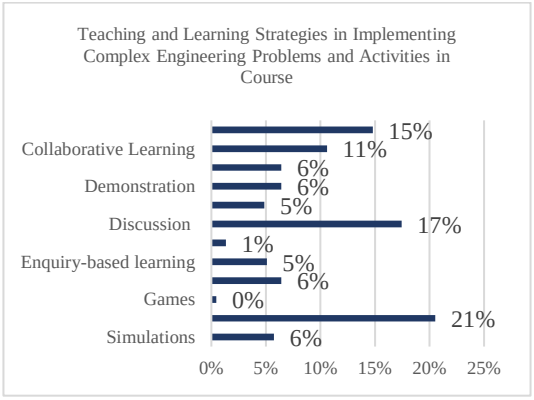

Fig. 2 Teaching and Learning Strategies in Implementing Complex Engineering Problem and Complex Engineering Activities in Courses

CONCLUSION

This study presents the strategies employed by 120 academic staff from 24 HLIs in Malaysia concerning the implementation of CEP and CEA in undergraduate engineering programmes in Malaysia. Among the significant findings are (1) the courses selected to assess CEP and CEA are project-based courses such as Final Year Project, Integrated Design Projects, and design-related courses, and (2) the teaching and learning approaches used to address the CEP and CEA in the courses mainly involved student-centered learning including problem-based learning, discussion, and active learning. In summary, although the awareness and implementation of CEP and CEA is already widespread in the HLIs in Malaysia, it is crucial to investigate the effectiveness in the strategies taken by the academic staff and the challenges faced by them.

REFERENCES

Azmin, N. F. M., Mat Isa, C. M., Lee, W.-K., Ibrahim, S. N., & Lian, O. C. (2024). Implementation of Complex Engineering Problem Solving (CEP) and Complex Engineering Activities (CEA) in Malaysian Engineering Curriculum: A Pilot Study. *2023 International Conference on University Teaching and Learning (InCULT)*, 1–6. https://doi.org/10.1109/incult59088.2023.10482478

Mat Isa, C.M, Lian, O.C and Pao, L.C, "Design of an Innovative Assessment Instrument Integrating Service-Learning Malaysia University for Society Approach for Engineers in Society Course during Covid19 Pandemic," *Asean J. Eng. Educ.*, vol. 6, no. March, pp. 58–68, 2022.

Mat Isa, C.M., Lian, O. C. Pao, L.C., Mohd Saman, H., Che Ibrahim, C.K., and Yusof, Z, "Effective Implementation of Complex Engineering Problems and Complex Engineering Activities in Malaysian Engineering Curricular," *Asian J. Univ. Educ.*, vol. 17, no. 4, pp. 170–178, 2021, doi: 10.24191/ajue.v17i4.16219.

Engineering Accreditation Council, *Engineering Programme Accreditation Standard 20207*, 2020th ed. Engineering Accreditation Department, Board of Engineers Malaysia, 2020.

Nunally, J.C., *Introduction to psychological measurement*. 1970.

Leppävirta, J., Kettunen, H. and Sihvola, A. "Complex Problem Exercises in Developing Engineering Students' Conceptual and Procedural Knowledge of Electromagnetics," *IEEE Trans. Educ.*, vol. 54, no. 1, pp. 63–66, 2011, doi: 10.1109/TE.2010.2043531.

Nor., N.M. and Zubir, N.A., "The Effectiveness of an Interactive Simulation-Based WDPP Tool in Fostering Student Comprehension of Complex Problem Solving," *Asian J. Univ. Educ.*, vol. 19, no. 1, pp. 156–169, 2023.

Tapsir, S. H. and Puteh, M, *Framing Malaysian Higher Education 4.0: Future-Proof Talents*. Perpustakaan Negara Malaysia, 2018.

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Developing a Methodological Framework Integrating Artificial Intelligence for Alternative Assessments in Engineering Education.

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ABSTRACT

The integration of alternative assessment (AA) in engineering education aims to enhance higher order thinking skills and prepare graduates for industrial challenges. Despite significant efforts, gaps persist in aligning outcomes with 21st-century skills and IR4.0 demands. This paper outlines the methodological framework to be in the development the Alternative Assessment for Culminating Courses integrating Generative Artificial Intelligence Framework (2A2CAIF) for engineering programmes in Malaysia. The framework was designed to address the evolving educational needs by incorporating AI to enhance assessment accuracy, personalization, and efficiency. The methodological process involved five key phases: a comprehensive literature review and document analysis, a qualitative exploratory study through focus group discussions, a quantitative pilot and main study, the development and administration of the final assessment instrument, and expert validation of the framework. At each phase, AI tools were leveraged to automate data analysis, design adaptive assessment instruments, and provide real-time feedback. This integration of AI aimed to ensure that the assessment framework is robust, reliable, and capable of addressing both cognitive and non-cognitive skills. The framework's development process highlights the potential of AI to transform educational assessment by making it more responsive to individual student needs and aligned with contemporary engineering education goals.

Keywords: Alternative Assessment (AA), Artificial Intelligence, Culminating Courses, Engineering Education, Methodological Framework

INTRODUCTION

The need for engineers with a diverse range of competencies, including critical thinking, systemic thinking, values, and ethics, is well-documented (Dieck-Assad et al., 2021). Similarly, industry demands for skills like problem-solving, teamwork, creativity, and communication highlight the need for dynamic educational frameworks (Thornhill-Miller et al., 2023). To address the multifaceted skill requirements of future engineers and align with current and dynamic educational needs, the integration of advanced technologies such as Artificial Intelligence (AI) into teaching, learning, and assessment methodologies is inevitable. Integrating AI into the curriculum involves careful design considerations regarding the selection of teaching content and pedagogical strategies. Key orientations for AI-integrated curricula include AI-focused, discipline-focused, and transdisciplinary approaches. These orientations aim to enhance AI literacy and apply AI knowledge to solve real-life problems (Park et. al, 2022). AI-enhanced alternative assessment frameworks can help solve traditional challenges in education, such as the need for extensive instructor training and the provision of continuous and meaningful feedback. Moreover, integrating AI facilitates a more granular understanding of student performance, enriching the feedback loop and enhancing student engagement and motivation (Hunter et al., 2022). This approach not only improves the efficiency and efficacy of formative assessments but also ensures that summative assessments are more reflective of student learning. By fostering continuous innovation and sustainable practices, this framework improves educational outcomes and sets a new standard for engineering programs in Malaysia and beyond, contributing to global educational advancements (Grassini, 2023).

This paper focuses on the most important aspects of the framework development which the methodological process to be taken place systematically.

RESULTS AND DISCUSSION

This section describes the methodological process that was established towards the development of An Alternative Assessment for Culminating Courses integrating Generative Artificial Intelligence Framework (2A2CAIF) for engineering programmes in Malaysia as shown in Fig. 1. The process is structured into five detailed phases.

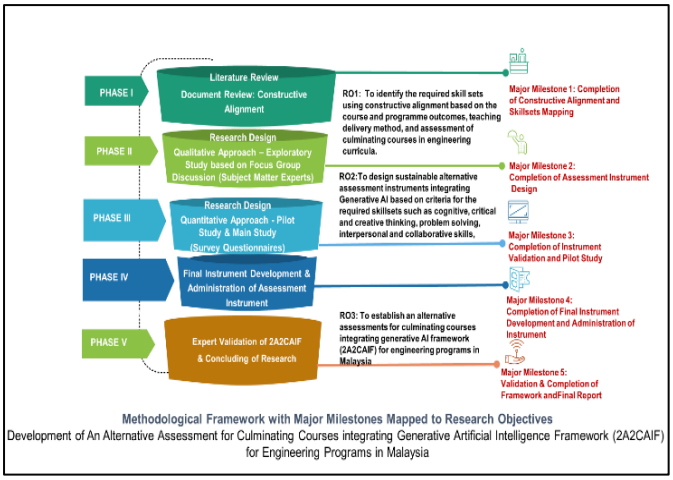

Fig. 1 Methodological Framework with Major Milestones Mapped to Research Objectives

Phase I involves a comprehensive literature review and document review focused on constructive alignment. This phase aims to identify the necessary skill sets required in engineering programs by aligning them with course and program outcomes. This phase's completion is marked by Major Milestone 1: the successful mapping of constructive alignment and skill sets.

Phase II employs a qualitative approach, which includes conducting exploratory studies and focus group discussions with subject matter experts. The goal here is to design sustainable alternative assessment instruments that integrate Generative AI, addressing essential skills such as cognitive, critical thinking, and problem-solving abilities. This phase culminates in Major Milestone 2: the completion of the assessment instrument design.

Phase III transitions to a quantitative approach, involving pilot and main studies using survey questionnaires. This phase is crucial for validating and refining the assessment instruments developed in Phase II. The successful completion of this phase is indicated by Major Milestone 3: the completion of instrument validation and pilot study.

Phase IV focuses on the final development and administration of the assessment instrument. This phase ensures that the instrument is fully developed and ready for implementation in the educational context. The achievement of Major Milestone 4 marks the completion of this phase with the final instrument development and its administration.

Phase V centers on expert validation and the conclusion of the research. This phase ensures that the developed assessment instruments are rigorously validated by experts and that the overall framework is finalized. The conclusion of this phase is marked by Major Milestone 5: the validation and completion of the framework and the final report.

This systematic and iterative process allows for continuous refinement and enhancement of the assessment instruments, ensuring they are robust, relevant, and aligned with the demands of 21st-century skills and the Industrial Revolution 4.0. The integration of Generative AI throughout the phases facilitates the creation of innovative assessment tools that simulate complex, real-world engineering scenarios, thereby improving the relevance and rigor of the assessments. The implementation of this methodological process is crucial to developing the 2A2CAIF, bridging the gap between educational outcomes and industrial requirements. This alignment is consistent with Malaysia's MADANI values on sustainability and innovation, equipping graduates with industry-ready skills. The resulting framework not only enhances the assessment process but also ensures that engineering graduates are well-prepared to meet the challenges and opportunities of the modern engineering landscape.

CONCLUSION

The methodological process presented in this paper outlines a systematic approach to developing the Alternative Assessment for Culminating Courses integrating Generative Artificial Intelligence Framework (2A2CAIF) in engineering programs. This process is designed to address the limitations of traditional assessment methods by leveraging AI to create adaptive, personalized, and comprehensive assessment instruments. This systematic and iterative process allows for continuous refinement and enhancement of the assessment instruments, ensuring they are robust, relevant, and aligned with the demands of 21st-century skills and the Industrial Revolution 4.0. The integration of Generative AI throughout the phases facilitates the creation of innovative assessment tools that simulate complex, real-world engineering scenarios, thereby improving the relevance and rigor of the assessments.

REFERENCES

Grassini, S. (2023). Shaping the Future of Education: Exploring the Potential and Consequences of AI and ChatGPT in Educational Settings. Education Sciences.

Hunter, J. D., Carlson, J. S., & Singh, P. (2022). Advancing student engagement through AI-enhanced feedback mechanisms. Journal of Educational Technology, 18(2), 67-83.

Park et al. (2023). Integrating artificial intelligence into science lessons: teachers' experiences and views *International Journal of STEM Education. 10 (61).*

Thornhill-Miller, B., et. al (2023). Creativity, Critical Thinking, Communication, and Collaboration: Assessment, Certification, and Promotion of 21st Century Skills for the Future of Work and Education. Journal of Intelligence, 11.

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LiQMeT: An Interactive Educational Tool for Enhancing Student Understanding of Lighting Quality and Its Impact on Well-being.

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ABSTRACT

All structures were meticulously designed to meet the country's standards and fulfill tenant needs, necessitating adherence to minimal Malaysian Standard guidelines for the lighting system. The objective is to introduce an innovative teaching and learning approach, particularly for the Building Services Laboratory at Universiti Teknologi MARA Cawangan Pulau Pinang (UiTMCPP). It helps in learning process especially in laboratory activities where students need to manually analyze illumination levels to complete their laboratory reports. Therefore, LiQMeT was developed to facilitate students in conducting laboratory activity, especially for illumination experiment. Through the implementation of the LiQMeT system, students can efficiently collect and analyze illumination data, saving time and enabling prompt remedial action where necessary. This system simplifies data collection for laboratory tasks, allowing for direct input, swift analysis, and instant results. Consequently, areas meeting the criteria are identified, while those falling short prompt attention and remedial maintenance.

Keywords: Illumination, Laboratory Task, LiQMeT System, Innovative Teaching, Malaysian Standard Guidelines

INTRODUCTION

Illumination in a building is determined by two main sources: daylight and artificial light. Daylight is natural sunlight entering through windows during the day, while artificial light provides illumination at night when sunlight is absent. Various locations require different illumination levels, guided by standards such as Panduan Teknik JKR and Malaysian Standard 1525. Low illumination levels signal a need for maintenance, whereas high levels indicate that lighting meets the necessary standards and is in good condition. By evaluating illumination levels, the facilities department can upgrade the lighting system as required.

Previous research measured lighting levels using the LM-8100 equipment for physical measurement. Lux readings were taken at three specific locations, designated as L1, L2, and L3, as shown in Figure 1. Data collection occurred over 11 hours for 2 days at the year 3 architecture studio at UKM, which has a floor area of 182 square meters (Musa, et al., 2012). Additionally, a questionnaire survey was conducted with studio occupants to support the accuracy and effectiveness of the physical measurements. The study's findings indicate that lighting measurements at L1, L2, and L3 varied across the two days.

Besides that, Chua, et. al. (2016) conducted a study examining the influence of physical environmental comfort on the performance of office employees. The research involved field studies conducted in three office spaces utilized by government employees, each spanning approximately 200 to 300 square meters. These employees' tasks included writing, reading, computer work, and occasional movement to deliver documents between workstations. Furthermore, Juslén et al. (2007) conducted a field study within the food industry, where they implemented localized task lighting alongside the existing general lighting setup in a food factory. This indicates that the process of collecting and recording data is time-consuming to complete. Similarly, students face difficulties in gathering data on illumination levels at specific locations.

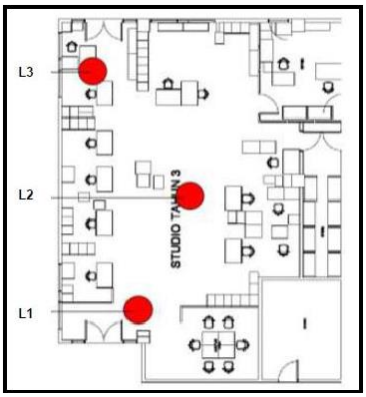

Fig. 1 Location of Data Collection as Labeled L1, L2 and L3

Thus, the LiQMeT system plays a crucial role in this process by assessing illumination levels and ensuring compliance with Malaysian standards. It offers an efficient and straightforward method for analyzing data, creating light zone contours that highlight areas with poor and adequate lighting. These contours identify critical areas needing prompt maintenance to ensure visual comfort. Additionally, the LiQMeT system reduces paper usage, saving time and costs in data collection. As a sustainable innovation, the LiQMeT system enhances

educational technology, providing long-term benefits for managing illumination levels effectively.

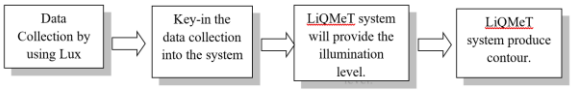

Fig 2. Research Workflow

In addition, questionnaires are also distributed to support the findings produced by LiQMeT. The purpose of the questionnaire is to obtain data in a practical manner, aiming to understand the real situations occurring in the study area. The questionnaires were distributed to the target groups, namely UiTM's students. Additionally, they will also be distributed to users, including staff and workers at the university. By gathering feedback from various parties, several suggestions can be proposed to enhance the effectiveness of the current lighting system.

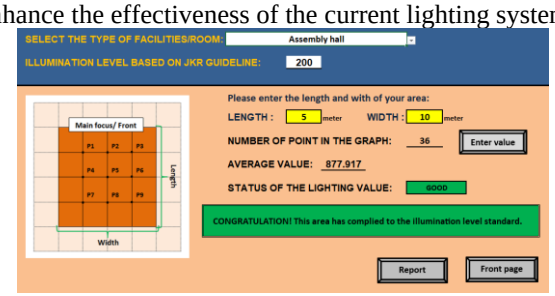

Fig 3. Data Input in LiQMeT

RESULTS AND DISCUSSION

According to the data collected from the questionnaire, the majority of students indicated a neutral condition for the classroom. This suggests that the classroom is generally in satisfactory condition.

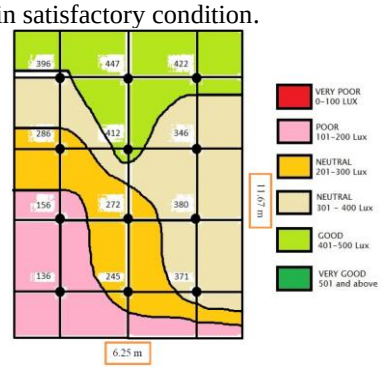

Fig. 4 The data generated by LiQMeT

The data obtained from both methods, namely data measurement and questionnaire, are consistent with each other, indicating that the neutral condition is predominant in the classroom. This suggests that the data obtained from both methods are accurate and aligned.It shows that the LiQMeT system offers an instant and user-friendly tool for analyzing data from scratch. It generates different color indicators to clearly delineate areas with poor and good lighting levels. Utilizing these indicators, critical areas are identified for prompt maintenance, ensuring visual comfort in specified areas.

Moreover, for laboratory purposes, it streamlines the evaluation of illumination by allowing direct data input into the LiQMeT system, which promptly displays illumination results for specific areas. Additionally, it promotes sustainability by reducing paper usage throughout the laboratory process, from data collection to analysis and report preparation. The need for printing final reports is minimized as the LiQMeT system provides report sheets for reporting purposes. This versatile system is suitable for industry as a quick and easy tool, as well as for teaching and learning purposes.

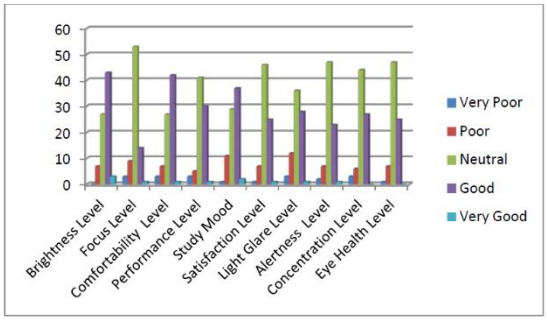

Fig. 5 The data from the questionnaires

CONCLUSION

In addition to assisting students in conducting laboratory activities, LiQMeT can also aid industries that require it to ensure that the illumination levels in their workplaces are maintained at optimal conditions. Based on physical appearance, LiQMeT system is practically useful to the maintenance department which makes them easier to know whether the illumination quality is poor or good. A part of that, LiQMeT system can be used for other department industries and also universities to monitor the illumination level at their workplace and can be apply for building services subject. It helps them to take early corrective action to make sure the works can be continued and lead to the cost saving due to maintenance and sustainable development.

REFERENCES

Chua, S. J. L., Ali, A. S., & Lim, M. E. L. (2016). Physical Environment Comfort Impacts on Office Employee's Performance. *MATEC Web of Conferences*, *66*, 00124.

Juslén, H. T., Verbossen, J., & Wouters, M. C. H. M. (2007). Appreciation of localised task lighting in shift work-A field study in the food industry. *International Journal of Industrial Ergonomics*, *37*(5),433–443.

Musa, A. R., Abdullah, N. A. G., Che-Ani, A. I., Tawil, N. M., & Tahir, M. M. (2012). Indoor Environmental Quality for UKM Architecture Studio: An Analysis on Lighting Performance. *Procedia - Social and Behavioral Sciences*, *60*(1994), 318–324. https://doi.org/10.1016/j.sbspro.2012.09.386

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Bridging the Coursework Assessment Gap: Introducing Simulation Marks (SimMarks) App for Lecturers

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ABSTRACT

Coursework is crucial in higher education, evaluating students' affective and psychomotor abilities. Typically, lecturers' subjective assessments can lead to inconsistent marks across groups. Using scoring rubrics is a solution, but discrepancies still exist between lecturers and coordinators due to some instructors not consulting domain criteria. The SimMarks App addresses this by enforcing the selection of domain criteria before scoring and identifying potential problems. Tests show the app is efficient, user-friendly, and meets quality goals, with over 90% command execution accuracy and positive usability ratings. The app's success is attributed to development following the ADDIE model. SimMarks aims to ensure reliable coursework assessment and may see widespread adoption in the future.

Keywords: Coursework assessment, Simulation of marks, Applications, Lecturers, Teaching and learning process.

INTRODUCTION

Coursework holds significant importance in higher education as it contributes to final grades alongside examinations. At the Centre for Civil Engineering Studies in UiTM, coursework assessment encompasses quizzes, reports, fieldwork, and projects, aiming to evaluate cognitive, affective, and psychomotor domains in alignment with outcome-based education principles. This pedagogical approach emphasizes crucial skills such as analysis, critical thinking, and problem-solving, which are indispensable in today's dynamic economy. However, the effectiveness of assessment hinges on adherence to scoring guidelines; deviations from these standards can lead to misrepresentation of students' abilities, adversely impacting both graduates and the reputation of educational institutions.

Outcome-based education (OBE) relies on scoring rubrics to ensure consistent and systematic assessment. These rubrics delineate clear criteria, aiding evaluators in assigning fair grades. Nonetheless, discrepancies often arise when there are variations in the interpretations of rubrics between lecturers and course coordinators, even when referring to the same set of criteria. Factors contributing to such disparities include lecturers' adherence to rubric guidelines and variations in their assessment proficiency. Studies indicate that these differences in grading can average around 4 points, occasionally escalating to 9 points, signifying significant inconsistency in assessment practices.

The proficiency of lecturers in assessment methodologies is paramount. In instances where lecturers lack a comprehensive understanding of learning outcomes and rubric criteria, the accuracy of grading is compromised. Moreover, the presence of multiple evaluators and ambiguities in rubric guidelines exacerbate the problem of inconsistent grading. Such discrepancies not only tarnish the reputation of educational institutions but also diminish graduates' employability, as their academic performance may not accurately reflect their true abilities.

To address these challenges, proactive measures must be implemented, encompassing considerations such as course load management, diversification of evaluation methods, enhancement of lecturer competence, and clarity in rubric guidelines. Ensuring accurate and consistent assessment practices is essential for aligning educational objectives with institutional goals and fostering the holistic development of students enhances for job prospects, maintaining the integrity and credibility of the educational system.

RESULTS AND DISCUSSION

The development of the SimMarks App aims to tackle the issue of grading inconsistencies among different instructors within a course. Unlike traditional mark-oriented approaches, the app adopts a domain-oriented assessment method. This involves selecting a specific domain for assessment and simulating marks based on the chosen domain. The primary goal is to minimize grading variations among instructors by promoting a fair and efficient assessment system that eliminates bias and emotional influence. In addition to addressing grading disparities, the SimMarks App serves as a comprehensive platform for instructors to share course-related information effortlessly. It also streamlines the

distribution of recorded grades to both individual students and entire class cohorts, enhancing administrative efficiency.

Moreover, the application aligns with the principles of Education Revolution 5.0, Industrial Revolution 4.0, and Sustainable Development Goal (SDG) #4, which focuses on achieving Quality Education. By embracing innovative technology and promoting fairness in assessment, the SimMarks App contributes to advancing educational practices in line with these global initiatives.

Table 1 Results of technical test-run in implementation phase

Functions	Number (no.)	Testing frequency (no.)	Testing result (no.)		Success rate (%)
			Success	Failure	
Button to navigate new screen	11	22	22	0	100.0
Button to open list picker and appear at textbox	17	34	32	2	94.1
Button to reset the textbox input	43	86	86	0	100.0
Button to simulate mark according to domain criteria	32	64	60	4	94.1
Button to calculate simulation mark	6	12	10	2	83.3
Button to open list of define terms	6	12	12	0	100.0
Button to open student profile	6	12	12	0	100.0
Button to save textbox input at list view	7	14	12	2	85.7
Button to reset text at list view	7	14	12	0	100.0
Button to send total simulation mark to student	6	12	12	0	100.0
Button to access storage	6	12	12	0	100.0
Button to select written coursework, sample or video from storage	6	12	12	0	100.0
Button to play video	2	4	4	0	100.0
Button to pause video	2	4	4	0	100.0
Button to stop video	2	4	4	0	100.0
Button to open time picker and appear at textbox	5	10	8	2	80.0
Button to open date picker and appear at textbox	5	10	10	0	100.0
Average (%)					**96.3**

Table 2 Results of target group acceptance test-run evaluation phase

Target group feedback	Score	Classification
Performance effectiveness	4.6	Very good
Graphic user interface design of application (user-friendly)	4.2	Good
Understanding concept of application	4.8	Very good
Simulation mark according to domain criteria	4.4	Good
Achieve the objective	4.6	Very good
Suitable as a supporting tool for teaching and learning process	4.8	Very good
Average	**4.6**	**Very good**

Table 3 Results of objective achievement test-run in evaluation phase

Coursework	Maximum mark	Difference assessment mark between lecturer and course coordinator						
		0	1	2	3	4	5	Average
Practical test	40	1	0	4	0	0	0	1.6
Laboratory activities observation	20	0	1	1	1	2	0	2.8
Assignment	10	4	1	0	0	0	0	0.2
Laboratory report (Level 0)	10	5	0	0	0	0	0	0.0
Laboratory report (Level 1)	10	3	2	0	0	0	0	0.4
Laboratory report (Level 2)	10	0	2	2	1	0	0	1.8
Average								**1.1**

CONCLUSION

At the pinnacle of professional competence lies the necessity for lecturers to exhibit an elevated level of expertise in orchestrating the teaching and learning journey. Among the myriad skills demanding mastery stands the pivotal task of evaluating student coursework. The ramifications of inadequate and inconsistent evaluations reverberate across learners, lecturers, and the institutional fabric itself. This challenge assumes heightened significance within academic programs characterized by a profusion of courses where coursework assessment carries substantial weightage, compounded by the involvement of multiple instructors overseeing diverse student cohorts.

Therefore, the central to this complexity is the inherently subjective nature of coursework evaluation, particularly in assessing the psychomotor domain. Consequently, there arises an urgent imperative to institute a robust mechanism capable of ameliorating significant disparities in grading assessments among lecturers. The advent of the SimMarks App holds promises in redressing this issue. Foreseen as a beacon of transformative change, this application is poised to permeate the fabric of UiTM campuses and potentially extend its reach to encompass tertiary educational institutions nationwide in the foreseeable future.

REFERENCES

Ahmad, E., Razali, H., Jamaludin, H. dan Mohd Yusop, H. (2012). Peranan UTHM dalam Melahirkan Pendidik Berketrampilan. Cabaran Pendidikan Teknik dan Vokasional (PTV) di Malaysia, 1.

Aravind C. V., Rajparthiban and Gibert Thio (2008). Industrial Placements Through Internet Based Cooperative System. Proceedings of Fourth International Conference on University Learning and Teaching, pp. 72-83.

Farrah, M. (2011). Online Communication and Enhancing Language Skills, Motivation and Cultural Understanding. AUC TESOL Journal, 2, 128–140.

Jonathan, V. M. (2017). Implementing Outcome-Based Education (OBE) Framework: Implications for Assessment of Student' Performance. Educational Measurement and Evaluation Review, 8(1), 1–10.

Cantas Gagal as a Method for an Intervention Programme to Support Students on the Civil Engineering Course

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ABSTRACT

The complexity of the Civil Engineering program often presents challenges and potential failure for some students, necessitating the implementation of intervention programs. These programs offer targeted support and personalized instruction to help students overcome academic obstacles and improve their performance. Beyond addressing academic difficulties, intervention programs also tackle underlying issues such as learning difficulties, attention problems, and personal circumstances. Various intervention strategies are employed in engineering programs, one of which is Cantas Gagal. This study implemented Cantas Gagal in a hydraulic engineering course to investigate its impact on student performance. A survey was conducted among 25 students who participated in the program, assessing their understanding of the intervention, the hydraulic engineering course, and their overall perception. The results indicated high awareness and willingness to participate in the Cantas Gagal program. Additionally, the survey revealed students' perceived difficulty levels of course topics and subtopics, providing valuable insights for lecturers to enhance their teaching methods. Overall, intervention programs are crucial in supporting students' academic journeys and enabling them to reach their full potential in the Civil Engineering program.

Keywords: Cantas gagal, Civil Engineering, Intervention programme.

INTRODUCTION

Civil engineering schools worldwide are responsible for producing highly educated and competent graduate engineers. Achieving this goal requires satisfactory academic performance and success. To ensure students perform well, civil engineering lecturers must make significant efforts to ensure that students can apply the knowledge they are taught. Jeffreys (2012) emphasized, in the context of nursing education, that without extra efforts from educators and nursing schools, students' academic performance may be inadequate, potentially leading to higher attrition rates. Similarly, Yusof et al. (2015) highlighted the importance of improving student performance in Technical and Vocational Education and Training (TVET) by demonstrating that a well-educated individual must possess the right attitude towards work and the competence to perform specific tasks in the workplace.

Although the program includes many subjects, an intervention development program is essential to enhance the quality of student performance, especially for repeaters. Intervention programs serve as a lifeline for students facing academic challenges by providing the targeted support often missing in regular classrooms. Through one-on-one tutoring or small group instruction, students have the opportunity to focus on their areas of difficulty. This personalized approach helps them understand concepts better and close knowledge gaps that may be hindering their progress.

Intervention programs also address more than just academic issues. They can tackle underlying barriers such as learning difficulties, attention issues, or personal circumstances outside of school. This comprehensive support may include social-emotional assistance, study skills development, or even the identification of learning disabilities. Ultimately, intervention programs enable students to overcome these challenges, build self-confidence through their achievements, and develop a strong academic foundation necessary to reach their full potential. Another approach, referred to as Cantas Gagal (Md Nor, 2021), involves teaching within small cohorts of students led by either the instructor or high-performing peers. This comprehensive strategy aims to give struggling engineering students the support they need to excel.

Given the various options for intervention programs, this study implemented Cantas Gagal in the selected course of Hydraulic Engineering. The primary objective was to investigate the performance of students in the Hydraulic Engineering course when participating in Cantas Gagal. To achieve this, a survey was conducted among 25 students who had participated in and failed this course.

RESULTS AND DISCUSSION

The primary aim of this study is to gauge the extent to which students believe in the effectiveness of this intervention. Fig. 1 illustrates the varying assessments of students on how well the intervention program helped them understand hydraulic engineering concepts. The highest percentage, 56%, indicates that a clear majority found the program very helpful. This suggests the program was successful for a significant number of participants. A moderate proportion, 36%, felt the program was somewhat helpful in enhancing their understanding of the concepts. The smallest percentage, 8%, reflects a minority who felt the program minimally improved their understanding. Overall, the results are positive: a clear majority (56%) found the intervention program very helpful, 36% found it moderately helpful, and only 8% felt it had minimal impact. Notably, no student reported that the program was not helpful at all.

Students were asked to rate their comfort level in seeking help or clarification during the intervention sessions on a scale of 1 to 5. Fig. 2 illustrates students' comfort levels during Cantas Gagal sessions. A high percentage of students rating "very comfortable" at scale 5 (36%) signifies a successful program where students feel well-supported. An "enjoyable" rating at scale 4, with a higher percentage of 44%, also indicates a successful program, as students feel the intervention is enhancing their studies. Only 20% of students selected scale 3, indicating a moderate level of comfort participating in the program. The distribution across the scales provides valuable insights into fostering a supportive learning environment.

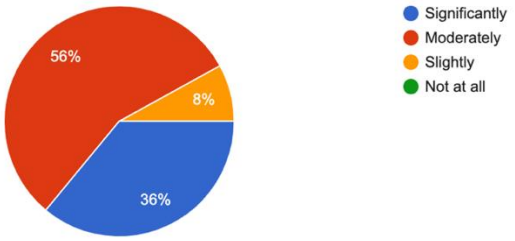

Fig. 1 To what extent do you believe the intervention program has helped you in understanding Hydraulic Engineering concepts?

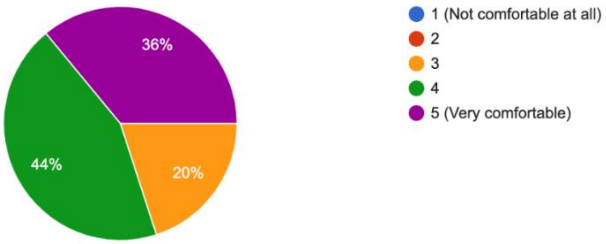

Fig. 2 How comfortable are you seeking help or clarification during the intervention sessions?

CONCLUSION

The intervention programme for hydraulic engineering students provided valuable insights into their attitudes and level of understanding. It was found that almost half of the students had a positive attitude towards the Cantas Gagal programme. However, subtopics such as uniform and non-uniform flow were challenging for some students, emphasising the need for targeted instructional support to reinforce these fundamental concepts. The Cantas Gagal programme promotes a student-centred approach by actively engaging students and encouraging reflection, which greatly enhances the overall learning experience in hydraulic engineering. The outcomes of the Cantas Gagal programme are critical for stakeholders to evaluate its effectiveness in supporting at-risk students. By thoroughly analysing the impact on student retention and academic performance, future interventions and allocation of resources can be better directed to provide targeted support to at-risk students.

REFERENCES

Jeffreys, M. R. (2012). Nursing student retention: Understanding the process and making a difference. Springer Publishing Company.

Md Nor, N. (2021) Program Cantas Gagal, Buletin FKA, 11.

Yusof, Y., Roddin, R., & Awang, H. (2015) What Students Need, and What Teacher Did: The Impact of Teacher's Teaching Approaches to the Development of Students' Generic Competences, Procedia - Social and Behavioral Sciences, 204, 36-44.

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Mixed-Methods Investigation of Problem-Solving in UiTM Design and Technology Students

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ABSTRACT

This comprehensive study investigates the interplay between thinking styles, inventive problem-solving (IPS) training, and problem-solving skills within the context of an integrated design project (IDP) course for design and technology students at Universiti Teknologi MARA (UiTM). A mixed-methods approach was employed, encompassing quantitative pre-test and post-test assessments of problem-solving skills, qualitative analysis of student reflections and instructor observations, and statistical analyses to determine the impact of individual cognitive preferences (thinking styles) and structured problem-solving techniques (IPS) on students' problem-solving abilities in a design context. Results reveal that adaptive thinking styles and IPS training significantly enhance students' problem-solving skills. This study contributes valuable insights to the field of design education in Malaysia. It offers practical implications for educators at UiTM and other institutions seeking to optimise problem-solving instruction within their curricula.

Keywords: Problem-solving skills, Thinking styles, Inventive problem-solving (IPS), Theory of Inventive Problem Solving (TRIZ), Quantitative assessment

INTRODUCTION

Problem-solving skills are indispensable for success in the design and technology fields, as professionals navigate complex, real-world challenges that often lack clear-cut solutions. Integrated design projects (IDPs) offer students authentic learning experiences that simulate these challenges, demanding creativity, critical thinking, and collaboration (Dym et al., 2005). At UiTM, IDPs are a cornerstone of design and technology education, providing students with opportunities to apply theoretical knowledge to practical design challenges. However, individual differences in cognitive approaches can significantly influence students' problem-solving performance.

This study explores the interplay between thinking styles, inventive problem-solving (IPS) training, and problem-solving skills in the context of an IDP course at UiTM. Thinking styles, as defined by Sternberg (1997), represent the habitual ways individuals prefer to utilize their intellectual faculties. The triarchic theory of intelligence distinguishes between legislative (creative), executive (practical), and judicial (analytical) thinking styles. Research suggests that certain thinking styles may be more conducive to problem-solving in design contexts (Puccio, 2006; Zhang, 2002).

IPS, rooted in the Theory of Inventive Problem Solving (TRIZ) developed by Altshuller (1999), provides individuals with a systematic toolkit for tackling complex problems. TRIZ postulates that inventive solutions often involve overcoming contradictions and identifying underlying patterns. IPS training has been shown to improve problem-solving skills in various fields (Casakin & Goldfire, 2006; Marsh et al., 2002).

RESULTS AND DISCUSSION

Table 1 presents the means and standard deviations of each group's pre- and post-test PSSA scores. The IPTG showed the largest increase in mean PSSA score from pre-test to post-test, followed by the TSG and CG. Table 4 clearly shows the mean and standard deviation for each group at both testing times, as well as the calculated improvement. The highest improvement is clearly seen in the IPTG group.

The mixed ANOVA revealed a significant main effect of time ($F(1, 117) = 28.31$, $p < .001$, $\eta^2 = .195$), indicating that overall, students' problem-solving skills improved from pre-test to post-test. The interaction between time and group ($F(2, 117) = 5.43$, $p = .005$, $\eta^2 = .085$) was also significant, suggesting that the rate of improvement differed across the three groups. Post-hoc tests confirmed

that both intervention groups (TSG and IPTG) showed significantly greater improvement in PSSA scores compared to the control group.

An analysis of the relationship between thinking styles and PSSA scores revealed that students with a legislative thinking style generally scored higher on the PSSA, both on pre-test and post-test. However, the group moderated this relationship, with the IPTG showing the strongest association between legislative thinking style and problem-solving performance.

Table1. Descriptive Statistics of Pre- and Post-Test PSSA Scores by Group

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	Improvement
Control Group (CG)	62.5 (10.3)	66.8 (9.8)	4.3
Thinking Styles Group (TSG)	63.2 (11.1)	72.4 (10.5)	9.2
IPS Training Group (IPTG)	61.9 (10.8)	78.3 (9.2)	16.4

The findings of this study have significant implications for design and technology education at UiTM and other institutions in Malaysia. The results demonstrate that both thinking styles instruction and IPS training can significantly enhance problem-solving skills among design and technology students. The study also highlights the importance of tailoring instruction to individual differences in cognitive preferences, as evidenced by the interaction effect between thinking style and group.

The implications for curriculum development and instructional design are evident. Design and technology programs at UiTM should consider incorporating explicit instruction on thinking styles and IPS training to enhance students' problem-solving capabilities. This could be achieved through workshops, seminars, or dedicated modules within existing courses. Faculty development programs could also be implemented to equip instructors with the knowledge and skills to facilitate these interventions effectively.

Furthermore, the study's findings have broader implications for the Malaysian education system as a whole. The Ministry of Higher Education has identified problem-solving as a key graduate attribute essential for success in the 21st-century workforce (Ministry of Higher Education, 2013). By integrating thinking styles and IPS training into design and technology curricula, universities can better prepare students for the challenges and opportunities of the modern workplace.

CONCLUSION

This comprehensive study provides compelling evidence for the effectiveness of integrating thinking styles and IPS training into an IDP course at UiTM to enhance students' problem-solving skills. The findings underscore the importance of recognising and leveraging individual differences in cognitive approaches while providing students with structured problem-solving tools and techniques. The mixed-methods approach employed in this study allowed for a deeper understanding of the complex interplay between thinking styles, IPS training, and problem-solving skills. The quantitative data revealed significant improvements in problem-solving performance for students in both intervention groups, particularly those with a legislative thinking style who received IPS training. The qualitative data provided rich insights into the mechanisms through which these interventions enhanced students' problem-solving skills, including developing a more comprehensive range of strategies, increased confidence and self-efficacy, and improved collaboration and communication. By incorporating the findings of this study into curriculum development and instructional design, educators at UiTM and other institutions can empower students to become more effective problem solvers, better collaborators, and, ultimately, more successful professionals in their chosen fields.

REFERENCES

Altshuller, G. S. (1999). *The innovation algorithm: TRIZ, systematic innovation, and technical creativity.* Technical Innovation Center, Inc.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* W.H. Freeman.

Basadur, M. (1995). Optimal ideation-evaluation ratios. *Creativity Research Journal*, *8*(1), 63-75.

Beaty, L. A. (2008). *Successful project management for dummies*. John Wiley & Sons.

Brown, T. (2009). *Change by design: How design thinking transforms organisations and inspires innovation*. Harper Business.

Casakin, H., & Goldfire, S. (2006). *TRIZ for engineers: Enabling inventive problem solving*. John Wiley & Sons.

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A Comprehensive Study of Software Preferences Among UiTM Civil Engineering Students and Implications for BIM Education

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ABSTRACT

This study investigates the software preferences of civil engineering students at Universiti Teknologi MARA (UiTM) in Malaysia, focusing on the adoption of Building Information Modelling (BIM) and traditional Computer-Aided Design (CAD) software. It specifically examines student preferences for the top 10 BIM software for civil engineers, explores factors influencing their choices, identifies perceived benefits and barriers to BIM adoption, and offers curriculum development recommendations to bridge the gap between theoretical knowledge and practical BIM application. A mixed-methods approach, including surveys, semi-structured interviews, and focus group discussions, gathered data from a large student sample. Results indicate a predominant preference for CAD software, especially AutoCAD, due to familiarity, ease of use, and prior exposure. However, students recognise BIM's potential benefits, such as improved collaboration, enhanced visualisation, and reduced errors. Key barriers to BIM adoption include limited software access, inadequate training, and concerns about industry readiness. The study emphasises the need for educational institutions to integrate BIM comprehensively into the curriculum, provide hands-on training with industry-standard software, and foster industry collaboration to prepare future civil engineers for the construction industry's digital transformation.

Keywords: Building Information Modeling (BIM), Computer-Aided Design (CAD), Civil Engineering Education, Software Preferences, Mixed-Methods Research

INTRODUCTION

The construction industry is undergoing a transformative shift towards digitalization, with Building Information Modeling (BIM) emerging as a central pillar of this evolution. BIM is a collaborative process that utilizes a digital representation of the physical and functional characteristics of a facility to facilitate design, construction, and operation processes (Eastman et al., 2011). This digital representation, known as a building information model, enables stakeholders to explore a project's physical and functional characteristics virtually, improving collaboration, enhancing efficiency, and minimizing errors (Azhar et al., 2012). However, realizing the full potential of BIM hinges on the preparedness of future construction professionals to adopt and effectively utilize this technology. Civil engineering students, the future workforce of the industry, play a pivotal role in driving BIM adoption. Their software preferences, attitudes, and perceptions towards BIM have significant implications for successfully integrating BIM into the construction industry. Understanding these factors is crucial for educational institutions to develop curricula and training programs that equip students with the necessary skills and knowledge to navigate the digital age of construction.

In the context of Malaysia, the government has been actively promoting the adoption of BIM through the Construction Industry Transformation Programme (CITP) (CIDB, 2017). The CITP aims to transform the Malaysian construction industry into a world-class, productive, sustainable, and resilient industry. One of the key strategies of the CITP is to promote the adoption of digital technologies, including BIM, in the construction industry. However, the successful implementation of BIM in Malaysia requires a skilled workforce that is proficient in using BIM software. This underscores the importance of understanding the software preferences of civil engineering students and the implications for BIM education in Malaysia.

This comprehensive study examines the software preferences of Universiti Teknologi MARA (UiTM) civil engineering students, focusing on the top 10 BIM software and traditional CAD software. The research aims to identify preferred software, understand factors influencing choices, analyze perceived benefits and barriers to BIM adoption, and propose recommendations

for enhancing BIM education in Malaysia's unique context. This research contributes to the growing body of knowledge on BIM adoption in academia, particularly in developing countries, and provides insights for stakeholders aiming to cultivate a BIM-ready workforce for the industry's digital transformation.

RESULTS AND DISCUSSION

The study's findings reveal a predominant preference for CAD software (78%) over BIM software (22%) among UiTM civil engineering students. Among CAD software, AutoCAD was the most preferred (92%), while Autodesk Revit was the most preferred BIM software (55%). Multiple linear regression analysis identified several factors influencing students' software choices. The strongest predictors of BIM software preference were curriculum integration and industry demand, while familiarity with CAD emerged as a negative predictor. Students perceived several benefits of BIM, including improved collaboration, enhanced visualization, and reduced errors. However, limited access to software and inadequate training were identified as major barriers to BIM adoption. Qualitative findings further revealed a desire for more comprehensive, hands-on, and industry-relevant BIM education.

These findings align with the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB), confirming the influence of perceived ease of use, usefulness, social norms, and perceived behavioural control on software preferences and adoption intentions (Davis, 1989; Ajzen, 1991). The study also highlights the importance of addressing the specific context of BIM education in Malaysia, where limited resources and expertise may pose additional challenges to BIM adoption. Students perceived several benefits of BIM, including improved collaboration (80%), enhanced visualization (75%), reduced errors (70%), increased efficiency (65%), and better cost estimation (60%) (Fig.1). However, several barriers to BIM adoption were also identified, with limited access to software (70%) and inadequate training (65%) being the most significant. Other barriers included the steep learning curve (55%) and concerns about industry resistance (45%) (Fig. 2).

CONCLUSION

This comprehensive study provides valuable insights into the software preferences of UiTM civil engineering students and the factors influencing their choices. While CAD software remains the dominant choice due to its familiarity and ease of use, there is a growing recognition of the potential benefits of BIM. By addressing the perceived barriers and implementing the recommendations outlined in this study, educational institutions can empower students to embrace BIM and contribute to the construction industry's digital transformation. Furthermore, this study underscores the importance of aligning BIM education with industry demands and practices. By fostering collaboration between academia and industry, we can ensure that future civil engineers are equipped with the necessary skills and knowledge to thrive in the rapidly evolving digital landscape of the construction industry.

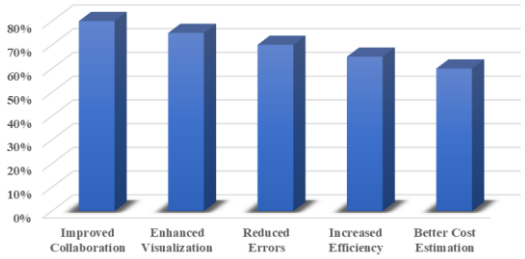

Fig. 1 Perceived Benefits of BIM

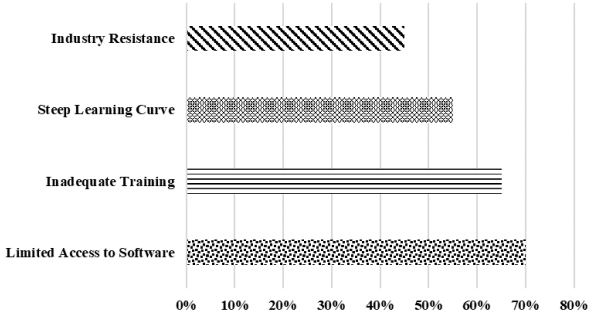

Fig. 2 Perceived Barriers to BIM Adoption

REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.

Azhar, S., Nadeem, A., Mok, J., & Leung, B. (2012). Building information modeling (BIM): A new paradigm for visual interactive modeling and simulation for construction projects. *First International Conference on Construction in Developing Countries (ICCIDC-I)* (pp. 23-33).

CIDB. (2017). *Construction Industry Transformation Programme*. Construction Industry Development Board Malaysia.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340.

Eastman, C., Teicholz, P., Sacks, R., & Liston, K. (2011). *BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors (2nd ed.)*. John Wiley & Sons.

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Differential Equation Learning Engagement Experience Among the Civil Engineering Students

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ABSTRACT

This paper presents an innovative teaching experience in a civil engineering course focused on solving a special differential equation of spring-mass systems. Our methodology integrates the use of the Computer Algebra System, MAXIMA, emphasizing hands-on learning for solving ordinary differential equation applications. To enhance the educational experience, we developed MAXIMA programs that allow students to intuitively explore the spring-mass system with minimal programming effort. Our results demonstrate that this approach significantly improves student motivation compared to traditional teaching methods. These findings provide valuable insights into the development of new pedagogical strategies for engineering students studying spring-mass systems using Computer Algebra Systems.

Keywords: Spring-mass system, Computer Algebra System, MAXIMA, Differential Equation.

INTRODUCTION

The objective of this research is to investigate student engagement in learning second-order differential equations using Maxima, a computer algebra system (CAS), and to enhance the foundational comprehension of mass-spring system problem-solving among third-year students enrolled in the Computational Analysis for Engineers (CES513) course. This study involved a small sample size of seven students, selected from both high-performing and low-performing groups. In civil engineering applications, such as solving free vibration and forced vibration problems in mass-spring systems, students must apply their foundational knowledge of differential equations (DE) acquired in previous mathematics courses. These skills are crucial for solving specific vibration problems.

Mullis et al. (2019) emphasized the importance of individual competence in modeling and solving DEs, highlighting its role in developing essential mathematical skills. However, some authors had reported that students often struggle with selecting appropriate methods for solving DEs and evaluating integrals during the solution process. Furthermore, Arslan (2010) observed that solutions to DEs can be obtained without a deep understanding and conceptualization of the underlying principles, a shortcoming that may not meet the requirements of civil engineering students.

Raj (2021) found that students exhibit increased interest and enjoyment in solving DEs when they can visualize the solutions and understand their engineering implications. Visual stimuli help students grasp the form of the solution and alleviate their apprehension towards mathematical language, leading to enhanced understanding, heightened interest, and increased motivation. Visualization is crucial for comprehending the dynamic aspects of the DE governing a mass-spring system, facilitating the interpretation of derivatives as slopes of mass-spring configurations and aiding in the analysis of graphs to identify equilibrium states.

The utilization of CAS, such as Maxima, provides a means to visualize the solutions of mass-spring system DEs through digital technology. This approach offers significant advantages, making the study of differential equations more meaningful. Boras (2021) highlighted the benefits of CAS software, particularly its availability on Android devices and offline usability, which enhances accessibility for learners. Researchers had confirmed the significant improvement in students' understanding of multivariate calculus through the use of Maple software. However, the choice of suitable CAS software depends on institutional budget constraints and the instructor's expertise.

To the best of the author's knowledge, this innovative teaching approach has not yet been adopted in the civil engineering curriculum of any universities in Malaysia, where students typically learn mass-spring system concepts through lectures, tutorials, and laboratory sessions. Therefore, this research aims to explore the use of Maxima as an open-source tool for teaching the fundamental concepts of mass-spring system solutions and their engineering applications to civil engineering students at the university level.

RESULTS AND DISCUSSION

The 16 students were divided equally into two groups, Group A and Group B. Group A consisted of students who had previously performed poorly in their Differential Equations course, while Group B was made up of students who had excelled in the same subject. In the initial stage (Stage 1) of this study, it was observed that Group A demonstrated a weaker fundamental understanding of integral calculus and differential equations (DE) compared to Group B, as shown in Table 1, based on a total of 16 students. These students from Group A struggled to recall previously learned concepts in integration and differentiation than Group B. Additionally, it was noted that these seven low-performing participants attempted to solve the given DE step-by-step but lacked the necessary conceptual understanding of the procedural approach.

Table 1: Percentage of students able to perform at Stage 1

Group	Percentage of student
A	12.5
B	87.5

However, by the third stage of the study, a 100 percent improvement was observed in Group A and Group B by the approach of these participants due to their learning experience with MAXIMA as shown in Table 2.

Table 2: Percentage of students able to perform at Stage 3 (Maxima)

Group	Percentage of student
A	100
B	100

According to their interview responses, most participants found MAXIMA to be a helpful tool, particularly given the time-consuming nature of DE solutions. They reported that using MAXIMA significantly reduced the computational effort and enhanced their understanding of key principles related to DE solutions. Nevertheless, it is crucial for instructors to address any misconceptions regarding DE concepts. Additionally, the provision of graphical representations of DE solutions reinforced the participants' ability to visualize and enhance their learning experience. These findings emphasize the need for special attention, dedicated efforts, and tailored learning strategies to effectively address DE problems, particularly for poorly performing civil engineering students.

CONCLUSION

The ability to solve differential equations (DE) and interpret their solutions is crucial for civil engineering students addressing mass-spring system problems. This study explored the application of MAXIMA software to enhance students' understanding of structural mechanics concepts, particularly regarding mass-spring systems. Despite the limited number of participants and their minimal programming skills, the use of MAXIMA significantly reduced the computational effort required to solve DE problems, including both equations and graphical representations. Notably, in the fourth phase of the study, participants demonstrated enthusiasm and high expectations for using this software tool, actively engaging in solving mass-spring system problems with various parameter settings. Plans are underway to further integrate and leverage this CAS software in future academic years.

REFERENCES

Mullis, I.V.S., Martin, M.O., Foy, P., Kelly, D.L. and Fishbein, B. (2019). TIMS International Results in Mathematics and Science, TIMSS and PIRLS International Study Center,

Arslan, S. (2010). Do students really understand what an ordinary differential equation is?. Int.J. Math. Educ. Sci. Technol. 41(7), 873–888.

Raj, L. L. (2021). Using the computer algebra system DERIVE to investigate solutions of differential equations. 53–58.

Boras, K.S. (2021). An Effective Use of Maxima in Teaching and Learning Mathematics: An Overview. Int. Journal of Science and Research, 10(8), 876-879.

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A Data-Driven Approach on Continual Quality Improvement for Programme Educational Objectives in a Public University

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ABSTRACT

In engineering education, ensuring that graduates meet well-defined Programme Educational Objectives (PEOs) is essential for their career success and professional development. This paper presents a data-driven approach to assessing and improving PEOs in the Civil Engineering program at a public university. The study focuses on three PEOs: career advancement, professional involvement, and lifelong learning. Data was collected from graduates of the 2018, 2019, and 2020 cohorts, assessing their achievements in five years post-graduation. Results indicate that PEO1 (career advancement) was attained by 71% of 2018 graduates, 75% of 2019 graduates, and 61% of 2020 graduates, all surpassing the 50% target. PEO2 (professional involvement) saw participation rates of 58%, 50%, and 41%, significantly exceeding the 20% target. PEO3 (lifelong learning) was achieved by 28% of 2018 graduates, 31% of 2019 graduates, and 26% of 2020 graduates, all above the 20% target. To address the decline in attainment rates, several Continual Quality Improvement (CQI) actions are proposed, including enhancing career services and promoting postgraduate opportunities. One limitation is the reliance on self-reported data from alumni, which may introduce response bias. Future research should incorporate objective measures and comparisons with other engineering programs.

Keywords: Engineering Graduates, Continual Quality Improvement, Programme Educational Objectives

INTRODUCTION

In today's rapidly evolving engineering landscape, educational programmes must continuously adapt to prepare graduates for the challenges and opportunities they will encounter in their professional careers. Programme Educational Objectives (PEOs) play a critical role in this process by outlining the expected achievements of graduates in terms of career advancement, professional involvement, and lifelong learning. These objectives not only guide curriculum development but also serve as benchmarks for evaluating the success of educational programs.

Despite the structured implementation of PEOs in engineering programmes, there is a need to assess their effectiveness and ensure they remain aligned with industry demands and educational standards. Research has shown that the selection and updating of PEOs must reflect industry demands and accreditation standards, and this process should involve dynamic feedback from stakeholders to ensure the alignment with market expectations (Rahman et. al., 2016). Additionally, a systematic approach to PEO assessment, integrating stakeholder input and employing continuous quality improvement strategies, is crucial for maintaining the relevance and effectiveness of engineering education programs (Tshai et al., 2014). Specific studies on PEO attainment have revealed that while the overall performance is satisfactory, there are often areas needing improvement, which can be identified through structured assessments and alumni feedback (Rahimullah et al., 2020). The primary objectives of this paper are (1) to evaluate the attainment of the programme educational objectives in terms of the achievements among Civil Engineering graduates and (2) to identify areas where the current strategies for achieving PEOs may be falling short, based on data-driven analysis. By addressing these objectives, this paper aims to contribute to the ongoing improvement of engineering education, ensuring that graduates are well-prepared for successful careers, active professional involvement, and lifelong learning.

RESULTS AND DISCUSSION

This study adopts a qualitative method based on a document review of the Programme Educational Objectives (PEOs) report for the Civil Engineering program at a public university. This approach involves (1) document review on the PEOs assessment report for the Civil Engineering program, which includes detailed data on graduate outcomes from the 2018, 2019, and 2020 cohorts. Additional documents such as curriculum outlines, accreditation reports, and feedback from industry stakeholders were also collected to provide context and support the analysis. Next is data extraction from the collected documents, focusing on the attainment of the three PEOs.

Fig. 1 shows the attainment of Programme Educational Objectives (PEOs) for Civil Engineering graduates from 2018 to 2020.

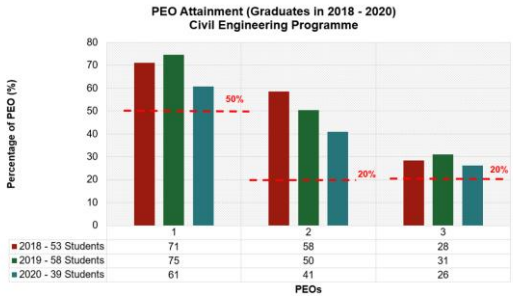

Fig. 1 PEO performance

For PEO1: Career Advancement with a target of 50% value. The data indicates that a significant majority of graduates from each cohort (2018-2020) have met the career advancement PEO. All cohorts exceeded the target of 50%, with 2019 graduates achieving the highest attainment at 75%. This suggests strong career progression among the graduates. For PEO2: Professional Involvement having a target of 20%. The attainment for professional involvement is also well above the target of 20% for all cohorts. The highest involvement was seen in the 2018 cohort at 58%, with a slight decrease over the years. Even the lowest attainment in 2020 at 41% is still significantly higher than the target, indicating active engagement in professional bodies or societies. Finally, for PEO3: Lifelong Learning having a target of 20% value. Lifelong learning attainment for all cohorts exceeds the 20% target. The 2019 cohort has the highest attainment at 31%, showing a positive trend in pursuing further education and development activities.

The consistent attainment across all years demonstrates a commitment to continual learning among the graduates. Overall, the assessment data shows that all three PEOs are being met and exceeded across the cohorts. This reflects positively on the program's ability to prepare graduates for career advancement, professional involvement, and lifelong learning. While there is a slight decrease in attainment percentages for each PEO from 2018 to 2020, the values remain above the targets, indicating sustained effectiveness of the educational objectives.

Continual Quality Improvement Strategies

First, to improve PEO1: Career Advancement, the action plans include enhancing career services through robust career counseling and placement services, establishing alumni-mentoring programs to guide new graduates, forming partnerships with industries for internships, projects, and job placements, and offering workshops and training programs focused on leadership skills. Second, to enhance PEO2: Professional Involvement, the action plans include hosting professional development seminars and workshops with professional bodies, providing subsidies or reimbursements for professional memberships, organizing networking events with industry professionals and alumni, and running campaigns to raise awareness about the benefits of professional involvement. Finally, to enhance PEO3: Lifelong Learning, the action plans include providing detailed information about available postgraduate programs and scholarships, developing and offering short courses and certifications on emerging topics, supporting graduates in obtaining professional certifications, and creating alumni development programs that encourage returning for further studies or professional development.

CONCLUSION

The assessment of Programme Educational Objectives (PEOs) for the Civil Engineering program at a public university indicates that the program successfully meets its goals in career advancement, professional involvement, and lifelong learning. Graduates from the 2018, 2019, and 2020 cohorts consistently exceeded the established targets, demonstrating a strong and effective curriculum. However, a slight decline in attainment rates over the years highlights the need for continual quality improvement (CQI). Proposed CQI measures include enhanced career services, mentorship programs, industry partnerships, leadership workshops, professional development seminars, membership subsidies, networking events, and awareness campaigns. Additionally, promoting postgraduate opportunities, offering continuing education courses, supporting professional certifications, and creating alumni development programs will further encourage lifelong learning. The study's focus on three cohorts provides a snapshot of PEO attainment, but a longer assessment period could offer deeper insights into long-term trends. The reliance on alumni surveys may introduce response bias or inaccuracies. Future research should conduct longitudinal studies to track graduates over extended periods, identifying long-term trends and the impact of CQI measures on PEO attainment.

REFERENCES

Rahman, J. A., Ab Rahman, M. S., & Yusoff, A. (2016). A case study of programme educational objectives (PEOs) assessment requirements for the electrical and electronic engineering programme in Malaysian public universities. Pertanika Journal of Social Science and Humanities, 24, 251-268.

Tshai, K., Ho, J., Yap, E., & Ng, H. K. (2014). Outcome-based Education – The Assessment of Programme Educational Objectives for an Engineering Undergraduate Degree. Engineering Education, 9, 74-85.

Rahimullah, B. N. S., Mansor, W., Latip, M., Mohamad, H., & Abdullah, S. (2020). Analysis of Graduates Performance Based on Programme Educational Objective Assessment for an Electrical Engineering Degree.

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Academic Performance in Hydraulics Course and The Alignment of Course Assessments with Specified Course Outcomes (COs) And Program Outcomes (POs)

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ABSTRACT

This study examines the relationship between student performance in a hydraulics course and the alignment of course assessments with specified Course Outcomes (COs) and Program Outcomes (POs). Data from undergraduate engineering students from the previous semester was analyzed, focusing on tests, assignments, and final exams. Results reveal that for CO1:PO1, test scores were highest at 88.8%, followed by assignments at 71.2% and final exams at 29.2%. For CO2:PO2, assignments scored the highest at 95.4%, with tests at 69.9% and final exams at 53.9%. The combined COPO analysis indicates moderate overall alignment, with CO1 and CO2 achieving total performance scores of 51.5% and 61.3%, respectively. These findings suggest that while there is reasonable alignment between course assessments and specified outcomes, there is potential for optimizing assessment strategies to better meet educational objectives. This research underscores the importance of strategically designing assessments that align closely with COs and POs, offering valuable insights for improving pedagogical practices in engineering education.

Keywords: Hydraulics Course, Course Outcomes, Program Outcomes, Academic Performance, Assessment Strategies

INTRODUCTION

The primary objective of this study is to analyze the correlation between the alignment of course assessments with Course Outcomes (COs) and Program Outcomes (POs) and the academic performance of students in a hydraulics course. By examining data from undergraduate engineering students' previous semesters, the study aims to provide insights into how assessment strategies can be optimized to enhance educational outcomes in engineering education.

Despite the critical role of alignment in educational efficacy, there is limited empirical research specifically examining how this alignment influences student performance in specialized engineering courses like hydraulics. The challenge lies in balancing theoretical knowledge with practical application, which is essential for preparing students for professional practice. This study addresses this gap by investigating the impact of COPO alignment on student success, focusing on various types of assessments, including tests, assignments, and final exams.

Previous research has highlighted the benefits of aligning assessments with COs and POs. Studies such as those by Johnson (2018) and Lee et al. (2019) suggest that significant alignment enhances student understanding and retention of material, particularly in technical subjects. However, the specific impacts on hydraulic engineering courses remain underexplored. This study seeks to fill this void by providing detailed insights into how assessment alignment affects student performance in hydraulics education, thereby offering valuable guidance for educators in designing more effective assessment methods.

RESULTS AND DISCUSSION

The analysis of the hydraulics course assessments reveals several key insights into student performance and the alignment with Course Outcomes (COs) and Program Outcomes (POs).

As shown in Figure 1, the assessment of CO1 and PO1 indicates that the test scores are the highest (88.8%), followed by assignments (71.2%) and the final exam (29.2%). This distribution suggests that students perform better in tests, indicating a stronger grasp of the course material evaluated through short-term assessments.

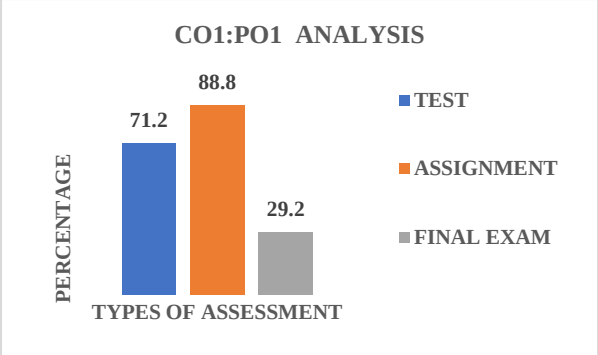

Fig. 1 CO1:PO1Analysis

Figure 2 illustrates the CO2 and PO2 analysis. The assignment scores are the highest (95.4%), followed by tests (69.9%) and the final exam (53.9%). This pattern suggests that students are better able to demonstrate their understanding through assignments, which may involve more comprehensive and practical applications of the course content.

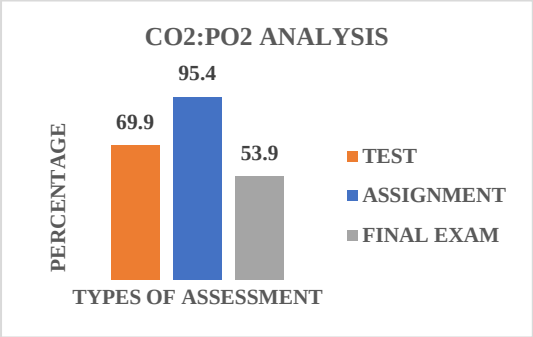

Fig. 2 CO2:PO2 Analysis

In **Figure 3**, a comprehensive COPO analysis is presented. The overall performance for CO1 and CO2 shows a total percentage of 51.5% and 61.3%, respectively. This indicates a moderate alignment between course assessments and the specified outcomes, with room for improvement in assessment strategies to better align with the educational objectives.

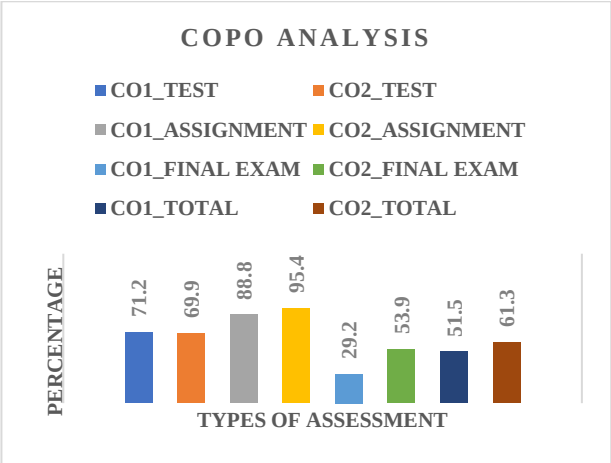

Fig. 3 COPO Analysis

CONCLUSION

In conclusion, the analysis of student performance in the hydraulics course demonstrates that the alignment of course assessments with Course Outcomes (COs) and Program Outcomes (POs) significantly influences academic success. The findings show that students excelled in tests for CO1:PO1 and assignments for CO2:PO2, indicating that different types of assessments can better capture different aspects of student learning. However, the moderate overall alignment suggests room for improvement. By optimizing assessment strategies to more closely align with COs and POs, educators can enhance the effectiveness of teaching methodologies, thereby improving student learning outcomes and better achieving educational objectives in engineering education.

REFERENCES

Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university: What the student does* (4th ed.). McGraw-Hill Education.

Bormann, I., & Fuchs, M. (2019). The relationship between instructional alignment and the development of students' skills in scientific inquiry. *International Journal of Science Education*, 41(4), 476-493. https://doi.org/10.1080/09500693.2019.1573935

Johnson, A. (2018). Impact of Course Outcome Alignment on Student Performance in Engineering Courses. *Journal of Engineering Education*, 107(2), 150-165. https://doi.org/10.1002/jee.20218

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Learning from the Field: The Influence of Internship Placements and Their Impact on Educational Experiences

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ABSTRACT

Well-structured internship programs play an important role in outcome-based education (OBE) for engineering programs. Interaction with various industrial players and adequate supervision from experienced professionals can greatly enhance engineering education. This study focuses on the various industrial backgrounds and learning impact in providing meaningful work experiences for civil engineering diploma students. The analysis was performed on graduated students' cohort September 2019 consisting of 121 students and 51 students from cohort 2020. In general, the finding indicated that students preferred to complete their internship in northern region (Perak, Kedah and Pulau Pinang). Construction companies are the most favorable to be choose by students, followed by government agencies and consulting firms. Internship placements across various industries play a significant role in providing meaningful learning experiences for students.

Keywords: Industrial internship, OBE, Civil engineering

INTRODUCTION

Outcome-Based Education (OBE) has emerged as a powerful framework to ensure quality learning experiences for engineering students. OBE shifts the focus from traditional content-centric teaching to student-centered learning outcomes. It emphasizes measurable results, competencies, and skills that graduates should possess upon completing their education. The success of OBE lies in its ability to align curriculum design, delivery, and assessment with real-world demands. It empowers graduates to contribute meaningfully to innovation, entrepreneurship, and societal progress. One of the critical courses is an engineering program is an industrial internship culminating course. Internships offer students the opportunity to apply theoretical knowledge gained in the classroom to real-world engineering challenges. This practical experience reinforces learning and helps students achieve the desired outcomes of the OBE framework. It provides students with invaluable exposure to the professional world, allowing them to apply theoretical knowledge in real-world scenarios. To achieve this purpose, a well-structured industrial internship program serves as a bridge between classroom learning and practical application. (Ozek. 2018).

An internship program is alleged to connect the academic world and practitioners through the involvement of students in the workplace within a stipulated time. During the internship, the knowledge transfer process would provide significant input to improve the education system itself. It could improve the lifelong learning potential of the students by improving their problem solving and critical thinking skills, teamwork, communication, and other vital attributes as graduates (Duncan et al., 2017). In civil engineering undergraduate courses, internship programs are crucial as it could train the students to cope with challenging tasks in the real world with dynamic situations and engineering profiles (Guler and Mert, 2012).

The impact of internship programs on educational practices has recently been a subject of interest among academicians and industrial practitioners. Previous study highlighted that could help to enhance the students' understanding of engineering concepts through problem-based learning approach (Jusoh and Hadibarata, 2024). By analyzing the placements of the students, the educators can identify areas for improvement for students learning experiences, thus helping the institution produce better graduates. This paper presents the findings of an insightful analysis of internship placements according to states, industry type and industry sector among civil engineering diploma students, UiTM Pulau Pinang Branch. The analysis was performed on graduated student's cohort September 2019 consisting of 121 students and 51 students from cohort 2020. Students were given opportunities to decide their own internship placements as they preferred. Upon application acceptance by companies, students were obliged to register their internship in faculty database to ensure all data were archived. Students were required to complete their internship on a stipulated duration which is 17 months 3 days, typically in October academic semester each year.

RESULTS AND DISCUSSION

Figure 1 shows internship placement among students according to cohort. The graph illustrates that students preferred to opt for internship placement in Kedah, Perak and Pulau Pinang. This is because most families of the students are living in the northern region, hence the students are likely to live with their parents during the internship period. The result shows the highest internship placement is in Pulau Pinang. This might be due to the state, Pulau Pinang has a relatively stable economy and a business-friendly environment, making it attractive for companies to establish operations and offer internship opportunities. Besides that, educational institutions often have established relationships with industry partners, facilitating internship placements for their students.

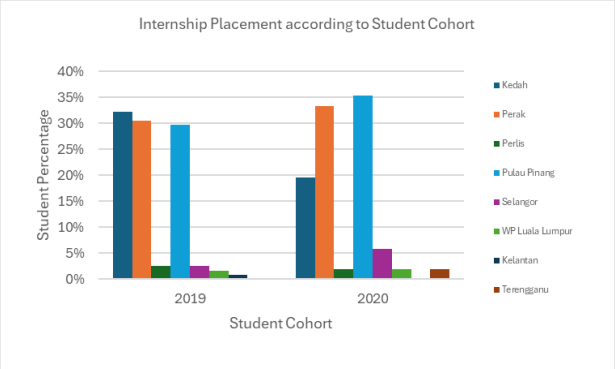

Fig. 1 Internship placement among student according to cohort

According to Figure 2, the result shows that students are highly preferring to complete their internship at construction companies, followed by federal government department or statutory body and consulting firms. This might be due to 4 months internship duration which enables them to learn more civil engineering activities at the construction site.

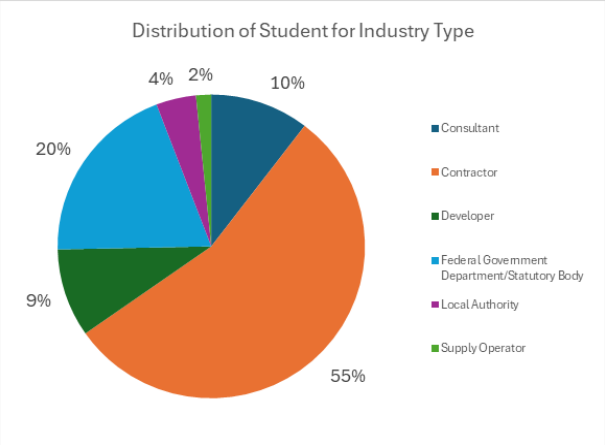

Fig. 2 Distribution of student according to industry type

Moreover, different types of industries enable students to acquire different industry-specific skills and knowledge. Construction sites provide interns on construction sites experience the physical demands, safety protocols, and logistical complexities of building projects. This immersive experience complements classroom learning, providing a deeper understanding of construction materials, methods, and project management. As for the government agencies or statutory body, internships in government agencies provide insight into the regulatory framework, public policy considerations, and long-term planning involved in civil engineering projects. Students learn about environmental impact assessments, permitting processes, and the social and economic impacts of infrastructure development. Meanwhile for consulting firms, they prepare a platform that offers exposure to a more collaborative and analytical environment. Students learn to work in teams, conduct research, analyze data, and present findings to clients, honing their communication and problem-solving skills.

CONCLUSION

This analysis of internship placements across various industries underscores the multifaceted impact on educational experiences for civil engineering students. The findings reveal that diverse placements offer unique learning opportunities, skill development, and career insights, ultimately shaping well-rounded and adaptable engineers. By strategically aligning internships with individual learning goals and career aspirations, educational institutions can maximize the benefits of these experiences and better prepare students for the dynamic demands of the civil engineering profession.

REFERENCES

Ozek H.Z. (2018) Impact of Internship in Engineering Education, *The Eurasia Proceedings of Educational & Social Sciences*, 9, 276-283.

Duncan, D.W., Birdsong, V., Fuhrman, N.E., & Borron, A. (2017). The Impacts of a National Internship Program on Interns' Perceived Leadership, Critical Thinking, and Communication Skills. *The Journal of Leadership Education*, 16, 23-39.

Guler, H. & Mert, N. (2012). Evaluation of Internship Programs for Educational Improvements: A Case Study for Civil Engineering, *International Journal of Engineering Education*, 28, 579-587.

Jusoh, H. & Hadibarata, T. (2024), Bridging Theory and Practice: The Role of Site Visits in Environmental Engineering Learning, *Acta Pedagogia Asiana*, 3, 13-22.

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Consistent Psychomotor Proficiency: An analysis of Embedded Laboratory Course in Electrical Engineering Diploma Programme

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ABSTRACT

The objective of this study is to examine the consistent development of psychomotor proficiency within the context of an embedded laboratory course in an electrical engineering diploma programme. The primary focus is to meticulously analyze the performance of students in the psychomotor domain throughout the semester, with particular attention to their engagement in weekly laboratory exercises and performance in practical test for a specific course code: ELE232. It is essential to underscore the significance of psychomotor proficiency, as it not only prepares students for the industry but also complements the cognitive and affective domains. The data collected over four semesters, each with a distinct student cohort, revealed a consistent trend wherein students effectively acquired skills from laboratory exercises and aptly applied them in practical tests, leading to commendable scores in both assessments.

Keywords: Embedded, Engineering, Laboratory, Practical test, Psychomotor domain

INTRODUCTION

Psychomotor proficiency plays a crucial role in developing hands-on skills among engineering students. According to the Engineering Technician Education Programme Accreditation Standard (2020), a practice-oriented component in the technical and specialist area is one of the qualifying requirements for programme accreditation. This underscores the importance of producing graduates with the skills and competence necessary to adapt to the industry.

Psychomotor domain is one of the learning attributes classified by Bloom's taxonomy. The other two domains are cognitive domain and affective domain as mentioned by Mun et al. (2023). Each domain encompasses multiple levels of learning, ranging from fundamental, surface-level learning to intricate, deep-level learning. By psychomotor learning, the acquisition of practical skills can be translated from theoretical knowledge into real-world applications. The learning encompasses hands-on experiences, deliberate practice and the development of skills. It complements cognitive learning by enabling students to apply their acquired knowledge in a practical and tangible manner. To ensure that graduates are well-equipped to address real-world challenges and undertake projects, it is recommended that the programme integrate applied learning courses into curriculum (Nasri, 2023).

In electrical engineering diploma programme, psychomotor domain assessment commonly involves practical laboratory exercises and hands-on projects aimed at evaluating students' technical skills and proficiency in working with electrical components and systems. Common methods of assessing are in laboratory experiments, practical tests, mini projects, simulations and prototypes. To have these assessments, the embedded laboratory course will have a combination of lectures and laboratory as a teaching and learning activities. The process commences with comprehensive lectures that cover fundamental concepts, which are subsequently put into practice by students in the laboratory setting.

The assessments are subsequently aligned with their respective Course Outcomes (COs) and Programme Outcomes (POs). COs delineate the significant and essential learning that students are expected to achieve and reliably demonstrate upon completion of a course. Conversely, POs articulate the knowledge and skills that students are expected to possess and demonstrate upon graduation. These outcomes encompass the skills, knowledge, and behavior that students acquire throughout the program.

RESULTS AND DISCUSSION

This study draws data from the course code ELE232, a core course of the electrical engineering diploma curriculum offered in the third semester at a public university. This particular course represents one of the embedded laboratory components, serving as the basis for assessing students in both cognitive and psychomotor domains, with respective weightings of 70% and 30%. The evaluation of psychomotor skills is further categorized into 20% for laboratory exercises and 10% for

practical tests. These assessments are aligned with CO3 and PO4, as outlined in Table 1.

Table 1. Statement of CO3 and PO4 of psychomotor domain for the course code ELE232

CO3	Construct basic electronic circuits using simulation software and/or experimental setup
PO4	Conduct investigations of well-defined problems; locate and search relevant codes and catalogues, conduct standard tests and measurements.

Throughout the course, students will engage in six laboratory exercises, each aligned with the course syllabus. These exercises are designed for individual completion and will be evaluated based on four sub-attributes: Handling Equipment, Conducting Experiment, Output Response, and Output Validation. Each sub-attribute will be assessed on a scale ranging from 1 (poor) to 4 (excellent). During the laboratory sessions, students will utilize equipment such as an oscilloscope, function generator, and power supplies. Additionally, they will be tasked with constructing electronic circuits using components including diodes, resistors, capacitors, and transistors on a breadboard. Upon completion of the semester, students' proficiency gained during the laboratory sessions will be assessed through a two-hour practical test.

Table 2 presents the enrollment figures for this course over the preceding four semesters. Additionally, Figure 1 illustrates the average scores for CO3 and PO4, which are derived from the psychomotor components, specifically the laboratory exercises and practical test.

Table 2. Number of enrolled students for the course code ELE232

Semester	Number of Students
Oct 2023 – Feb 2024	28
Mar 2023 – Aug 2023	7
Oct 2022 – Feb 2023	43
Mar 2022 – Aug 2022	19

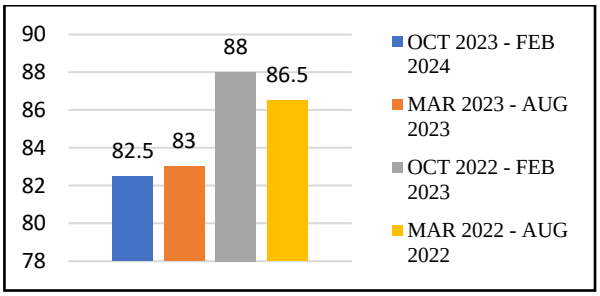

Fig. 1 CO3-PO4 achievement for the course code ELE232

The data presented in Figure 2 illustrates consistently high average marks for laboratory exercises and practical test across all semesters of this course. This indicates that students have effectively acquired fundamental practical skills during their weekly laboratory exercises and have been able to apply these skills proficiently in their practical test. These findings align with the research of Mat Isa et al. (2020), which suggests that the development of psychomotor skills significantly contributes to students' self-confidence and proficiency.

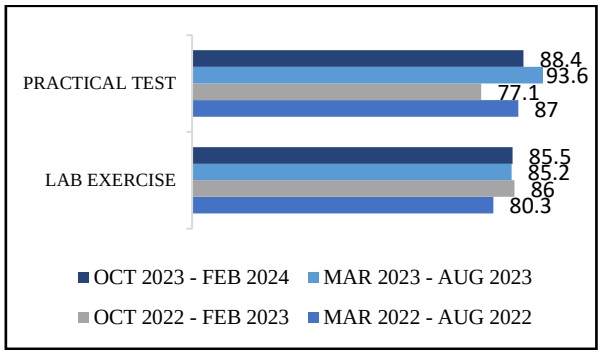

Fig. 2 Average marks for laboratory exercise and practical test for the course code ELE232

CONCLUSION

In conclusion, our inquiry into the consistent attainment of psychomotor proficiency has yielded valuable insights. The findings indicate that students were able to acquire practical skills through the structured psychomotor assessment. The instructional laboratory must balance theoretical learning with practical experience. Furthermore, it is imperative for curriculum designers to take these findings into account in order to optimize embedded laboratory courses and prepare graduates for engineering practice.

REFERENCES

Mun, N. K., Rahim, A. A. A., Saparon, A., Rahman, A.F.N.A. & Buniyamin, N. (2023). Measuring the Learning Effectiveness in the Cognitive, Affective, and Psychomotor (CAP) Domains in Electrical Engineering Laboratory Courses Using Online Delivery Mode: Universiti Teknologi MARA. *Pertanika Journal of Science & Technology, 31*(4), 1807 - 1825.

Nasri, M. (2023). Implementing laboratory and project-based embedded control sequence courses in electrical and computer engineering. *American Society for Engineering Education (ASEE) Annual Conference & Exposition.*

Mat Isa, C. M., Mustaffa, N. K., Joseph, E. O., & Preece, C. N. (2020). Development of psychomotor skill and programme outcome attainment of civil engineering students in Malaysia. *Asian Journal of Vocational Education and Humanities, 1*(2), 14-38.

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Program Learning Outcome Viability for Industrial Training Course for Undergraduate Diploma Mechanical Engineering Program

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ABSTRACT

Program learning outcome or more commonly known as PO has the potential to provide the desired outcomes that students will acquire by the end of each of their courses throughout their study. The mechanical engineering Diploma program in this University abides by the list of PO that has been standardized by the Engineering Technology Accreditation Council (ETAC). Industrial Training is one of the courses required to be completed by the students to graduate. This paper seeks the viability of the course outcome to program outcome mapping for industrial training course. The percentage of PO attained is based on the evaluation by the respective student's industrial supervisor and evaluating lecturer. It is concluded that both MEC399 and MEC390 codes for industrial training have attained high PO percentages. However, MEC390 is more viable in the long term as their CO-PO mapping is more matched to the current conditions of the industrial training.

Keywords: Industrial Training, Program Learning Outcome, ETAC, Employability

INTRODUCTION

Program learning outcomes or more commonly known as PO, are a list of outcomes that details out the knowledge or skills students should acquire by the end of a particular course. It is to be expected that students have the knowledge and skills worthy of an engineering graduate by the time of their graduation as per Board of Engineers Malaysia (BEM) Engineering Technology Accreditation Council (ETAC) standard (2020). These POs are formulated in such a way that they correlate with the skills, knowledge, and behavior that these students acquire throughout their engineering study. The POs are mapped to the course outcome of the subject. The Course Outcome (CO) to the PO mapping is done during the curriculum review process in the department.

For graduates to be employable upon their graduation, it is pertinent that they undergo industrial training as part of the graduating requirement. Industrial training provides real first-hand experience in an engineering practice environment outside of the University. With the Fourth Industrial Revolution (IR4.0) era combined with advancement in artificial intelligence, it is pertinent for engineering education to review its curriculum so that the students are well prepared for the industrial workforce. Not only that, but the University also needs to prepare the students for a future where the industry is such a volatile, uncertain, complex and ambiguous environment as discussed by Buhler et. al. (2022). A method of reviewing the industrial training course is through its program outcomes compatibility with the course outcomes together with feedback from all prior industrial supervisor for the student interns.

The PO attained from this course is based on the CQI data provided by the Resource Person of the subject. The subject has two different versions, which is the MEC390 and MEC399 versions. The MEC399 version mainly refers to students prior to semester March 2022 – July 2022 (intake year 2018 and below) with few extended students within March 2022 until February 2024. The MEC390 version refers to students taking the course between March 2022 until February 2024 (intake year 2019 and above). The MEC399 version has different CO-PO mapping than the MEC390 version. Table 1 and Table 2 provide the CO-PO mapping for each of the respective course codes.

Table 1. MEC390 Industrial Training CO-PO Mapping

COURSE OUTCOME	PROGRAM OUTCOME
CO1 – Adapt problem solving skills with theoretical mechanical engineering fundamentals, techniques, resources and modern IT tools	PO5 (Modern Tool Usage)
CO2 – Demonstrate safety and health responsibilities in engineering practices	PO6 (The Engineer and Society)
CO3 – Act professionally and ethically to increase employability potentials	PO8 (Ethics)
CO4 – Demonstrate effective communication on well-defined engineering activities with the engineers and society at large	PO10 (Communications)

Table 2. MEC399 Industrial Training CO-PO Mapping

COURSE OUTCOME	PROGRAM OUTCOME
CO1 – Apply the theoretical and practical aspects of mechanical engineering	PO2 (Problem analysis)
CO2 – Adopt the right attitude and professionalism to increase their employability potentials	PO7 (Environment and Sustainability)
CO3 – Perform the given tasks with minimum supervision	PO3 (Design/Development of solutions)
CO4 – Demonstrate effective communication, not only with engineers but also with the community at large	PO4 (Investigation) & PO11 (Project Management and Finance)

RESULTS AND DISCUSSION

Table 3 and Table 4 shows the performance of each of the PO based on the percentage of students obtaining more than 50 percent score. 50 percent score is the passing marks for each of the students.

Table 3. MEC399 Industrial Training PO Percentage Attainment

COURSE OUTCOME	CO1	CO2	CO3	CO4	CO4
PROGRAM OUTCOME / SEMESTER	**PO2**	**PO3**	**PO7**	**PO4**	**PO11**
Oct 2023 - Feb 2024	100	100	100	100	100
Oct 2022 - Feb 2023	100	100	100	100	100
March - July 2022	100	100	100	100	100
Oct 2021 - Feb 2022	100	100	100	100	100
March - July 2021	99	99	99	99	99
Oct 2020 - Feb 2021	100	100	100	100	100
March - July 2020	99.3	99.3	99.3	99.3	99.3

Based on the data shown in table 3, it is observed that there is no significant difference in PO attainment for each semester, with one percent or less decrease in March-July 2021 and March-July 2020 semesters. Most of the students can achieve a minimum passing grade for each PO. This may have been contributed to the simpler rubric given to the industrial supervisors and evaluating lecturers. However, the data obtained may not be fully viable in the long run to observe student intern's capability for the subject through the given POs as shown in table 2 as there may have been some mismatch to the mapping. This is one of the reasons as to why MEC390 code is formed to properly attain the correct PO to the industrial training subject.

Based on the data shown in Table 4, it is observed there is a significant decrease in the percentage for each of the PO for subject code MEC390 for semester March-July 2023. As this batch of students came from those who had their head start in the tertiary education through online, they may have lacked certain skillsets that are useful during their internship. This correlates with studies by Asgari et.al. (2021) which identified issues of online class fatigues, lack of sufficient hands-on training, difficulty in maintaining focus and lack of in-class engagement as part of the challenges during the online education during the pandemic. However, MEC390 PO attainment is much more viable in the long run to observe intern students' achievement as they are reasonably mapped correctly to the ETAC POs.

Table 4. MEC390 Industrial Training PO Percentage Attainment

COURSE OUTCOME	CO1	CO2	CO3	CO4
PROGRAM OUTCOME / SEMESTER	**PO5**	**PO6**	**PO8**	**PO10**
Oct 2023 - Feb 2024	100	100	100	93.3
March - July 2023	89.54	99.16	98.74	95.82
Oct 2022 - Feb 2023	100	100	100	100
March - July 2022	100	100	100	100

CONCLUSION

Through all this culminated data, it can be concluded that all students successfully passed all POs based on the percentage attainment. However, when compared for viability of each of the subject codes, MEC390 proved to be much more viable in the long run to observe students' achievement in the industrial training course. It is also suggested that the MEC390 code would consider having the Project Management and Finance PO as this particular PO is very much applicable to the industrial training course.

REFERENCES

Asgari, S., Trajkovic, J., Rahmani, M., Zhang, W., Lo, R.C., & Sciortino, A. (2021). An observational study of engineering online education during the COVID-19 pandemic, PLoS ONE 16 (4), e0250041

Board of Engineers Malaysia (2020). Engineering Technician Education Programme Accreditation Standard

Buhler, M.M., Jelinek, T., & Nubel, K. (2022). Training and Preparing Tomorrow's Workforce for the Fourth Industrial Revolution, *Education Sciences,* 12, 782

A Five-Year Review of Student Online Feedback for Course X in the Civil Engineering Degree Program

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ABSTRACT

This study examines the impact of the COVID-19 pandemic on the student experience in a civil engineering course (Course X) using student online feedback (SUFO) collected over five years. Students' online feedback from ten semesters (20192 - 20234) for Course X was analysed, focusing on four key areas: students' overall impression of the course, lecturers' professionalism, effectiveness of teaching and learning activities, and adequacy of infrastructure. The research design explored possible changes in students' perceptions in these areas before, during and after the pandemic's shift to online learning. It explored whether the shift to online delivery may have negatively impacted the student experience in Course X. Examining trends in feedback across semesters will allow us to identify any deterioration in student perceptions and guide possible improvements to enhance the effectiveness of the course, particularly in an online learning environment.

Keywords: Student online feedback, Covid-19, Civil engineering degree programme, Online class, Physical class.

INTRODUCTION

Effective educational programmes constantly strive for improvement. In the Civil Engineering programme, Course X plays an important role in providing fundamental knowledge and skills. To ensure that this course continues to effectively prepare future generations of engineers, it is important to collect and analyse student feedback over an extended period of time. Student feedback provides valuable insight into various aspects of the learning environment for Course X. These include the students' overall impression of the course, the professionalism of the lecturers, the effectiveness of the teaching and learning activities and the adequacy of the infrastructure.

The overall impression of the course reflects the students' satisfaction with the content, organisation and relevance to their educational goals. It summarises their holistic perceptions and includes factors such as engagement, clarity of objectives and how well the course meets their expectations. Martin et al (2023) found that student feedback is a valuable tool to improve the overall impression of a course. In addition, Bashir et al. (2016) found that student feedback is not only important for improving the learning experience, but also plays an important role in professionalising teaching in higher education. Dalipi et al. (2022) investigated the impact of the Covid-19 pandemic on computer science courses and analysed the impressions, feedback and experiences of students and lecturers during this time. By analysing student feedback on Course X over time, areas for improvement can be identified and ensure that the course continues to provide a quality learning experience for future generations of civil engineering students.

Recognising the importance of student feedback for course improvement, this study looks at online student feedback (SUFO) on course X over the last five years. The main objective of this study is to gain a deeper understanding of the student experience in this important civil engineering course. By carefully analysing trends and recurring themes within the feedback data, areas where Course X can be improved can be identified. By addressing these areas, it can be ensured that Course X continues to provide a high quality learning experience that equips future generations of civil engineers with the necessary knowledge and skills.

The following method was used to conduct this study. The study focused on the semesters 20192, 20194, 20202, 20204, 20212, 20214, 20222, 20224, 20232 and 20234. The focus of the SUFO analysis aims to gain insights into students' perceptions and experiences of certain aspects of the educational programme before Covid-19, during Covid-19 and after Covid-19, thus supporting the evaluation and improvement of teaching methods and curriculum design. The main criteria for the SUFO analysis were the students' overall impression of course X, and the professionalism of the lecturers.

RESULTS AND DISCUSSION

Figure 1 analyses the students' feedback on their overall impression of course X. The data shows a consistently high level of agreement with the positive statements about the course, ranging from 84.95% to 97.32% agreement

across ten semesters (20192 - 20234). This indicates a general satisfaction with the content and delivery of the course.

However, a closer look reveals some interesting trends when considering the timing of transitions between physical and online learning due to Covid-19. The initial transition to online teaching between semesters 20192 and 20194 coincides with a small dip in student impressions (89.41% to 84.95%). This could be an indication of initial challenges or adjustments students faced during the transition. Hodges et al (2020) suggests that online learning is sometimes perceived as lower quality than face-to-face learning, which may explain this initial dip.

The transition back to face-to-face teaching (semesters 20214 to 20222) also shows a slight decrease in initial impressions (89.76% and 89.51%). This could be due to students getting used to the classroom environment again after a period of online learning. Thereafter, however, the data shows a positive trend, with impressions increasing significantly in the final semesters. The peak scores in 20224 (97.32%) and subsequent high scores (20232 and 20234) indicate that Course X has successfully navigated these transitions, ultimately resulting in higher student satisfaction. Overall, despite the challenges of these transitions, the course has demonstrated its resilience and adaptability, keeping student impressions consistently high.

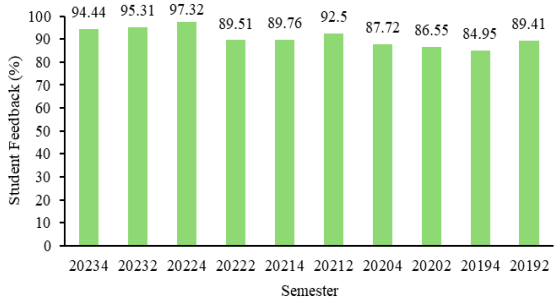

Fig. 1 SUFO analysis based on students' overall impression of Course X in relation to Covid-19

The analysis of student feedback on the professionalism of lecturers in Figure 2 shows consistently high ratings of over 85% in all semesters. In particular, semesters 20232 (97.62%) and 20224 (97.96%) achieved the highest scores, indicating top performance. However, a significant drop can be observed between semesters 20192 (90.7%) and 20194 (85.13%), which coincides with the switch to online teaching due to Covid-19. This transition probably posed a challenge for both lecturers and students and had an impact on the perception of professionalism. Furthermore, the transition back to face-to-face teaching from semester 20214 (91.87%) to 20222 (91.58%) shows relatively stable ratings, albeit slightly lower than the pre-pandemic peaks. This stability indicates a successful adaptation of lecturers over time, maintaining a high standard despite the disruptions. Overall, while the pandemic has led to fluctuations in feedback, the ratings reflect a robust and professional response from lecturers who have adapted to these unprecedented changes. This study underscores the importance of continuous assessment to ensure excellence in teaching and learning and to serve as a support system and tool for faculty professional development.

Table 1. SUFO analysis based on the lecturer professionalism for Course X

Semester	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)	Average (%)
20234	0	0	14	49	94.44
20232	0	0	8	76	97.62
20224	0	0	4	45	97.96
20222	0	0	66	130	91.58
20214	0	3	208	447	91.87
20212	0	0	112	273	92.73
20204	0	6	538	625	88.24
20202	0	11	282	302	87.23
20194	5	16	994	735	85.13
20192	0	3	257	447	90.7

CONCLUSION

It can be concluded that despite the challenges posed by the transition between online and face-to-face teaching due to Covid-19, student feedback on Course X was consistently positive, indicating overall satisfaction with the course content and delivery. The results also underscores the resilience and adaptability of instructors, as ratings of professionalism rebounded after initial dips during the transition, ultimately resulting in a good impression on students and a solid learning experience. This study underscores the value of continuous feedback analysis to support faculty members' continuous improvement and professional development.

REFERENCES

Martijn J. M., Leenknecht D. C. (2023) Students' feedback seeking behaviour in undergraduate education: A scoping review. Educational Research Review.

Bashir, M.M.A., Kabir, R. and Rahman, I. (2016) The Value and Effectiveness of Feedback in Improving Students' Learning and Professionalizing Teaching in Higher Education, Journal of Education and Practice, 7 (16).

Dalipi F., Jokela P., Kastrati Z., Kurti A., Elm P. (2022) Going digital as a result of COVID-19: Insights from students' and teachers' impressions in a Swedish university, International Journal of Educational Research Open (3).

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A Study of Student Learning Time (SLT)

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ABSTRACT

Student learning time (SLT) is very important for every subject or course. SLT determines the detail design of each assessment based the topic of study, Bloom's Taxonomy, duration of student preparation time (SPT), and more importantly the appropriate number of words for every question as well as duration of presentation. The purpose of this study is to determine the present the SLT being applied for engineering students in one of the subjects undertaken. This is due to the lack of comprehensive understanding regarding SLT's in the three domains of Bloom's Taxonomy and student academic achievement. Data was collected from assessments questions and student achievement. Data analysis shows that test score was irregular across semesters so as the different Program Outcomes (POs) which is cognitive, psychomotor and affective domains as the SLT for various assessments were also dissimilar across semesters. The actual SLT was much beyond the syllabus. Thus, it is essential to review the SLT according to the syllabus.

Keywords: student learning time, blooms' taxonomy, engineering student, student preparation time, affective domain.

INTRODUCTION

The Institute of Higher Learning (IHL) of Malaysia has introduced student learning time (SLT) as a tool so that the content of syllabus, delivery, assessment and student preparation time (SPT) are matched with the desire SLT of each subject. However, the improper implementations of SLT have affected student learning process and defeated the achievement of students' grades, the respective Program Outcome (PO) and each Course Outcome (CO). This paper aims to present the achievements across 4 academic semesters, namely semester 20204, 20214, 20224, 20234 of Mechanical and Electrical Engineering course being offered to Bachelor Degree of Civil Engineering students based on the respective SLT. The research method is descriptive in nature which is based on quantitative data of students' achievement across 4 semesters against the SLT of each semester. Further, this paper will highlight and examine the SLTs relevant to the result of semester 20224 and 20234. The SLT for this course as shown in Table 1 was generated based on Table 2 and Table 3.

Table 1. Student Learning Time (SLT) for Teaching and Learning

Week	Topic	Teaching and Learning (TnL)		(SPT)	Total
		Lecture F2F	Lab F2F	Lecture (NF2F)	SLT
1-14	1	14	28	14	56
Total		14	28	14	56
SLT per week		1	2	1	4

Table 2. Student Learning Time Reference 1

10. Distribution of Student Learning Time (SLT):

Course Content Outline	CLO*	Learning and Teaching Activities						Total SLT
		Guided Learning (F2F)				Guided Learning (NF2F) e.g. e-Learning	Independent Learning (NF2F)	
		L	T	P	O			
1.								
2.								
3.								
4.								

Continuous Assessment	Percentage (%)	F2F	Independent Learning (NF2F)	Total SLT
1.				
2.				
Final Assessment	Percentage (%)	F2F	Independent Learning (NF2F)	Total SLT
1.				
2.				
GRAND TOTAL SLT				

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face
*Indicate the CLO based on the CLO's numbering in Item 8.

11. Identify special requirement or resources to deliver the course (e.g., software, nursery, computer lab, simulation room):
12. References (include required and further readings, and should be the most current):
13. Other additional information (if applicable):

(Malaysian Qualifications Agency, 2017)

Table 3. Student Learning Time Reference 2

Table 3.6: Simulation of SLT for substitute blended learning.
[Source: *Garis Panduan Pembelajaran Teradun Gantian (Pembelajaran dalam Talian)*, MOHE]

Syllabus		Student Learning Time (Conventional)						Student Learning Time (Online Learning)		
Week	Chapter	Lecture	Tutorial	Lab	Self-Learning		Assessment	TnL Material	TnL Activities	Assessment
					Guided	Non-Guided				
1	Introduction to Problem Solving				2	2				
2	Introduction to Programming	2		2	2	1				
3	Identifier, Variable, Assignment					1		4	2	8
4	Input & Output Statements					1		2	2	
5	Operator & Expression					2		3	2	
6	Control Statements Test 1	2			2	3	2			
7	Control Statements	2		2	2	1				
8	Arrays					1		3	4	
9	Arrays Mini Project					2	6	2	4	
10	Modular Programming	2		2	2	1				
11	Modular Programming	2		2	2	1				
12	Pointer	2		2	2	1				
13	File Processing Test 2	2			2	3	2			
14	Mini Project Presentation					1	1			
15	Final Exam					9	3			
	Total	14	0	10	16	30	14	14	14	8
		SLT for Conventional Learning					84	SLT for Online Learning		36
		Overall SLT						120		

(Malaysian Qualifications Agency, 2023)

RESULTS AND DISCUSSION

Figure 1 shows the results of students across 4 semesters which is in the range of 66 to 72.

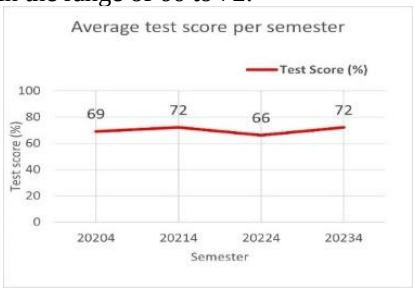

Fig. 1 Average Test Score Per Semester

Figure 2 shows that PO1 is moving in the rage of 60 to 66, PO5 dropped from 86 to 68 and up to 76; whereas PO10 dropped from 80 to 68 and climbed back to 80.

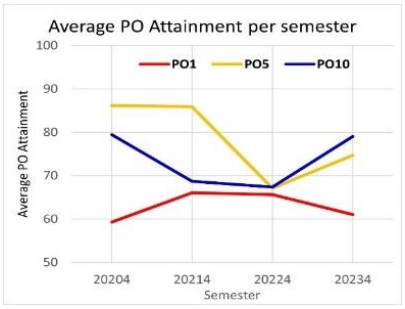

Fig. 2 Average PO Attainment Per Semester

As PO1 is only linked to CO1, PO5 to CO2 and PO10 to CO3; the results of COs as in Figure 3 are similar to Figure 2 with the replacement of respective COs.

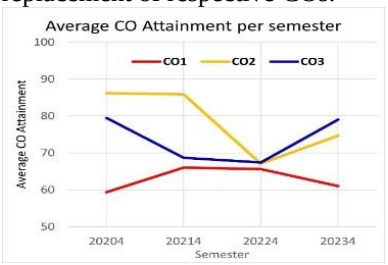

Fig. 3 Average CO Attainment Per Semester

Based on Figure 4, the actual SLT for PO1 in semester 20234 is the same as 20224 due to overlapping of lines. However, the actual PO1 TnL SLTand the PO1 TOTAL SLT has a gap of 30%, and no difference in term of Assessment SLT.

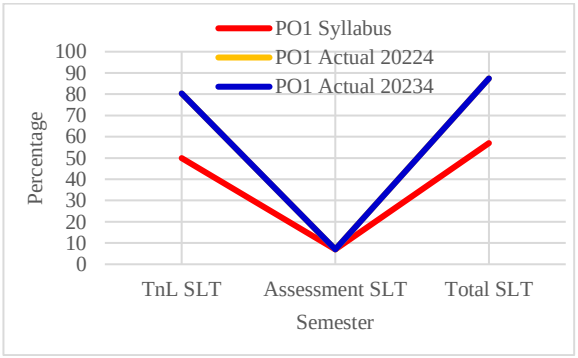

Fig. 4 Analysis of PO1 SLT

Based on Figure 5, the actual SLT for PO5 in semester 20234 is the same as 20224 (due to overlapping). There was no difference of PO5 TnL SLT, but PO5 total SLT has a gap of 15 – 13 which is 2%.

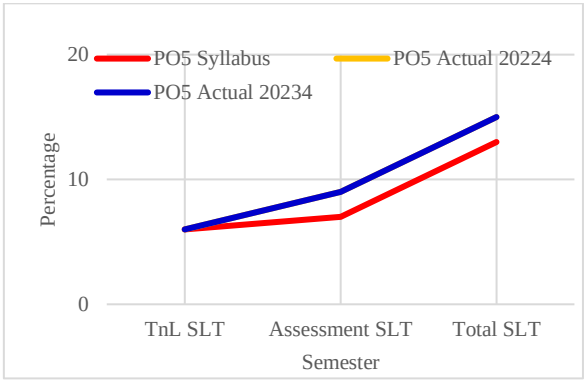

Fig. 5 Analysis of PO5 SLT

Based on Figure 6, the actual SLT for PO10 in semester 20234 is the same as syllabus (due to overlapping). The difference was observed on Actual Assessment SLT between 2 semesters, with a gap of 16 – 10 which is 6%.

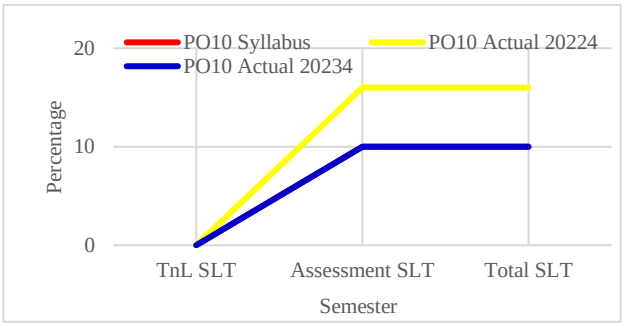

Fig. 6 Analysis of PO10 SLT

CONCLUSION

Over the 4 semesters, the average test score fluctuated in a narrow range of 66 to 72. The average PO1 attainment was within a small scale of 59 to 66. However, PO5 and PO10 displayed substantial decreases and recoveries. The Student Learning Times for each PO should be reviewed accordingly.

REFERENCES

Malaysian Qualifications Agency (MQA). (2017). Code of Practice for Programme Accreditation, 2nd edition. Malaysia. Pg 41.

Malaysian Qualifications Agency (MQA). (2023). Guidelines to Good Practices: Programme Design and Delivery, 2nd edition. Malaysia. Pg 47.

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Implementation of Open-Ended Laboratory in Geotechnical Laboratory Course

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ABSTRACT

Open-Ended Laboratory (OEL) refers to laboratory activities, which the end results or outcome is different for each person or group conducting the activities. As the scale of openness increases, not only the end part is different; the beginning and middle part is also different. In this article, the implementation of OEL in Geotechnical Laboratory course is presented. The laboratory works are divided into three level, which are OEL1, OEL2 and OEL3. Implementation of OEL1 is straightforward, while for OEL2 and OEL3, explanation is provided to give an overview on the difference between each level of OEL. As a conclusion, it is important to properly implement OEL3 in early year of study, as it provides fundamental for conducting Final Year Project.

Keywords: Open-Ended Laboratory, Geotechnical Laboratory, Level Of Openness

INTRODUCTION

In any engineering programme, laboratory work is one of the necessary components to be included in the curriculum. Laboratory work will increase students' understanding on the theory that had been delivered during lecture session. Generally, laboratory work can be divided into two categories. The first category is laboratory works that are conducted to verify the theory, and the second category is laboratory works that are conducted to investigate. The latter category fits into what is defined as Open-Ended Laboratory (OEL).

Engineering Program Accreditation Standard (EAC,2020) stipulated that "It is expected that a significant number of laboratory works shall be open-ended". OEL is a term that is used to represent laboratory activities, where students are required to develop their own experiments. There are several classifications on OEL. The earliest one is as provided by Schwab (1962) and later refined by Herron (1971), as shown in Table 1.

Table 1. Schwab-Herron Scale of Laboratory Openness (Herron 1971).

Level	Problem	Method	Results
0	Given	Given	Given
1	Given	Given	Student
2	Given	Student	Student
3	Student	Student	Student

Level 0 indicates fully guided laboratory activities. For Level 1, the instructor will pose a problem, and the students will provide the solution on their own. In the second level, the instructor still provides the problem, but the students need to develop a suitable method, which also requires them to provide their own solution. For Level 3, the students need to formulate their own problem, followed by developing suitable methods and solutions.

IEA (2021) also implicitly highlighted the three different components of laboratory works as in Herron (1971), and it can be summarized as shown in Table 2.

Table 2. IEA (2021) components of laboratory work mapped to Herron (1971)

Herron (1971)	Problem	Method	Results
IEA (2021)	research-based knowledge	design of experiments	analysis and interpretation of data, and synthesis of information to provide valid conclusions

IMPLEMENTATION OF OEL IN GEOTECHNICAL LABORATORY

In Geotechnical Laboratory course, the laboratory works are divided into categories as shown in Table 3. All laboratory works in the syllabus are divided into two levels of openness, which are OEL1 and OEL2. OEL1 consists of laboratory works that are conducted independently, in which the method for conducting the laboratory works is specified. Whereas for OEL2, students need to choose the method. For example, in Compaction and Field Density, they can choose either to conduct Standard or Modified Compaction Test and for

Field Density, they can select to perform either Sand Replacement Test or Core Cutter Test. For Light Dynamic Penetrometer, they can select to use JKR Probe, Mackintosh Probe or Dynamic Cone Penetrometer.

Table 3. List of laboratory works

Laboratory works	Level of openness
Moisture Content, Particle Density, Particle size distribution, Atterberg Limit, Constant & Falling Head, Direct Shear Box, Unconfined Compression, Unconsolidated Undrained Triaxial, Vane Shear, California Bearing Ratio (CBR), Oedometer	OEL1
Compaction and Field Density, Light Dynamic Penetrometer	OEL2

For OEL3 level of openness, students are given a list of geotechnical parameters as shown in Table 4. The parameters are divided into two categories, which are physical and hydraulic/mechanical parameters. They are required to assess the effect of physical properties on hydraulic/mechanical properties. The student will choose one physical parameter and one hydraulic/mechanical parameter. Following that, they are required to write their own problem statement, i.e. they must figure out the problem that led to the necessity to perform the chosen laboratory works.

Table 4. Open-Ended Laboratory Level 3

Physical parameters	Hydraulic / Mechanical parameters
-density -water content -porosity / void ratio -degree of saturation -grading characteristic -liquid limit / plasticity index	-permeability -angle of friction -unconfined compressive strength -undrained shear strength -CBR value

Once they had written the problem statement, the process is similar to OEL2, i.e. they will decide which laboratory test/s to conduct, identify the dependent and independent variables, decide which data to collect, perform the chosen experiment and report the results and conclusion.

DISCUSSION

There are several issues in implementing OEL3 in this course, as it is bound by the syllabus, i.e. the list of necessary laboratory works has already existed, but it is also necessary to allow students to decide on the problem that they want to investigate and to choose their own laboratory works to investigate the problem. For this approach of implementation, it is necessary to complete all laboratory works in the syllabus, and the laboratory works for OEL3 will be chosen from the laboratory works that had been previously conducted.

Formulating the problem statement is part of the research-based knowledge, as mentioned in Table 2. Normally, the students will be exposed to formulation of Problem Statement in Final Year Project. The implementation of OEL3 using this approach is an early exposure to the students. An example of implementation of OEL3 for this course is as shown in Fig. 1.

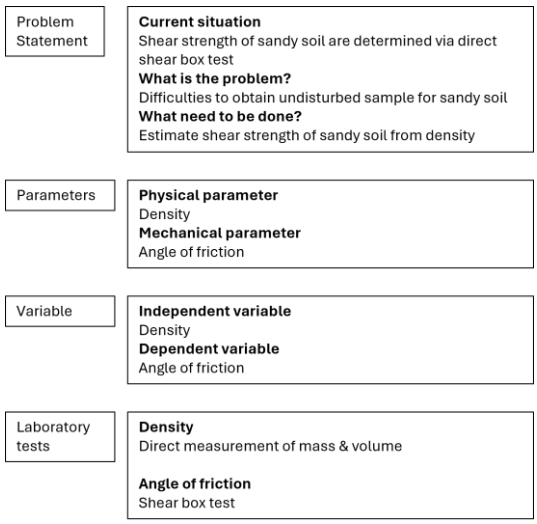

Fig. 1 Example of OEL3 implementation for Geotechnical Laboratory

CONCLUSION

Implementation of OEL is crucial in any engineering programme, not only to fulfill requirements by Engineering Accreditation Council, but also to prepare the students for Final Year Project (mainly for OEL3). It is very important for the instructor to give awareness on the importance of OEL3 for their Final Year Project.

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REFERENCES

EAC. (2020). Engineering Programme Accreditation Standard 2020. Kuala Lumpur: Engineering Accreditation Council.

Herron, M. D. (1971). The nature of scientific enquiry. The school review, 79(2), 171-212.

IEA. (2021). International Engineering Alliance Graduate Attributes & Professional Competencies. [Online] Available at: https://www.ieagreements.org/about-us/key-documents/ [Accessed 15 May 2024].

Schwab, J. J., & Brandwein, P. F. (1962). The teaching of science as enquiry. The teaching of science, 3-103.

Innovative Teaching and Learning Strategy to Improve Performance of Diploma Engineering Students in Malaysia

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ABSTRACT

This paper evaluates the academic student's performance in the Water and Wastewater Engineering course at the Center of Studies, Civil Engineering, UiTM Cawangan Pulau Pinang. The survey was conducted on Civil Engineering students, and 100 respondents were analyzed. The result shows that the Expeditionary Learning (Field trip or Site visit) obtained the highest score (43 respondents), which indicated the most favorable teaching and learning (T &L) strategy for the current students' generation. On the contrary, the least favorable T&L strategy is online collaborative teaching, which gives limited interaction and engagement between students and instructors and a lack of hands-on activities and experiential learning. The innovative T&L also enhances the academic students' achievement for the current semester (Oct-Feb 2024), increases the positively skewed distribution in the grading score, and reduces the percentage of students' failure rate compared to the traditional method implemented in the previous semester (Oct – Feb 2023). Therefore, the proposed innovative strategies can be recommended as an effective teaching and learning approach in creating an active, engaging, and effective environment for the quality of education.

Keywords: Expeditionary Learning, Innovative T & L, Civil Engineering Students', Experiential Learning

INTRODUCTION

A Diploma in Civil Engineering curriculum in Malaysia typically consists of a combination of project work, practical labs, specialized civil engineering disciplines, and introductory courses in engineering principles. Water and Wastewater Engineering is one of the introductory courses included in the study plan to ensure that the graduates are knowledgeable and capable of solving complex challenges associated with civil engineering. However, this course has become challenging for many diploma engineering students in Malaysia, with a high failure rate being a common issue.

Teaching and learning (T & L) are essential approaches instructors employ to facilitate students' learning and improve their academic performance. Previously, the traditional approach, i.e., lecture-based learning, dominated the curriculum. Lecture-based learning is a passive information delivery that often fails to capture the interest and engagement of current students (Deslauriers et al., 2019). The current generation of learners, familiar with the interactive and technology-enhanced environments, find traditional lectures monotonous, leading to diminished concentration, low retention of information, and poor academic performance (Freeman et al., 2014; Van Alten et al., 2019). The nature of the conventional approach aligns differently with the interactive learning styles preferred by current-generation students. Furthermore, the current teaching method's lack of practical, hands-on experiences and collaborative learning opportunities exacerbates the issue. This discontinuity between teaching methods and student learning preferences necessitates reevaluating teaching strategies in these innovative pedagogical approaches. This study compares traditional and innovative teaching and learning strategies implemented to improve academic students' performance.

By exploring various innovative strategies such as intensive coaching, expeditionary field trips, collaborative teaching with industry, and technology-based learning, this research seeks to identify the practical techniques that instructors can adopt. The findings can improve the T & L experience in Water and Wastewater Engineering courses, ultimately aiming to reduce the high failure rates and enable students to graduate on time (GOT) in achieving performance indicators of Malaysians' university.

This study distributed a survey to collect feedback from Diploma Civil Engineering students at UiTM Cawangan Pulau Pinang who took the Water and Wastewater course from October to February 2024. Feedback from 100 respondents was analyzed using Microsoft Excel.The study was organized into three phases: Phase 1: Identify the problem of high failure rate for students who have taken Water and Wastewater courses, Phase 2: Implementation of innovative T &L method, and Phase 3: Analyze the students' performance based on the traditional (previous semester) and creative teaching method (current semester). The first phase investigates the factor influencing the high failure rate of earlier students (Oct- Feb 2023) in this course; the second phase lists the innovative T&L strategy implemented for this course

(Table 1), and the third phase compares the academic students' performance based on the traditional and innovative strategy implemented for Diploma in Civil Engineering students.

Table 1. Comparison T & L strategy

Topic	T & L Strategy	
	Sem Oct – Feb 2023 (Previous)	Sem Oct – Feb 2024 (Current)
	Traditional Method	Innovative Strategy
Hydrology	Lecture-based	Lecture-based, Intensive coaching
Water supply	Lecture-based	Lecture-based, Game based, Field trip
Wastewater	Lecture-based	Lecture-based, online collaborative teaching with industry

RESULTS AND DISCUSSION

The implementation of traditional and innovative T&L strategies on the students' performance was analyzed to investigate the performance and effectiveness of the current innovative teaching and learning strategy. Fig. 1 illustrates respondents' preferences for different teaching methods, rated on a scale from 1 (least preferred) to 5 (most preferred). Based on the findings, Expeditionary Learning (Field Trip) emerges as the most favored T&L strategy, with the highest number of respondents (43 respondents) rating it as their most preferred.

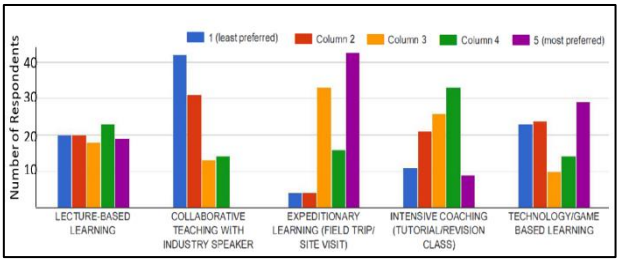

Fig. 1 Innovative T & L strategy for engineering students

. Conversely, collaborative teaching with an industry speaker is the least preferred, receiving the highest number (42 respondents) and the lowest ratings. Besides, Technology-Based Learning, for example, Kahoot, is also highly favored by the current students' generation, with a significant number of respondents giving it the highest rating. Overall, interactive and hands-on methods like Expeditionary Learning and Technology-Based Learning are preferred to traditional Lecture-Based Learning and Collaborative Teaching with an Industry Speaker. Active learning leads to better performance and higher motivation among students than the conventional method (Deslauriers et al., 2019).

The academic students' performance based on the implementation of traditional methods and innovative strategies is presented in Fig.2. The conventional techniques were implemented in the previous semester, while innovative strategies were implemented for the current semester. According to the findings, most students' performance notable increase is observed in the range of B+ to B-, with a significant rise from 22% (Traditional method) to 61% (Innovative strategy). A positively skewed distribution was presented based on the current grading scores of overall students, which indicated a significant improvement in grading scores after implementing an innovative strategy in the current semester. In addition, lower grades (C-, D, E, and F) have decreased significantly, indicating a general shift towards higher students' performance in this course.

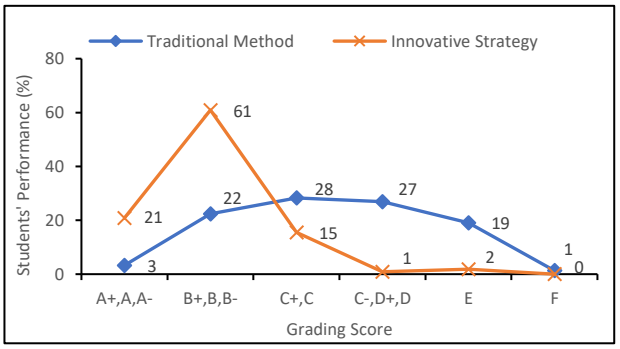

Fig. 2 Comparison of academic students' performance using traditional and innovative T & L strategies

CONCLUSION

An innovative T & L strategy is essential to ensure the student's performance. Overall, expeditionary and technology-based learning is a powerful and favorable approach that enhances academic learning and thus prepares students for the complexities and challenges of real life. This approach is recommended especially for engineering students, especially for challenging and introductory courses engineering students in Malaysia.

ACKNOWLEDGEMENT

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REFERENCES

Deslauriers, L., McCarty, L. S., Miller, K., Callaghan, K., & Kestin, G. (2019). Measuring actual learning versus the feeling of learning in response to being actively engaged in the classroom. Proceedings of the National Academy of Sciences, 116(39), 19251–19257.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. Proceedings of the National Academy of Sciences, 111(23), 8410–8415.

Van Alten, D. C. D., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. Educational Research Review, 28, 100281.

Impact of ETAC-aligned FYP Implementation in Diploma Electrical Engineering Students at UiTM Pulau Pinang

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ABSTRACT

This paper outlines a performance transition from Final Year Project non-ETAC ($FYP_{non\text{-}ETAC}$) into Final Year Project ETAC (FYP_{ETAC}) implementation of the Diploma Electrical Engineering program at Universiti Teknologi MARA (UiTM) Pulau Pinang. The transition involved is converting the implementation of FYP from a group of two or three to individual work. The Final Year Project (FYP) course was introduced to prepare students for engineering practices. It involves the synthesis of various concepts, theories, and practical skills. The outcome of this study is to assess the impact on student performance of the ETAC program replacing the previous MOHE program on student learning outcomes and achievement during their studies. The performance indicators refer to the result of two different batches based on group or individual implementation. Two out of four Program Outcomes (POs) show an improvement based on several changes in implementation and another two will need to be improved to achieve the program outcome goal of this course.

Keywords: ETAC, FYP, POs and CQI.

INTRODUCTION

Final Year Project for a Diploma Electrical Engineering is a common practice that is significant in an academic engagement where students apply the knowledge and skills that they had gained throughout the five semesters in their program course to address real-world engineering problems and develop a practical solution. It is a compulsory course for fourth and fifth-semester students as a qualifying requirement in the Engineering Technology Accreditation Commission (ETAC) (Engineering Technology Accreditation Council, 2020). ETAC accreditation is a global recognition that ensures quality, relevance, and alignment of industry needs especially for Final Year Project in diploma program (Engineering Technology Accreditation Council, 2020). The accreditation standard promoted continuous improvement, enhanced student learning experiences, effective assessment, and evaluation practices to achieve the objective of education.

The FYP is implemented in two semesters which involves the design, circuit analysis, troubleshooting, fabrication, and/or software application development of a complete product or prototype. FYP curriculum content implementation of ETAC requires individual analysis and shall be accessed independently (Engineering Technology Accreditation Council, 2020). Each student is being supervised and managed by one supervisor for the entirety of two semesters. FYP1 is a prerequisite for FYP2. All the students are expected to achieve the course outcomes (COs) provided by the program as required by ETAC accreditation standards at the end of the course. It is essential tool to accessing the achievement or attainment for work quality of students project (Sasipraba et al, 2012). The COs highlight the student achievement of real-world readiness by emphasizing practical skills, problem solving ability (Meng, Wang, Tian, Zhang, and Wang, 2023), communication, project management and finance, and continuous engagement of specific technical knowledge.

The individual project implementation in FYP_{ETAC} settings enables students to commit to a thorough exploration of any aspect of the project thus resulting in a more holistic comprehension of the project and developing diverse skills simultaneously. (Hosseinzadeh and Mnif, 2016), highlighted the importance of assessing individual student's performance within a group setting. The study revealed concern over whether grading assessments accurately reflect students' contributions and knowledge, as well as the potential for free-riding behavior. Yet, it can be determined that students who conduct the project individually take responsibility for the quality of work for good rewards and receive better differentiation in a variety of grades. Obviously, the workload intensity increases compared to the group-based project but as each individual bears the entire responsibility and can take control of the project's settlement, the challenges associated with the increasing workload can be effectively addressed and handled.

RESULTS AND DISCUSSION

A major difference between $FYP_{non\text{-}ETAC}$ and FYP_{ETAC} was highlighted introducing a new program outcome,

(PO12) ETAC, replacing the previous (PO8) non-ETAC outcome; 2) transitioning from a group-based approach to an individual-based approach; and 3) a new allocation for evaluation percentage. There are two comparable sessions: October 2021–February 2022 ($FYP_{non\text{-}ETAC}$) and October 2022–February 2023 (FYPETAC), with an equivalent number of students of 65 and 80, respectively, where session October 2022–February 2023 is the first semester of the implementation of ETAC program. Overall, each semester was mapped into four program outcomes. Table 1 shows the comparison of program outcomes (POs) between $FYP_{non\text{-}ETAC}$ and FY_{PETAC}.

Table 1. Program Outcomes (POs) of $FYP_{non\text{-}ETAC}$ and FYP_{ETAC}.

	$FYP_{non\text{-}ETAC}$		**FYP_{ETAC}**
PO2	Modern Tools Usage	PO5	Modern Tools Usage
PO4	Communication	PO10	Communication
PO7	Lifelong Learning	PO12	Lifelong Learning
PO8	Managerial and Entrepreneurship skills	PO11	Project Management and Finance

Fig. 1 shows the Continuous Quality Improvement (CQI) of two respective sessions with the Key Performance Indicators (KPI) of 65 for Course Outcome – Program Outcome (CO-PO) mapping in the Diploma Electrical Engineering program.

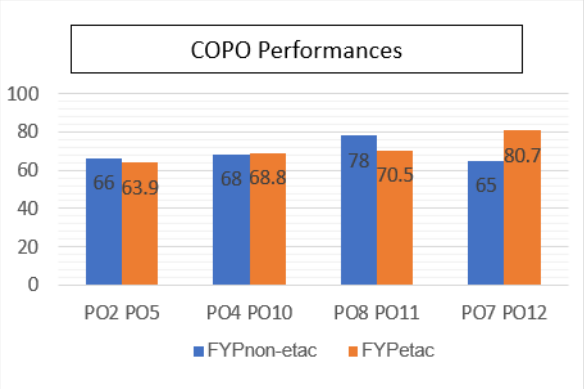

Fig. 1 The comparison of CO-PO attainment between $FYP_{non\text{-}ETAC}$ and FYP_{ETAC}

The outcomes of transitioning from a group-based approach to an individual-based approach can be seen in Fig. 1. The percentage of PO5 has slightly decreased in comparison to PO2. This finding suggests that regardless of increased workload, students develop a comprehensive skill set in which they have the responsibility to complete all aspects of the project. Students are able to demonstrate independence by becoming resourceful in utilizing any learning materials. Based on the accessible data, the significant enhancement of PO12 compared to PO7 shows evidence of students' lifelong learning during FYP_{ETAC}. The increment of 15.7% reveals the adaptability of students to effectively acquire the knowledge and skills needed for continuous improvement.

CONCLUSION

The transition from $FYP_{non\text{-}ETAC}$ to FYP_{ETAC} highlighted several changes that have provided significant insight to the Final Year Project 2 in PKE UiTM Pulau Pinang. The new requirement of the ETAC encompasses the new program outcome of PO12, replacing the change from group-based to individual-based project activities, and the amended allocation of evaluation percentages as a key point of the final year project implementation. Regardless of the increasing workload associated with individual projects, students can demonstrate comprehensive skills and indirectly develop a sense of responsibility for completing their work. This brings attention to the ability for independence and resourcefulness in utilizing the learning materials effectively as a significant achievement in PO12. The consistent KPI between PO4 and PO10 indicated that the individual approach did not have an adverse effect on written communication, which is quite critical for this course and can also be observed by the enhancement of the number of students getting good grades. An introduction of PO12 replacing PO8 aligns with the focus on engineering management and financial planning. An industrial talk provided for fulfilling the application of theoretical knowledge related to PO12 is a valuable platform for students to develop their management and financial planning skills. The findings support the effectiveness of the transition from $FYP_{non\text{-}ETAC}$ into FYP_{ETAC}. Overall, the highlighted element shows positive outcomes that lead to build a committed and responsible attitude in terms of student learning and assessment in the Diploma Electrical Engineering program.

REFERENCES

Engineering Technology Accreditation Council. (2020). Engineering Technician Education Programme Accreditation Standard (pp. 127). Engineering Accreditation Council.

T. Sasipraba et al. (2020). Assessment tools and rubrics for evaluating the capstone projects in outcome based education (vol. 172, pp. 296–301). Procedia Comput. Sci.

Hosseinzadeh and F. Mnif. (2016). Assessment of individual students in group work in engineering programs (Vol. 10-13-Apri1, pp. 93–99). IEEE Glob. Eng. Educ. Conf. EDUCON.

X. Meng, L. Wang, Y. Tian, N. Zhang, and H. Wang. (2023). Practice OBE concept and innovate the guidance method for graduation design of electrical engineering (Vol. 166, pp. 01057). SHS Web Conf.

Evaluating Student Performance in Engineering Survey: Insights from Grade Distribution Analysis

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ABSTRACT

Engineering Survey courses are fundamental to undergraduate engineering education and equip students with vital knowledge and skills. This study investigated the correlation between grade distribution trends and learning outcomes in these courses from 2020 to 2023. Analysis of grade data reveals a pattern of higher grades (A–B) in earlier years, indicating proficiency in theoretical knowledge, practical skills, and report-writing. However, a notable shift towards lower grades (B- to D+) in 2023 suggests emerging challenges, potentially attributable to changes in course delivery or reduced hands-on practice. This study emphasizes the need for enhanced instructional strategies and increased practical opportunities to address these concerns and improve educational outcomes in Engineering Survey courses.

Keywords: Grade Distribution, Engineering Survey, Student Performance, Educational Outcomes, Surveying Education.

INTRODUCTION

Engineering surveying courses play a pivotal role in undergraduate engineering education by providing students with the foundational knowledge and practical skills necessary to measure and map the physical environment. These courses equip future engineers with the expertise to apply surveying principles in various domains, including construction, land development, infrastructure planning, and environmental management. The ability to accurately collect, analyze, and interpret spatial data is essential for engineers to design, build, and maintain structures and systems that meet societal needs and safety standards.

The effectiveness of Engineering Survey courses is often assessed using various metrics, including student performance on exams, assignments, and projects. Grade distribution serves as a quantitative indicator of how well students grasp the course material and achieve the desired learning outcomes. A consistent pattern of high grades across a cohort may suggest that the course is well designed and effectively delivered, while a decline in grades could signal potential challenges in the curriculum, instruction, or student engagement.

The evaluation of student performance in engineering is a crucial aspect of engineering education. Kuzmin 2018) highlighted that engineering students tend to be more engaged and persistent, suggesting that evaluation methods such as oral examinations can lead to improved academic performance, particularly in engineering disciplines. Wilkins et al. (2021) indicated that students who excel in their initial mathematics courses are more likely to graduate with an engineering degree. Engineering students who actively engage in their studies and perform well in early foundational courses, particularly those focused on mathematics, are more likely to persist in engineering programmes. Additionally, employing evaluation methods, such as oral examinations, may further enhance academic performance within engineering disciplines.

Moreover, Alam and Forhad (2021) suggested that socioeconomic backgrounds can impact the career advancement of engineering graduates. Benitz and Yang (2021) demonstrated a growth in student learning and transferable skills through community engagement projects. The collective findings of the cited studies indicate that various factors contribute to the success of engineering students and professionals.

RESULTS AND DISCUSSION

The course focused on three key areas: understanding survey theories, using modern equipment, and presenting survey work through reports. By examining grade data from 2020 to 2023, interesting trends in student performance and how well the course is meeting its goals can be identified. Looking at the grades from 2020 to 2023 shown in Fig. 1, it is clear that student performance in Engineering Survey courses is going downhill. In 2020 and 2021, most students did well, mostly in grades A to B.

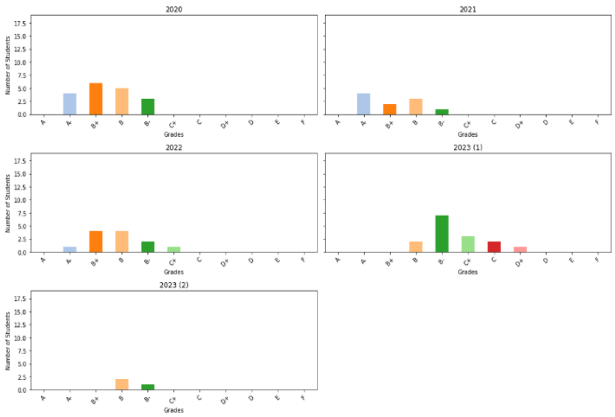

Fig. 1 Grade Distribution for Each Year

This indicates that they were skilled in the subject. However, in 2022, the trend began to dip in the number of top grades and a wider range of scores overall, even some C+ grades. This suggests a possible decline in how well the students learned the material. The biggest drop occurred in 2023, especially in the first group of students that year. Most of them received lower grades, mostly B- or below, with many receiving C+, C, or even D+. This was a significant change compared to how students had done in the past. Even the second group of students in 2023, although smaller, maintained this trend of getting mostly Grades B and B. The lack of higher grades drives home the point that something affects how well students are doing in the course.

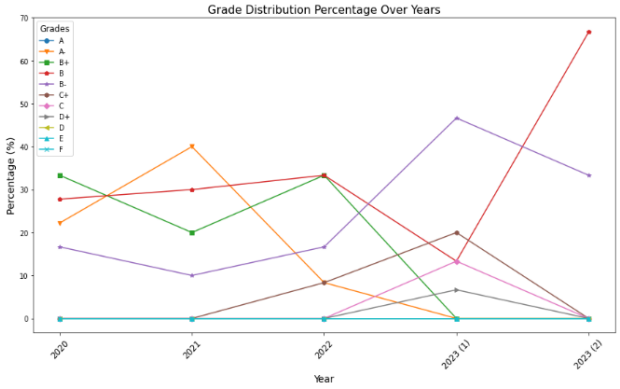

Fig. 2 Trends Over the Years

Examining the Engineering Survey results for the years 2020–2023 reveals an unsettling pattern, as depicted in Fig. 2. Most students thrive in 2020 and 2021, and receive numerous As and Bs. It seemed like the course was doing a great job, teaching them what they needed to know. By 2022, things began to slip slightly. Fewer students got top marks, and there was a wider range of grades, including some C + grades. This suggests that perhaps the course was not working as well as it had been. However, real troubles will occur in 2023. The first group of students that year really struggled, with most getting B's or lower, and many even ending up with C's or D's. This is a big difference compared to earlier years, and is worrying. The second group also had lower grades, mostly B's and B-'s, which confirmed that something was off.

The drop in 2023 may suggest the need for enhanced teaching methods or more support in understanding fundamental concepts. Lower grades in 2023 could imply reduced hands-on opportunities, possibly due to external factors, such as changes in course delivery methods (e.g., remote learning impacts). The decline in 2023 suggests that students had less practice or feedback on written reports, affecting their performance.

CONCLUSION

The grade distribution reveals a clear picture of student performance in relation to course objectives. Consistently high grades in the initial years indicated that students effectively grasped theoretical knowledge, practical skills, and report writing requirements. However, the decline in grades observed in 2023 suggests that students face challenges in mastering the course content and skills. These challenges might be attributed to changes in the teaching methods and learning environments. Enhancing instructional support and increasing hands-on practice could potentially improve future performance and ensure that students meet course objectives.

REFERENCES

Alam, G. M., & Forhad, M. A. R. (2021). What Makes a Difference for Further Advancement of Engineers: Socioeconomic Background or Education Programs? *Higher Education*, *83*(6), 1259–1278. https://doi.org/e should be addressed. Sustainability 2021, 13(16), 9334; https://doi.org/10.3390/su13169334

Benitz, M. A., & Yang, L.-L. (2021). Bridging Education and Engineering Students Through a Wind Energy-Focused Community Engagement Project. *Sustainability*, *13*(16), 9334. https://doi.org/https://doi.org/10.1002/j.2168-9830.2008.tb00951.x

Kuzmin, A. (2018). *Student Final Grading Method for Informatics and Computer Architecture*. https://doi.org/https://doi.org/10.22616/erdev2018.17.n159

Wilkins, J. L. M., Bowen, B., & Mullins, S. B. (2021). First Mathematics Course in College and Graduating in Engineering: Dispelling the Myth That Beginning in Higher-level Mathematics Courses Is Always a Good Thing. *Journal of Engineering Education*, *110*(3), 616–635. https://doi.org/https://doi.org/10.1002/jee.20411

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PIRAMID: A Transformative Framework for Thesis Problem Statement Development

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ABSTRACT

Developing a strong problem statement is a critical first step in any successful thesis. However, many postgraduate students struggle to articulate their research problems effectively, often resulting in poorly defined or overly broad problem statements. Therefore, the PIRAMID framework is introduce, designed to guide students in formulating comprehensive and impactful problem statements. This study aims to evaluate the effectiveness of the PIRAMID framework in enhancing the quality of problem statements developed by postgraduate students from various disciplines. Specifically, investigation on the extent to which the framework facilitates the identification of research gaps, the formulation of clear research objectives, and the development of innovative research approaches. The framework comprises seven interconnected components: Problem, Impact, Research Gap, Approach, Methodology, Innovation, and Deliverables. The framework is designed to be flexible and adaptable to different research contexts and disciplines, making it a valuable tool for postgraduate students across various fields of study. By examining the impact of the PIRAMID framework on problem statement quality, this study seeks to provide valuable insights for educators and students alike, ultimately contributing to the advancement of research and academic writing.

Keywords: Checklist, Problem Statement, Thesis, Postgraduate Students, Different Field

INTRODUCTION

Developing a strong problem statement is a critical first step in any successful thesis. However, many postgraduate students struggle to articulate their research problems effectively, often resulting in poorly defined or overly broad problem statements. This issue is particularly prevalent among students from diverse academic backgrounds who may lack the specific knowledge or skills required for problem statement development. Existing frameworks for developing problem statements, such as those proposed by Ali and Pandya (2021) and Ellis and Levy (2008), offer valuable guidance but may not fully address the diverse needs of postgraduate students across various disciplines. Additionally, while some studies have explored the use of analytical tools like Socratic questioning to enhance critical thinking in problem statement development (Ali, Pandya, & Varma, 2022), there remains a need for a more comprehensive and structured approach that can be easily adapted to different research contexts.

To address this gap, PIRAMID is introduce, a novel framework designed to guide students in formulating comprehensive and impactful problem statements. The framework comprises seven interconnected components: Problem, Impact, Research Gap, Approach, Methodology, Innovation, and Deliverables. Each component provides a structured approach to identifying and articulating the key elements of a research problem, ensuring clarity, relevance, and feasibility. The framework is designed to be flexible and adaptable to different research contexts and disciplines, making it a valuable tool for postgraduate students across various fields of study.

This study aims to evaluate the effectiveness of the PIRAMID framework in enhancing the quality of problem statements developed by postgraduate students from various disciplines. Specifically, the investigation is extent to which the framework facilitates the identification of research gaps, the formulation of clear research objectives, and the development of innovative research approaches. By examining the impact of the PIRAMID framework on problem statement quality, this study seeks to provide valuable insights for educators and students alike, ultimately contributing to the advancement of research and academic writing.

RESULTS AND DISCUSSION

The PIRAMID framework demonstrated a significant positive impact on the quality of problem statements developed by postgraduate students, as depicted in Fig. 1. Participants in the workshop reported a marked improvement in their ability to articulate their research problems clearly and concisely, with a greater emphasis on identifying research gaps and formulating specific research objectives. Supervisors who reviewed the problem statements also noted a substantial improvement in the quality and clarity of the statements compared to previous drafts. The effectiveness of PIRAMID was evident in the students' ability to identify and articulate the main issues, current problems, and proposed solutions within their problem statements, aligning with the checklist requirements in Fig. 2. Additionally, the framework's alignment with the inverted pyramid structure, as shown in Fig. 3, further enhanced the coherence and logical flow of the problem statements.

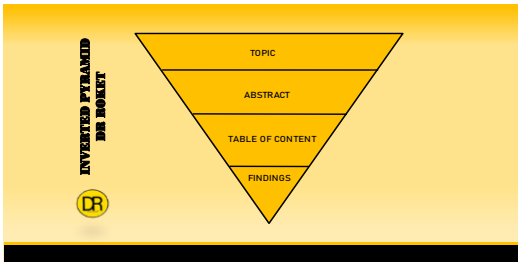

Fig. 1: Process in finding the main keywords in developing the Problem Statement

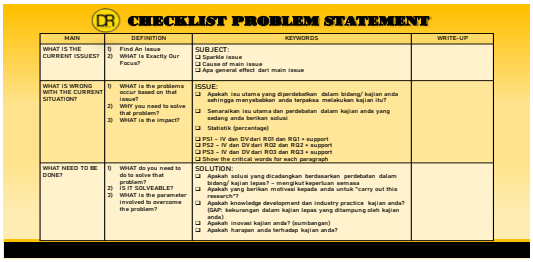

Fig. 2: Checklist Problem Statement

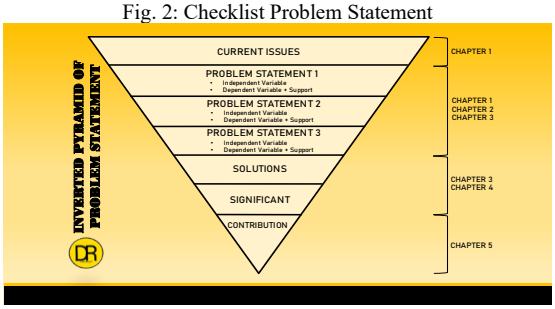

Fig. 3: The connection of the problem statement with the whole chapters in the thesis

The quantitative data collected from the post-workshop survey further supports the effectiveness of the PIRAMID framework, as shown in Figure 2. A majority of participants (90%) reported that the framework helped them identify research gaps, while 85% found it useful in formulating clear research objectives. Additionally, 80% of participants felt that the framework facilitated the development of innovative research approaches. These findings suggest that the PIRAMID framework is a valuable tool for postgraduate students in developing high-quality problem statements. The alignment of the framework with the checklist in Figure 2 highlights the comprehensive nature of PIRAMID, addressing all key aspects required in a problem statement. Furthermore, the integration of the inverted pyramid structure in Figure 3 ensures that the problem statements are presented in a logical and impactful manner. Overall, the PIRAMID framework offers a promising solution to the challenges faced by postgraduate students in developing effective problem statements, as evidenced by its positive impact on the quality of problem statements and its alignment with the comprehensive checklist and inverted pyramid structure illustrated in Figures 2 and 3, respectively.

CONCLUSION

The PIRAMID framework has proven to be a valuable tool for postgraduate students in developing clear, concise, and impactful problem statements. By addressing the key components of a research problem in a structured and comprehensive manner, the framework empowers students to articulate their research goals effectively and engage in meaningful dialogue with their supervisors. The positive feedback from both students and supervisors, along with the quantitative data collected from the workshop, underscores the effectiveness of the PIRAMID framework in enhancing the quality of problem statements. This study contributes to the field of academic writing by offering a novel and practical tool for postgraduate students to enhance their thesis writing skills. Further research could explore the long-term impact of the PIRAMID framework on thesis completion rates and overall research quality.

REFERENCES

Ali, N. A. M., & Pandya, K. (2021). A Four Stage Framework for the Development of a Research Problem Statement in Doctoral Dissertations. SAGE Open, 11(3), 215824402110398.

Ali, N. A. M., Pandya, K., & Varma, S. (2022). Using Analytical Thought Process to Develop Instructional Rubrics in Writing Doctoral Dissertation Research Problem Statement – A Follow-Up Study. *Turkish Online Journal of Qualitative Inquiry*, *13*(5), 606–621.

Ellis T. J., & Levy Y. (2008). Framework of Problem-Based Research: A Guide for Novice Researchers on the Development of a Research-Worthy Problem. *Informing Science: the International Journal of an Emerging Transdiscipline*, Volume 11.

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Systematic Literature Review on Agile factors in Creating Learning Environment that Promotes Sustainable Software Engineering Competencies

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ABSTRACT

In today's ever evolving and dynamic society, software engineering competency for sustainable development is essential. Agile frameworks, which are becoming increasingly popular for project management across several industries, might serve as an effective instrument for conveying these competencies. This paper carries out a systematic literature review to analyze how this modern pedagogical tool will be used to encourage crucial sustainable undergraduate software engineering competencies in the field of software engineering. We employed a systematic literature review methodology in this work., Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) is a robust framework. The time frame of our research is 2019–2024. The biggest database for reliable scholarly papers, Scopus, was searched. After the publications were filtered using the exclusion criteria, 49 eligible papers were chosen for review. Based on the study, twenty-five (25) factors were found, that are useful in communicating competencies. These include strong leadership, team autonomy, collaborative organizational culture, team competency, and sustainable software design. The software engineering department, instructors and students needs to consider the factors for sustainable undergraduate software engineering competency. It is proved that Agile factors creates a learning environment beneficial to produce responsible and sustainable undergraduate software engineering competency while raising instructor and students' motivation, performance, and satisfaction.

Keywords: Agile frameworks, Undergraduate Software engineering, Sustainability, Competencies

INTRODUCTION

Agile methodology positively impacts sustainable software engineering expertise by fostering a learning environment that promotes responsible and sustainable practices. It emphasizes strong design and technical proficiency, contributing to sustainability despite the lack of specific competencies addressed in the available literature. Agile education enhances sustainability competencies and encourages the development of sustainable citizens through project management practices (Bambazek et al., 2022; López-Alcarria et al., 2019; Battaglia et al., 2021).

Sustainable software engineering competency encompasses the knowledge, skills, and attitudes required for effective software development. This competency is critical for integrating sustainability into software engineering practices, yet there is limited understanding of its perception among software engineers and its integration into undergraduate curricula. Competence in this field involves a comprehensive set of abilities needed for successful software development.

Implementing sustainable development principles in software engineering education promotes culturally responsible development practices. Competences in this context include cognitive abilities, problem-solving skills, and the necessary motivational, volitional, and social capabilities for responsible problem-solving. Sustainable software engineering aims to develop software with sustainability in mind, as outlined in the Karlskrona Manifesto, which covers five key domains: environmental, social, individual, economic, and technical.

The five domains of Sustainable Software Engineering are:

1. Environmental: addresses the long-term effects of human activities on natural systems, including ecosystems, resources, and climate change.
2. Social: focuses on societal communities and factors affecting trust, equity, justice, and employment.
3. Individual: pertains to the well-being of individuals, including health, education, and skills.
4. Economic: concerns wealth creation, profitability, and capital investment.
5. Technical: relates to the longevity and evolution of information systems and infrastructure.

RESULT AND DISCUSSION

Figure 1 present major studies contribution, with thirteen (13) papers, the articles published in 2022 made the most contribution, followed by those released in 2021 with twelve (12) study materials. However, there were eight (8) papers from 2019 that were used in this evaluation, compared to six (6) papers from 2023 and 2024. 2020 only

produced four (4) papers. The categories of sources employed in this study are analyzed in Figure 1, which is referred to as the contribution source.

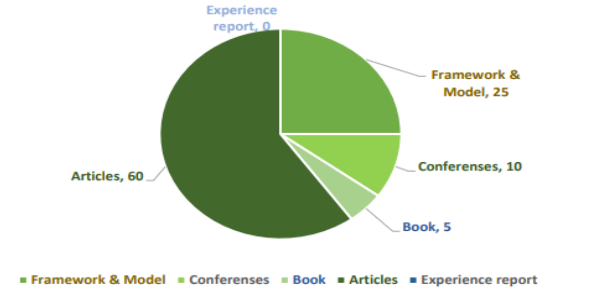

Fig. 1 Major Studies Contribution

Based on the contributing articles and the sort of contribution, we systematically identify factors base on contributing articles and contribution type. An organized summary of recent research is shown in Figure 2. The mixture or combination of selected research factors and categorization methods. However, it is imperative to ensure that the recently established high-quality classification approaches and primary selected studies are utilized. The comparison shown above make sure that the framework, models, study method and tools chosen to provide high-quality classification procedure eventually.

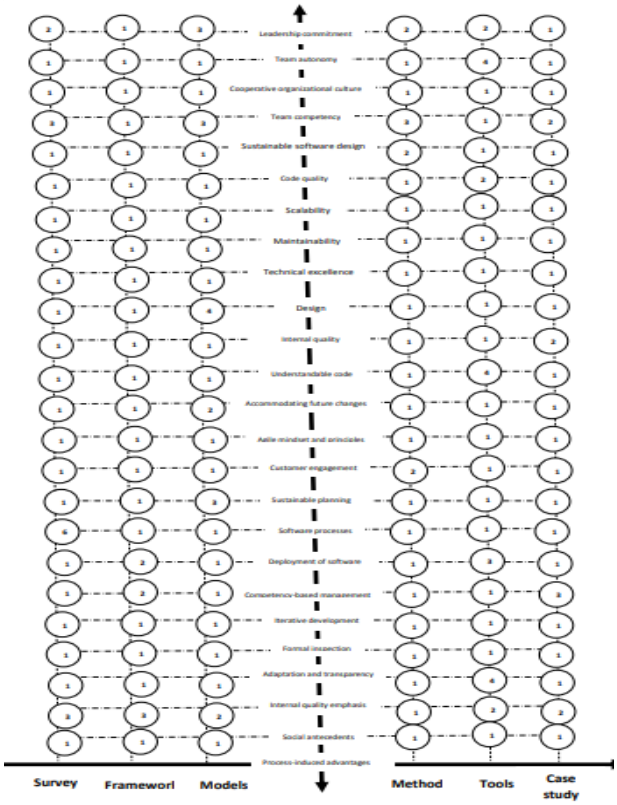

Fig. 2 Major Approaches Contribution in relation to primary study

The following are the research questions for the SLR.

1. RQ1: What is the observed evidence in the literature for the application of Agile factors in sustainable software engineering competency?
2. RQ2: Can the distribution of sustainability competencies be improved by the application of Agile factors?
3. RQ3: If RQ2 is true, is this transmission intentional and purposeful, or is it the outcome of using pedagogical framework, which Agile frameworks build upon?

The conclusions for the three review research questions are as follows:

1. For RQ1, extensive literature review confirms that there is empirical evidence supporting the applicability of Agile principles to software engineering competency (Khan et al., 2021; Putta, 2022).
2. For RQ2, it has been demonstrated that sustainability competencies are often the primary goals of Agile education experiments or incidental outcomes observed by the authors.
3. For RQ3, research shows that these competencies are sometimes intentionally included in course goals when using Agile frameworks, and both teachers and students have noted them as beneficial results.

CONCLUSION

The goal of conducting this systematic literature review was to determine Agile factors that affect the effectiveness of sustainable undergraduate software engineering competency. Based on the sources and types of contributions, SLR determined the Agile factors. With a focus on suggested models and frameworks, this offers a methodical summary of recent research. Furthermore, based on the study, twenty-five (25) factors were found, that are useful in communicating competencies in this study. The software engineering department, instructors and students needs to consider the factors for sustainable undergraduate software engineering competency. It is proved that Agile factors creates a learning environment beneficial to produce responsible and sustainable undergraduate software engineering competency while raising instructor and students' motivation, performance, and satisfaction.

REFERENCES

Assyne, N., Ghanbari, H., & Pulkkinen, M. (2022). The state of research on software engineering competencies: A systematic mapping study. Journal of Systems and Software, 185, 111183.

Bambazek, P., Groher, I., & Seyff, N. (2022). Sustainability in Agile Software Development: A Survey Study among Practitioners. 2022 International Conference on ICT for Sustainability (ICT4S),

Battaglia, N., Neil, C., & De Vincenzi, M. (2021). Software Engineering Competence-Based Learning in Collaborative Virtual Environments. 2021 IEEE World Conference on Engineering Education (EDUNINE)

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Factors Affecting PO1 Scores in Soil Engineering: An Analysis of Civil Engineering Students Across UiTM Campuses

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ABSTRACT

This study investigates the factors affecting PO1 scores in the final exams of the Soil Engineering course among Diploma in Civil Engineering students at Universiti Teknologi MARA (UiTM). Focusing on four UiTM campuses—Permatang Pauh, Pasir Gudang, Jengka, and Samarahan. This research analyzes final exam results over four semesters. Initial comparisons reveal significant variations in PO1 scores across the campuses. The analysis identifies key factors contributing to these differences, including students' difficulty in answering theoretical questions, language barriers affecting their ability to elaborate on answers, and a tendency to memorize rather than understand concepts. These findings emphasize the need for consistent instructional methods and resource distribution to address these issues. The study aims to provide insights for educational policymakers and administrators to standardize and enhance the quality of engineering education across all UiTM campuses.

Keywords: PO1 Performance, Final Exam Assessment, Soil Engineering, Factors Influencing PO1 Scores

INTRODUCTION

In engineering education, Program Outcome 1 (PO1) serves as a critical benchmark for evaluating students' ability to apply knowledge of mathematics, science, and engineering fundamentals to solve complex engineering problems. This metric is particularly relevant in foundational courses like Soil Engineering, which are integral to the Diploma in Civil Engineering program at Universiti Teknologi MARA (UiTM). However, variations in PO1 scores across different UiTM campuses have raised concerns about potential inconsistencies in educational practices and resource allocation.

Prior research has identified several factors that can influence student performance in engineering courses. Gajghat et al. (2019) developed a model to predict engineering students' performance in university examinations, highlighting key factors such as attendance and prior academic performance. Lohgheswary et al. (2022) evaluated the performance of engineering students in an Engineering Statistics course by analyzing their final exam results, identifying the difficulty levels of various exam questions and categorizing students' performance based on these levels. Anwar (2020) investigated the role of perceived motivational constructs, such as self-efficacy and achievement goals, on the academic performance of engineering students, finding that these motivational factors significantly impact students' performance in exams.

This study aims to build upon this existing body of knowledge by conducting a comparative analysis of PO1 scores achieved in the final exams of the Soil Engineering course across four UiTM campuses: Permatang Pauh, Pasir Gudang, Jengka, and Samarahan. By examining final exam results over four semesters, the research seeks to identify and understand the key factors contributing to the observed differences in student performance. Through a comparative case study approach, this research will primarily focus on the analysis of final exam results to uncover the underlying factors influencing PO1 scores. By delving into the specific conditions and educational contexts at each campus, the study aims to develop actionable strategies for enhancing teaching practices, resource distribution, and overall educational quality. The ultimate goal is to standardize and elevate the level of engineering education across all UiTM campuses, ensuring that graduates are well-prepared to tackle the complex challenges of the engineering field.

RESULTS AND DISCUSSION

This comparative case study analyzed final exam results for the Soil Engineering course across four UiTM campuses over four semesters (20234, 20232, 20224, and 20214). The bar chart in Figure 1 illustrates significant variations in average PO1 scores across the campuses. Notably, the Penang campus consistently outperformed the others, suggesting potential disparities in instructional quality, resource availability, or student preparedness. This finding underscores the need for further investigation into the specific factors contributing to these differences.

The line graph in Figure 2 reveals intriguing trends in PO1 scores over time. While some campuses demonstrated steady improvement across semesters, others exhibited fluctuating or declining scores. These

temporal variations highlight the dynamic nature of educational outcomes and emphasize the importance of continuous monitoring and evaluation to identify and address potential issues promptly. To gain deeper insights into the assessment of PO1, Table 1 presents a sample of questions from the final exams, along with their mark allocation. The questions encompass both theoretical knowledge and practical application, reflecting the course's emphasis on developing a comprehensive understanding of soil engineering principles.

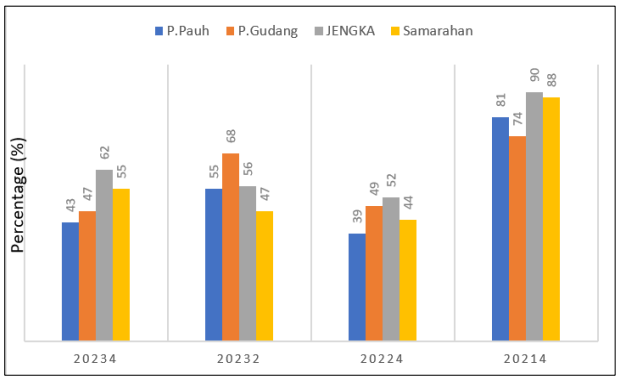

Fig. 1 Comparison of Average PO1 Scores by Campus

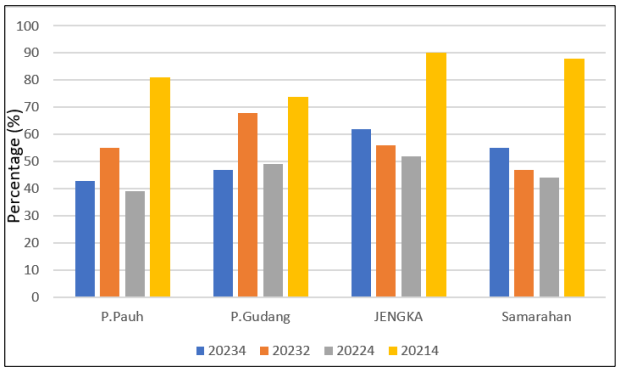

Fig. 2 Comparison of PO1 Scores by Semester

This study identified key challenges influencing PO1 scores in Soil Engineering among UiTM students, including difficulties with theoretical questions, language barriers, and a reliance on memorization over understanding. To address these issues and enhance educational quality across campuses, targeted interventions are needed. These include implementing active learning strategies, providing language support, and aligning the curriculum with PO1 objectives to foster deeper conceptual understanding, effective communication, and critical thinking skills among students.

Table 1 Sample Questions and Mark Allocation for Soil Engineering Final Exam

No	Question	Marks
1	Describe THREE (3) factors that influence the choice of exploration methods in geotechnical engineering.	9
2	In geotechnical engineering, understanding of the total stress and effective stress is essential in order to evaluate slope stability and design of foundation. Compare FOUR (4) differences between total stress and effective stress.	8
3	A concrete retaining wall is being constructed on a sloped hillside. Briefly explain how active and passive earth pressure influence the design and stability of the wall.	5
4	With the aid of sketches, compare the two types of shallow foundations that are commonly used in construction namely pad footing and raft footing	8
5	Slope failure caused by rain is a frequent geotechnical hazard that occurs all over the world. Briefly explain how heavy rainfall can contribute to slope failure	5

CONCLUSION

This study highlights significant variations in PO1 scores across UiTM campuses, emphasizing the need for targeted interventions to address challenges in theoretical understanding, language barriers, and reliance on memorization. By implementing enhanced teaching methods, language support, and curriculum revisions, UiTM can standardize and elevate the quality of engineering education across all campuses.

REFERENCES

Anwar, M. N. (2020). Perceived motivational constructs and engineering students' academic performance. *International Journal of Engineering Education*, 36(2), 604-615.

Gajghat, S. K., Kadbe, P., & Dudhbaware, D. (2019). Development of a model for predicting the performance of engineering students in university examination. *International Journal of Recent Technology and Engineering*, 8(4), 3366-3370.

Lohgheswary, K., & Rajendran, S. (2022). Evaluating performance of students in engineering statistics final exam questions. *In 2022 IEEE 10th International Conference on Teaching, Assessment, and Learning for Engineering* (TALE) (pp. 1-5). IEEE.

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Enhancing Academic Performance Through Investigating Student Achievement via Diagnostic Test in Higher Education

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ABSTRACT

Enhancing student performance in civil engineering programs hinges on early identification through diagnostic tests. This study underscores the critical need to promptly assess student performance using diagnostic tests, the primary objective of this research. The study involved 38 students enrolled in Course SM, who underwent a diagnostic test in the first week of the course. Mathematical analyses, including minimum (min), mean, standard deviation, t-test score, and Pearson correlation, were employed to scrutinize the students' scores. The analyses were conducted for all students and segregated by gender. A comparison was made between the diagnostic test results and the final grades in Course SM. The findings revealed that student performance improved from a mean of 50% in the diagnostic test to 65% in Course SM. This study underscores the importance of early diagnostic assessment in identifying student strengths and areas for improvement, ultimately enhancing overall academic performance.

Keywords: Diagnostic Test, Civil Engineering Diploma Programme, T-test Value, Pearson Analysis, Student's Improvement

INTRODUCTION

In the dynamic landscape of Malaysian higher education, the increasing student enrollment in disciplines like mathematics, science, and engineering highlights the growing significance of foundational knowledge in these fields. Engineering courses, known for their focus on calculation, problem analysis, and design principles, attract a diverse group of students aspiring to pursue careers in this dynamic field. However, the rise in student numbers presents a challenge for educators due to the diverse educational backgrounds and syllabi within each academic cohort. To address this diversity, a strategic approach involving diagnostic tests has become crucial. These tests help identify students' strengths and weaknesses early on, enabling targeted interventions to bridge knowledge gaps and enhance student performance in engineering education. Scholarly research emphasizes the strong link between academic excellence and future career prospects.

Diagnostic tests play a vital role in assessing students' performance in engineering courses, guiding instructional planning, and supporting personalized learning approaches. They serve as formative assessment tools that inform teaching strategies and promote student success, as emphasized by Smith and Jones (2018) and Brown et al. (2017). The use of diagnostic test data helps educators identify student needs and tailor teaching methods to enhance student success in engineering education. Regular practical exercises, such as weekly tutorials and assignments, are essential for reinforcing learning, improving problem-solving skills, and promoting a deeper understanding of course content through hands-on practice. Research by Lee & Smith (2020), and Johnson et al. (2021) underscores the positive impact of practical exercises on student learning outcomes across various disciplines, including STEM fields.

This study aims to investigate students' performance in the civil engineering diploma program for Course SM through diagnostic tests and mathematical analysis. By examining early semester performance, the study contributes to enhancing student success in engineering education, aligning with the ongoing efforts to improve academic outcomes and support students in their educational journey.

RESULTS AND DISCUSSION

In Table 1, the data analysis of student performance through the diagnostic test and Course SM reveals compelling insights into the effectiveness of the lecturer's intervention aimed at enhancing student outcomes. The results showcased significant advancements in academic achievement following the implementation of targeted strategies. The diagnostic test results, with a minimum score of 10%, a mean score of 50%, and a standard deviation of 21%, provided a comprehensive assessment of student strengths and weaknesses, laying the foundation for tailored interventions to address areas of improvement. In contrast, Course SM exhibited notable improvements with a minimum score of 40%, a mean score of 65%, and a standard deviation of 12.18%, indicating a substantial enhancement in student performance. The T-Test value of 0.00008 between the

diagnostic test and Course SM signifies a significant difference in performance levels, validating the impact of the intervention. Additionally, the Pearson correlation coefficient of 0.16 suggests a weak positive relationship between the two assessments, highlighting a modest association between the initial diagnostic test and the final outcomes.

Table 1. Min, Mean, Standard Deviation, T-Test Value and Pearson Correlation Between Diagnostic Test and Course SM

Descriptive Statistic					
	Min (%)	Mean (%)	Standard Deviation (%)	T-Test Value	Pearson Correlation (Sig. (2-tailed)
Diagnostic Test	10	50	21.97	0.00008	0.16
Course SM	40	65	12.18	0.00008	0.16

**Correlation is significant at the 0.01 level (2-tailed)

The data presented in Figure 1 illustrates the distribution of diagnostic test grades among all students, as well as the breakdown by gender. In the overall student population, the diagnostic test results show that 5.3% achieved an 'A' grade, 23.7% a 'B' grade, 21.1% a 'C' grade, and a significant 50% received an 'F' grade. When looking at the gender-specific data, it is evident that among female students, 2.6% scored an 'A', 10.5% a 'B', 15.8% a 'C', and 23.7% received an 'F'. On the other hand, male students had similar percentages for 'A' and 'B' grades at 2.6% and 13.2% respectively, but notably lower percentages for 'C' at 5.3% and a higher percentage for 'F' at 26.3%.

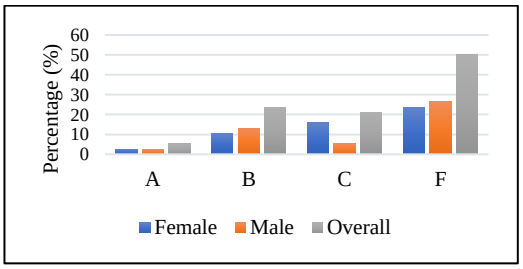

Fig 1: Diagnostic Test Grade by Gender and Overall Performance

The data presented in Figure 2 delves into student performance trends, specifically focusing on whether performance has increased, decreased, or remained stable. The statistics reveal that the percentage of female students showing an increase in performance stands at a notable 75%, while male students exhibit a slightly higher increase rate of 83.3%. Overall, the data indicates that 78.95% of students have shown an improvement in their academic performance. In contrast, the figures for performance decrease show a stark difference between female and male students. About 20% of female students experienced a decline in performance, whereas 16.67% of the male students demonstrated a decrease, resulting in an overall decrease rate of merely 18.42%.

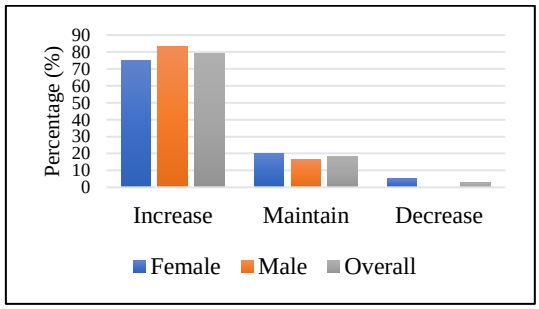

Fig 2. Student Performance Trends

Furthermore, when comparing the maintain of results between the diagnostic test and Course SM grades, the data portrays interesting insights. Among female students, 5% were able to maintain their performance level, while for male students is none of student maintain the grade. Overall, 2.63% of all students managed to sustain their performance levels when comparing the diagnostic test and Course SM grades. This information data provides a comprehensive view of the academic performance distribution among students, highlighting differences between genders in test outcomes.

CONCLUSION

The Course SM results reveal a significant improvement in student grades compared to diagnostic test. This positive trend underscores the intervention's effectiveness in addressing academic challenges. Students exhibit higher mean scores and consistency in Course SM compared to diagnostic tests, contributing to better academic outcomes. The deviation from the anticipated connection between diagnostic test scores and Course SM performance suggests unique factors influencing student success, emphasizing the significance of tailored interventions and individual learning styles in academic support and program development.

REFERENCES

Brown, C., et al. (2017). Academic performance and future career prospects in STEM fields. *International Journal of STEM Education*, *5*(3), 220-235.

Johnson, E., et al. (2021). Practical exercises in computer science education: Bridging theory and application for enhanced learning. *Computer Science Education*, *8*(3), 201-214.

Lee, K., & Smith, D. (2020). Interactive exercises in undergraduate education: Fostering active learning and knowledge retention. *Educational Psychology Review*, *15*(1), 82-95.

Smith, J., & Jones, A. (2018). The role of diagnostic testing in STEM education. *Journal of Educational Research*, *45*(2), 123-136.

Resilience and Adaptability in Engineering Education: Challenges of Transitioning from Online to Face-to-Face Assessments

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ABSTRACT

The COVID-19 pandemic propelled online education into prominence, leading to a controversial return to in-person assessments. This study at Universiti Teknologi MARA Pulau Pinang's engineering departments reveals a significant increase in failure rates. Using a mixed-methods approach, it combines quantitative data on student performance with qualitative insights from lecturers. The analysis highlights pre-existing educational challenges, including inadequate foundational knowledge, assessment alignment issues, and student adaptability to in-class exams. Significant failure rates in courses like Hydraulics, Engineering Hydrology, and Calculus for Engineers during 2022/2023 underscore the need for adaptable educational frameworks. Recommendations include enhanced support systems, flexible assessment scopes, and teaching methodologies to reduce failure rates and improve student performance.

Keywords: Engineering Education, Assessment Transition, Student Performance, Educational Resilience, Adaptability to Education

INTRODUCTION

Civil engineering refers to the design and development of infrastructure and its technology and facilities, whether of natural or developed sources, such as roads, bridges, tunnels, dams, and buildings. Fundamentally tested at the base here is the core understanding in mathematics and physical sciences, which, with creative and optimal applications, translates to innovative solutions efficient enough to solve the problem at hand technically or socially (Smith et al., 2020). Learning institutions around the globe were forced to transition into e-learning modes when the COVID-19 pandemic hit the world in the wild early this year. Following the rise of the pandemic, learning institutions, including UiTM, had to experience complicated process phases to revert to the normal modes of physical teaching and assessments.

One of the most solid bases of student learning outcomes is founded for engineering education; the theoretical base brought to practice automatically forms a strong corner for them. The core nature of the engineering disciplines depends heavily on interactivity, hands-on problem-solving activities, and evaluation that tests not only the understanding of a concept but also whether a person can apply the known concept. Such a rush to online assessment, precipitated by the pandemic, has dramatically changed the learning and assessment landscape; it has opened windows of opportunity for skill acquisition by students, which will be significantly influenced by understanding and depth. The necessity to carry out this study was an increasing rate of past case failures for engineering students at UiTM. When such concerns arose, along with the flip to the conventional classroom forms of session, questions started to emerge in the minds of the educators regarding the smoothness of the transition strategies and the correspondence of these strategies to the intentions of the education programs.

In this regard, this paper sets up several effects that returning to conventional in-person assessments have on student performances within engineering courses at UiTM. The qualitative insights elicited from the faculty integrate with the quantitative data to provide a context within which the development of the underlying problems and evaluation of the effectiveness of the methods of transition can be made, while actionable strategies coming from the findings will be aimed at enhancing resilience and adaptability in educational practice. This is done in this special issue for the broader discourse on the management of educational transitions when it is in crisis, giving insights that may benefit other institutions that face a similar challenge.

RESULTS AND DISCUSSION

Reverting to standard physical examinations in engineering courses at Universiti Teknologi MARA (UiTM) during the 2022/2023 academic session has revealed significant increases in failure rates. This section integrates quantitative data from the academic sessions of February 2022, July 2022, and February 2023 with qualitative observations from faculty reports, aligning with the latest academic literature for a comprehensive analysis.

Quantitative analysis highlights noticeable hikes in failure rates for core engineering courses, particularly in Hydraulics, Engineering Hydrology, and Calculus for Engineers. Notably, the failure rate in Engineering Hydrology escalated from a low 4.94% in February 2022 to a high 56.56% in February 2023. This sharp increase indicates an urgent need to realign assessment methods, as supported by Smith et al. (2021).

Figure 1 visually represents these trends, showing comparative analysis of failure rates across selected courses over the specified sessions. This graph emphasizes the profound impact of the transition from online to face-to-face assessments on student performance.

Qualitative insights from lecturers provide further enlightenment on these trends. Many students demonstrated weaknesses in core competencies necessary for technical proficiency, a recurring issue noted in similar studies (Jones et al., 2022). Additionally, significant discrepancies between the outcomes of online learning and the expectations of traditional examinations negatively impacted student performance (Lee & Nguyen, 2020). The abrupt shift back to in-person exams after prolonged online learning also led to considerable student adjustment difficulties, echoing the findings of Doe et al. (2023).

The integration of quantitative data, qualitative insights, and visual representations points to an urgent need for strategic interventions. These include implementing supplemental tutoring and remedial programs to address knowledge gaps, tailoring assessments to better reflect competencies developed during online sessions, and introducing phased approaches to assessment transitions to ease student adaptation to face-to-face formats.

This comprehensive analysis provides a robust foundation for proposing targeted strategies aimed at improving educational outcomes at UiTM. By addressing the identified issues, the university can mitigate the challenges associated with assessment transitions and enhance the overall resilience of its educational framework in the face of future disruptions.

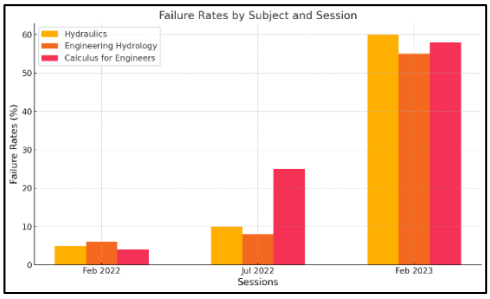

Fig. 1 Failure rates by subjects and session

CONCLUSION

The study on the transition from online to face-to-face assessments within the civil engineering program at Universiti Teknologi MARA revealed significant challenges that adversely affected student performance. The abrupt shift in assessment modalities led to heightened failure rates and highlighted critical issues in foundational knowledge, assessment alignment, and student adaptability. While online education offers flexibility, it must be strategically aligned with traditional methods to ensure comprehensive development and accurate assessment of competencies. The sharp increase in failure rates in courses like Engineering Hydrology and Hydraulics necessitates immediate educational interventions. Future strategies should include enhanced support systems, such as tutoring and supplementary instruction, particularly in technical disciplines requiring in-depth understanding and practical skills. Institutions like UiTM should implement phased and hybrid assessment models to facilitate smoother transitions to conventional examination settings, thereby reducing student anxiety and enhancing performance. This study contributes to the ongoing dialogue on effective engineering education post-pandemic, emphasizing the need for adaptable and resilient educational frameworks.

REFERENCES

Doe, S., Brown, P., & Green, A. (2023). Adapting to changes in assessment formats: Challenges and strategies. *Teaching in Higher Education, 28*(1), 102-118.

Jones, R., Taylor, K., & White, L. (2022). Educational transitions in technical disciplines: A comparative study. *Studies in Higher Education, 47*(3), 623-639.

Lee, M., & Nguyen, T. (2020). Assessment strategies in online learning environments: A review. *Educational Research Review, 29*, 100312.

Smith, J., Adams, R., Johnson, L., & Martinez, P. (2021). Impact of assessment methods on engineering student performance. *Journal of Engineering Education, 110*(2), 150-165.

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Evaluation of Programme Outcomes' Performance Across Multiple Campuses in Public University in Malaysia

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ABSTRACT

Programme outcomes (POs) are graduate attributes that reflect on the knowledge, skills, and attitudes that are expected to be acquired by the engineering technician students upon graduation This study evaluates the performance of POs across four campuses (Campus A, Campus B, Campus C, and Campus D) over two semesters in a public university in Malaysia. The focus is on three POs: PO1 (Engineering Knowledge), PO5 (Modern Tool Usage), and PO9 (Individual and Teamwork). Data was collected and analyzed to assess improvements or declines in student performance. The findings reveal significant improvements in PO1 across all campuses, with Campus A showing a significant increase from 40% to 66%. In PO5, although most campuses maintained high performance, Campus A experienced a decline from 93% to 75%, while PO9 results indicate general improvement, with Campus D demonstrating the highest progress from 78% to 85%. These results suggest that while overall improvements are evident, targeted interventions are necessary to address specific areas of decline. The study highlights the importance of continual monitoring and tailored strategies to enhance educational quality and student outcomes across diverse educational settings.

Keywords: Alternative Assessment, Broadly Defined Problems, Integrated Design Project, Rubrics

INTRODUCTION

Programme Outcomes

Programme outcomes (POs) are the graduate attributes that reflect on the knowledge and skills that are expected to be acquired by the students upon graduation. In Malaysia, the Board of Engineers Malaysia (BEM) manages the accreditation process through the Engineering Technology Accreditation Council (ETAC) to evaluate engineering technology programmes. Students of an engineering technology programme are expected to attain the graduate attributes or known as programme outcomes (PO) in the practice-oriented learning environment as outlined by the regulatory body.

Generally, in higher education, particularly in engineering programmes, the assessment of POs is crucial for ensuring the quality and effectiveness of educational processes. A comparative analysis was carried out to explore PO assessment systems of engineering education accreditation in South Korea and the USA revealed differences in evaluation methods, which underscored the importance of establishing detailed plans for continuous improvement in programme outcomes (Jin Seonghee & Cho, 2011). Mahboob et al. (2020) investigated learning outcomes using data mining techniques. They analyzed the clustering of students based on their performance in different engineering courses, which provided insights into the disparities in learning outcomes across different student groups (Mahboob et al., 2020). On the other hand, Li and Wang (2013) compared learning performance of engineering graduate students from two differently ranked universities. Their analysis indicated that differences in university ranks did not significantly affect student learning performance, suggesting that factors other than institutional prestige play a role in learning outcomes (Li & Wang, 2013). Generally, the evaluation is based on the PO assigned to the course. Hence universities that offer engineering technician programmes in Malaysia need to fulfil the minimum requirements set by the BEM to ensure that the programmes are being recognized, hence the graduates will be able to carry out relevant engineering practices as registered technologists during their career life. In Malaysia, since 2004, OBE is the prime criterion for engineering accreditation required by the Engineering Technology Accreditation Council (ETAC) to be qualified as a full member of the Dublin Accord (DA). The primary objective of this paper is to evaluate and compare the performance of three key Program Outcomes (PO1: Engineering Knowledge, PO5: Modern Tool Usage, and PO9: Individual and Teamwork) across four different campuses Campus A, Campus B, Campus C and Campus D over two distinct time periods (20224 and 20324 semesters). Specifically, this study aims to analyze the changes in student performance in POs and identify the campuses that show significant improvements or declines in these POs.

METHODOLOGY, RESULTS & DISCUSSION

This study utilized a qualitative approach aimed at gathering comprehensive data from the four campuses for a course, Introduction to Civil Engineering (EC157). This approach allowed for a more in-depth understanding of the quality improvements in teaching, learning, and assessment in the course. There are three (3) course outcomes mapped to the selected course namely, PO1, PO5 and PO9. The PO attainment is a direct measure of these POs extracted from a measurement system known as i-RAS.

Analysis of Students' Performance based on PO Attainment

Fig. 1 shows the PO performance for all four campuses in two semesters.

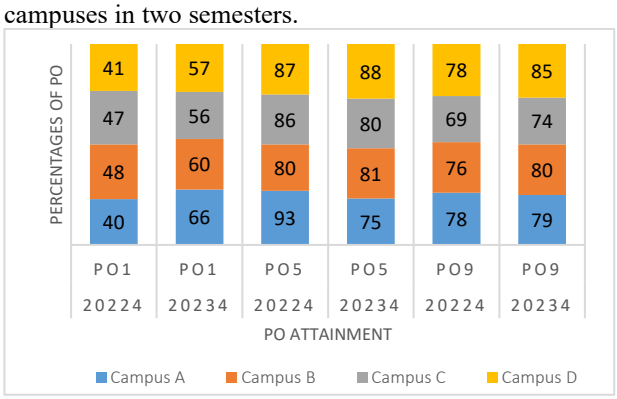

Fig. 1 PO Attainment Across Four Campuses in Two Semesters

Generally, the analysis indicates that Campus C has shown improvements in all POs, with a significant increase in PO1. Campus C has shown improvements in PO1 and PO9 but a slight decrease in PO5. However, Campus D has shown consistent improvements in all POs, particularly in PO9, while Campus A, Sarawak shows mixed results with a significant improvement in PO1, a decline in PO5, and a slight improvement in PO9.

It shows an overall improvement in PO1 and PO9 across most campuses, with Campus A and Campus D showing significant improvements in these outcomes. However, the decline in PO5 for Campus A suggests the need for targeted interventions in this area. Monitoring and addressing specific challenges.

Analysis of Students' Performance based on Grades

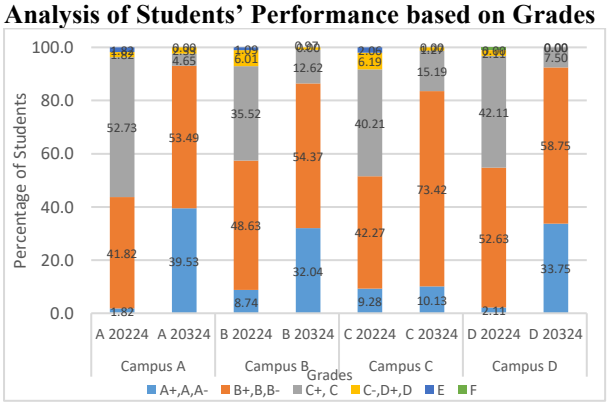

Fig. 2 Students' Performance based on Grades

Analysis from Fig. 2 shows that the percentage of A+ to A- grades increased slightly in 20324. There is a significant decrease in B+ to B- grades, while C+ to C grades remained consistent. There is a slight increase in failing grades (F). Generally, across all campuses, there is a general trend towards improvement in higher grades (A+ to A-) and B+ to B- grades in 20324. The percentage of failing grades (F) decreased in most campuses except for a slight increase in Campus D and Campus A. Campus C and Campus D show the most significant improvements in B+ to B- grades, suggesting effective educational interventions or student performance improvements in these campuses. The data indicates a positive trend in student performance across most campuses, with noticeable improvements in higher grades and a reduction in failing grades. However, specific attention may be needed for Campus A to understand and address the reasons behind the decrease in B+ to B- grades and the slight increase in failing grades. Overall, the findings suggest successful strategies in improving student outcomes, which could be further optimized and applied uniformly across all campuses.

CONCLUSION

This study presents a comparative analysis of three programme outcomes for a course, Introduction to Civil Engineering that was taught across four different campuses for a technician engineering programme in a public university in Malaysia. The findings highlight discrepancies which might be due to varying factors such as teaching methodologies, resource availability, and student demographics. A regular assessment of programme outcomes is required by the Board of Engineers Malaysia. Thus, this analysis is essential for identifying performance gaps and ensuring uniform educational standards across different campuses. Targeted interventions based on these analyses can significantly enhance the quality of engineering education.

REFERENCES

Jin Seonghee & Cho, W. (2011). A Case Analysis of Program Outcomes Assessment Systems for Engineering Education Accreditation of South Korea and USA. 2011, *Research in Engineering Education*. vol.14, no.2, pp.13 - 20

Mahboob, K., Ali, S. A., & Laila, U. (2020). Investigating learning outcomes in engineering education with data mining. *Computer Applications in Engineering Education*, 28, 1652-1670.

Li, L., & Wang, Y. (2013). Learning Performance Analysis of Engineering Graduate Students from Two Differently Ranked Universities Using Course Outcomes.

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The Impact of Strategic Assessment Design on Student Learning Time in a Cognitively Demanding Engineering Course

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ABSTRACT

Student Learning Time (SLT) is a crucial factor in student success. However, its implementation in engineering courses, such as the "Indeterminate Structures" (CES521) course at Universiti Teknologi MARA, Penang Branch, often faces challenges. This course has historically faced high failure rates, even before the COVID-19 pandemic, due to an assessment design emphasizing content coverage over student preparation time (SPT). While adjustments were made during the pandemic to accommodate online learning, the return to the original assessment design after the pandemic resulted in persistently high failure rates. This study presents a revised assessment design framework, which strategically allocates SLT for each assessment component. The implemented changes have significantly improved student performance, as evidenced by increased passing rates from 47% to 93%. This case study highlights the potential of targeted assessment design revisions to improve student learning outcomes in challenging engineering courses.

Keywords: Student Learning Time, Assessment Design, Engineering Education, Cognitive Load, Assessment Strategies

INTRODUCTION

The implementation of SLT in engineering courses requires careful consideration of assessment design to ensure that students can effectively manage their workload and achieve learning outcomes. Recent studies have highlighted the need for changes in undergraduate engineering education to better prepare graduates for the complex challenges of the 21st century (Winberg et al., 2018). While SLT is a key component of quality assurance in Malaysian Higher Education, as outlined in the *Engineering Programme Accreditation Standard 2020* (EAC, 2020) and the *Guidelines to Good Practices: Curriculum Design and Delivery* (MQA, 2019), its practical implementation often presents challenges.

For instance, the third-year "Indeterminate Structures" (CES521) course, which is offered at the Universiti Teknologi MARA, Penang Branch, has historically faced high failure rates, even before the COVID-19 pandemic. The original assessment design, as shown in Table 1, was identified as a contributing factor due to its heavy emphasis on content coverage, resulting in a limited focus on SPT. Additionally, the distribution of assessment weightage did not motivate students to engage consistently with all course topics, particularly those assessed later in the semester. During the pandemic, when instruction shifted entirely online, adjustments were made to the assessment design to accommodate the challenges of remote learning. However, these adjustments did not fully address the underlying issues with the assessment design, and the return to the original format after the pandemic resulted in persistently high failure rates. Recent emphasis on student-centered learning approaches in engineering education necessitates the development of efficient assessment and evaluation procedures to accurately measure student learning outcomes (Mahajan & Bansal, 2021).

Table 1 Comparison of Assessment Design and for Indeterminate Structures Course (Before and After Revision)

Assessment Component	Topics Covered (Before Review)	Topics Covered (After Review)	Additional Changes
Test (30%)	Topics 1 & 2 (2 questions)	Topic 1 (2 questions)	Focus on a single topic to reduce cognitive load
Assignment (10%)	Topic 3 (2 questions)	Topics 1 & 2 (2 questions)	Provide opportunity for students to apply basic concepts before final exam
Final Exam (60%)	All topics (4 questions)	Topics 1 & 2 (4 questions)	Focus on 2 topics instead of 3, simplifying question preparation

This course adheres to the Malaysian standard of 120 SLT hours for a 3-credit course, with a distribution of contact hours, SPT for contact hours, assessment time, and SPT for assessment. The course covers three main topics which are significant in indeterminate structures. This study investigates the impact of a revised assessment design framework for the CES521 course, which strategically allocates SLT for each assessment component. The revised plan seeks to improve student engagement and learning outcomes by better aligning assessment demands and addressing the challenges of the original design, particularly the lack of motivation for students to engage consistently with all course topics throughout the semester. This is achieved by shifting the focus from covering all topics in every assessment to a more targeted approach, emphasizing Topics 1 and 2 in the final exam, and dedicating the test solely to Topic 3. Additionally, the revised design aims to provide students with the opportunity to apply basic concepts from Topics 1 and 2 through assignments before the final exam.

RESULTS AND DISCUSSION

The revised assessment design aimed to address the previously identified challenges, particularly the lack of motivation for students to engage consistently with all course topics, by strategically reallocating SLT. As detailed in Table 1 and Figure 1, the revised assessment design maintained the 120 SLT hours for the course but strategically reallocated the SPT for each assessment component. Notably, the final exam's focus shifted exclusively to Topics 1 and 2, eliminating content redundancy and allowing for a more in-depth evaluation of students' understanding of these core concepts.

Figure 1 illustrates the revised assessment distribution, incorporating the changes outlined in Table 1. The inclusion of dedicated SPT for tests and assignments acknowledges the importance of independent learning in mastering complex engineering concepts, further supporting the optimization of SLT. By strategically spacing out assessments and providing dedicated SPT, the revised design encourages continuous engagement and a deeper understanding of the course material.

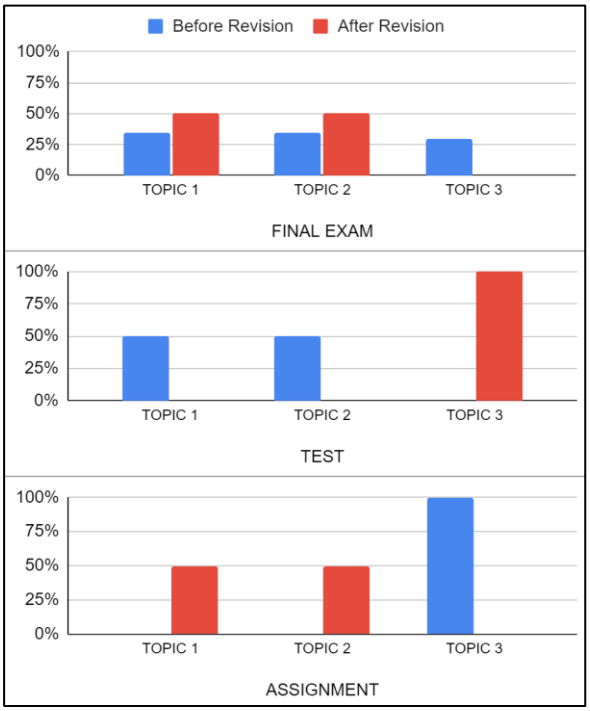

Fig. 1 Comparison of SPT Allocation for Assessments, by Percentage (Before and After Revision)

The impact of this revised assessment design is evident in the significant improvement in student performance, as shown in Figure 2. The average passing rate increased from 47% to 93%, highlighting the positive effect of the revised SLT allocation and targeted assessment approach. This improvement aligns with the study's objective to enhance student learning outcomes through a more balanced and targeted assessment design that optimizes SLT.

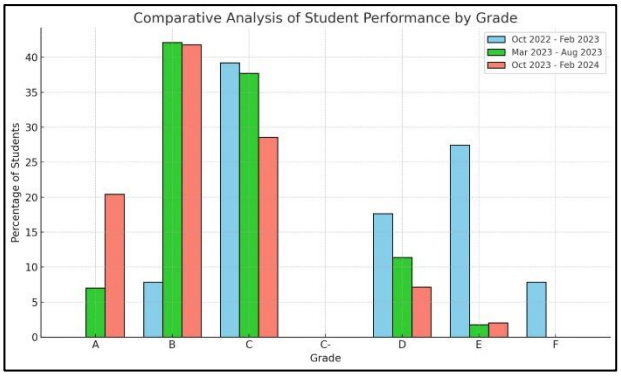

Fig. 2 Impact of Revised Assessment Design on Student Performance in Indeterminate Structures Course (Oct 2022 - Feb 2024)

CONCLUSION

In conclusion, this study demonstrates the positive impact of a revised assessment design framework on student learning outcomes in the "Indeterminate Structure" (CES521) course. By strategically reallocating SLT, the revised design successfully addressed the challenges of the original assessment structure. The significant improvement in passing rates following the implementation of the revised design highlights the importance of aligning assessment practices with the principles of SLT. This case study serves as a valuable example for other engineering courses seeking to enhance student engagement and performance through targeted assessment design revisions. Future research should investigate the relationship between SLT, student workload and lecturer understanding of assessment design.

REFERENCES

Engineering Accreditation Council (EAC). (2020). *Engineering Programme Accreditation Manual* (7th ed.). Engineering Accreditation Council.

Mahajan, R., & Bansal, D. (2021). Designing Performance Metrics and Rubrics to Assess Student Outcome Attainment in Engineering Project Design Course. *Journal of Education*, *203*, 459 - 467.

Malaysian Qualifications Agency (MQA). (2019). *Guidelines to Good Practices: Curriculum Design and Delivery*. Malaysian Qualifications Agency.

Winberg, C., Bramhall, M.D., Greenfield, D.C., Johnson, P., Rowlett, P., Lewis, O., Waldock, J.A., & Wolff, K.E. (2018). Developing Employability in Engineering Education: A Systematic Review of The Literature. *European Journal of Engineering Education*, *45*, 165 - 180.

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Enhancing Climate Literacy Among Malaysian Youth: Impact Evaluation of the National Conference on MYOUTH Climate 2022 (NCmYC2022)

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ABSTRACT

Climate change poses significant challenges globally, including in Malaysia. Engaging youth in climate literacy is critical for fostering a generation capable of addressing climate change effectively. Thus, the National Conference on MYOUTH Climate 2022 (NCmYC2022) was organized to enhance climate literacy among Malaysian youth. It is aimed to empower Malaysian youth by providing comprehensive climate education and promoting active engagement in climate action. The conference, conducted online, featured various activities including talks, quizzes, competitions, and the launch of an e-learning module. This study employs a quantitative approach to evaluate the impact of the conference on participants' knowledge, attitudes, and skills related to climate change. A survey was administered to 556 participants, and descriptive analysis was used to interpret the data. The results indicated significant improvements in climate literacy among participants, with high levels of satisfaction and recommendations for future programmes.

Keywords: Climate Change Literacy, Youth Engagement

INTRODUCTION

Climate change poses significant challenges globally, including in Malaysia. Engaging youth in climate literacy is critical for fostering a generation capable of addressing climate change effectively. Climate literacy among youth is essential for promoting energy conservation behaviors and sustainable practices (Aruta, 2023). Despite increasing awareness of climate change, many youths lack the necessary knowledge and skills to engage in effective climate action. This gap in climate literacy hinders their ability to contribute to mitigation and adaptation efforts. A collaborative global effort is needed to promote the sociocultural aspects of energy literacy as a framework for energy and climate justice (Gladwin et al., 2022).

This paper aims to evaluate the impact of NCmYC2022 on participants' climate literacy, focusing on changes in knowledge, attitudes, and skills. It also seeks to assess participant satisfaction and recommendations for future programmes. Previous studies highlight the importance of integrating climate change knowledge with practical applications to enhance understanding among young people (Shan, 2023).

This study employs a quantitative approach to evaluate the impact of the conference on participants' knowledge, attitudes, and skills related to climate change. The online survey questionnaires received responses from 556 participants who attended the conference using a convenient sampling method.

RESULTS AND DISCUSSION

Prior to the program, 68% of respondents had basic knowledge of climate change. After the program, 86% reported improved knowledge and understanding, indicating an 18% increase (see Fig. 1a and Fig 1b).

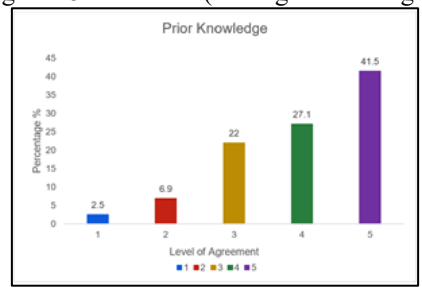

Fig. 1a Knowledge (Before the programme)

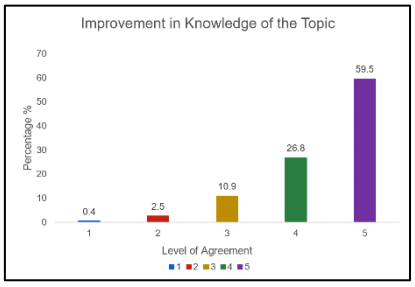

Fig. 1b Improvement in Knowledge (After the programme)

Additionally, 87% found the programme content adequate and easy to follow, and 88% agreed that the programme objectives were achieved (see Fig. 2a and Fig 2b).
Overall, 86% of participants were satisfied with the

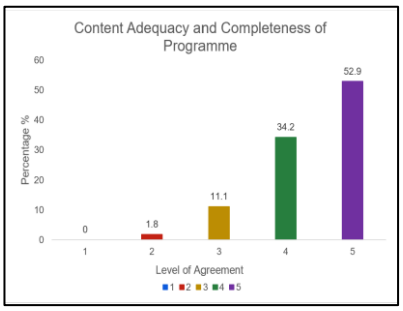

Fig. 2a Programme Content and Objectives

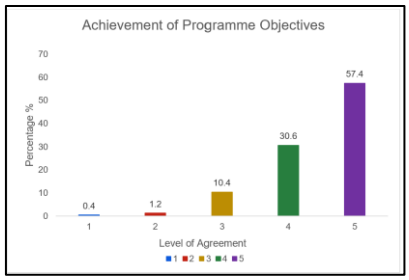

Fig. 2b Achievement of Programme Objectives

programme, and 88% recommended its continuation (see Fig. 3a and Fig. 3b).

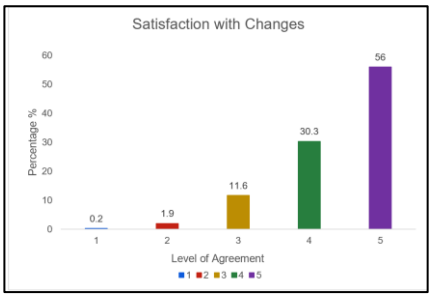

Fig. 3a Participants' Satisfaction with Changes

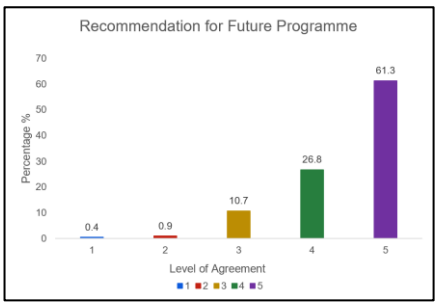

Fig. 3b Participants' Recommendation

The findings highlight the effectiveness of NCmYC2022 in enhancing climate literacy among Malaysian youth. Future programmes should consider the collaborative and sociocultural approaches to climate education to build a more comprehensive understanding of climate issues (Aruta, 2023; Gladwin et al., 2022).

CONCLUSION

NCmYC2022 successfully improved participants' climate literacy, with significant gains in knowledge, attitudes, and skills. High levels of satisfaction and recommendations for future programmes show the importance of such initiatives in promoting climate education. Future programmes should build on this success, incorporating feedback to further enhance their impact and sustainability. The study demonstrates the value of engaging youth in climate literacy to prepare them for future challenges and empower them to take proactive climate action.

LIMITATIONS OF STUDY AND RECOMMENDATIONS FOR FUTURE RESEARCH

While the study provides valuable insights into the effectiveness of NCmYC2022, it is not without limitations. The reliance on self-reported data may introduce response biases, as participants might overstate their knowledge or satisfaction. The convenience sampling technique, while useful for increasing participant numbers, may not fully represent the broader population. Additionally, the online format of the conference might have excluded those with limited internet access or technological skills, potentially skewing the results. Future studies should aim to address these limitations by employing more diverse sampling methods and considering mixed method approaches to gain a deeper understanding of participant experiences.

REFERENCES

Aruta, J. J. B. R. (2023). Science literacy promotes energy conservation behaviors in Filipino youth via climate change knowledge efficacy: Evidence from PISA 2018. *Australian Journal of Environmental Education*, *39*(1), 55–66. https://doi.org/10.1017/aee.2022.10

Gladwin, D., Karsgaard, C., & Shultz, L. (2022). Collaborative learning on energy justice: International youth perspectives on energy literacy and climate justice. *Journal of Environmental Education*, *53*(5), 251–260. https://doi.org/10.1080/00958964.2022.2113019

Shan, X. (2023). Analyzing the Impact of Integration on Climate Change Knowledge among Young People. *Lecture Notes in Education Psychology and Public Media*, *5*(1), 6–12. https://doi.org/10.54254/2753-7048/5/20220354

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Community Engagement and Student Learning Through International SULAM Projects: Insights from the 1st International Symposium on Sustainable Communities

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ABSTRACT

Service-learning has emerged as an innovative pedagogical approach that combines academic coursework with meaningful community engagement. The SULAM (Service-Learning Malaysia-University for Society) initiative, supported by the Malaysian Ministry of Higher Education, aims to address societal challenges while enhancing students' educational experiences. The 1st International Symposium on Sustainable Communities Through SULAM Projects 2023 highlighted the transformative impact of integrating academic learning with community service. This paper analyzes the symposium's activities, focusing on the effectiveness of the international SULAM projects in fostering sustainable communities. Using document analysis the key findings indicate enhanced community engagement, improved student skills, and significant contributions to sustainability goals. The study also identifies challenges in scalability and evaluation, offering recommendations for future initiatives.

Keywords: Community Engagement, International SULAM, Service-Learning, Sustainable Development

INTRODUCTION

Service-Learning Malaysia-University for Society or SULAM has emerged as an educational approach that combines academic coursework with community service. The 1st International Symposium on Sustainable Communities Through SULAM Projects 2023 served as a platform to showcase the impact of these initiatives. SULAM projects aim to address real-world challenges while providing students with practical experience and fostering a sense of social responsibility. Studies have demonstrated that such approaches can significantly enhance student engagement and community impact (González-Sánchez et al., 2022; Paul et al., 2023). Additionally, the integration of service-learning into university curricula has shown to foster critical thinking and social responsibility among students, contributing to sustainable community development (Bilous et al., 2022; Hurd & Stanton, 2022). Despite the recognized benefits of service-learning, challenges remain in effectively measuring the impact of these projects and scaling them to achieve broader societal benefits.

There is a need for more structured evaluation frameworks to systematically assess the outcomes of SULAM initiatives (González-Sánchez et al., 2022). This paper aims to analyze the activities and outcomes of the 1st International Symposium on Sustainable Communities Through SULAM Projects 2023. Specifically, it seeks to evaluate the effectiveness of SULAM projects in enhancing community engagement and student learning.

METHODOLOGY, RESULTS AND DISCUSSION

This study adopts a qualitative approach based on the document review and analysis on the symposium activities. Data were collected through participant feedback surveys and session recordings, focusing on the perceived impact of the projects on both the communities and the students involved. The study also reviewed the project documentation provided by the symposium organizers. The 1st International Symposium on Sustainable Communities Through SULAM Projects 2023 was held on the 26th of June 2023 (see Fig. 1)

Fig 1. Poster of the Symposium

It was organized by the final year students undertaking a course namely, Engineers in Society (ECC589) in collaboration with Universiti Sains Malaysia and

Presidency University, India. The activities include keynote speeches, panel discussions, and project presentations by the EIS students on their community project showcases to the experts from both Presidency University and Universiti Sains Malaysia (see Fig. 2)

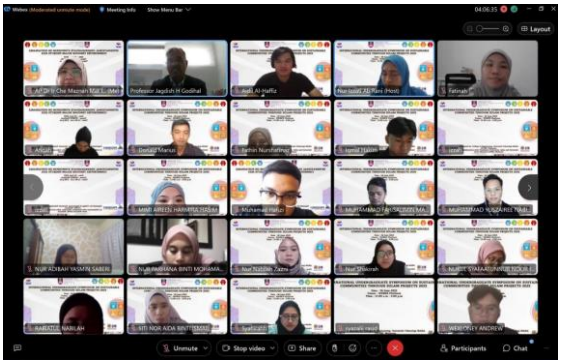

Fig. 2 Keynote Speech by Prof Jagdish, Presidency University, India

It highlighted the transformative impact of integrating academic learning with community service. The SULAM projects discussed at the symposium have demonstrated significant benefits in enhancing community engagement and student learning. For instance, Paul et al., (2023) emphasize the role of service-learning in developing social consciousness and personal development among students. Similarly, Bilous et al., (2022) discuss the reciprocal and respectful relationships fostered through community-based service-learning, which challenge traditional giver-receiver dynamics. The symposium also revealed challenges in scaling these projects and evaluating their long-term impact. Hurd and Stanton (2022) propose a multilateral, equity-focused approach to community engagement that can potentially address these challenges and transform higher education's approach to community partnership-building and student learning. Furthermore, González-Sánchez et al., (2022) demonstrate the efficacy of service-learning in achieving sustainable development goals by integrating it into the curriculum, thus contributing to more inclusive and resilient communities.

CONCLUSIONS

The findings from the qualitative analysis on the symposium activities indicate that SULAM projects significantly enhance community engagement and student learning outcomes in terms of improved soft skills, such as communication, teamwork, and problem-solving, as well as a deeper understanding of sustainability issues. However, challenges remain in scaling these projects and implementing robust evaluation frameworks. There are some limitations of this study, in which the SULAM projects presented at the symposium were conducted over relatively short periods, limiting the depth of engagement and long-term impact on both students and communities. Second, is the analysis primarily relied on self-reported feedback from participants, which can introduce bias and affect the accuracy of the findings. While individual projects showed significant impact, scaling these initiatives to benefit a larger audience remains a challenge due to limited resources and logistical constraints. Next, is the online format of the symposium and some projects may have limited face-to-face interactions, which are crucial for building strong community relationships and engagement.

Future research should involve extended duration studies to assess the long-term impact of SULAM projects on both students and communities. Longitudinal studies could provide deeper insights into the sustainability of project outcomes. A mixed-methods evaluation frameworks that combine quantitative and qualitative data to provide a more comprehensive assessment of project impact. This could include pre- and post-project assessments, interviews, and focus groups. Research could explore models for expanding reach, securing additional funding, and building stronger community partnerships. Research could focus on hybrid models that combine online and face-to-face interactions to maximize engagement and learning outcomes.
academic excellence.

REFERENCES

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Bilous, R., Hammersley, L., & Lloyd, K. (2022). Community based service learning for development. In K. Sims, N. Banks, S. Engel, P. Hodge, J. Makuwira, N. Nakamura, J. Rigg, A. Salamanca, & P. Yeophantong (Eds.), *The Routledge Handbook of Global Development*. pp. 641-652. Routledge, Taylor and Francis Group.

González-Sánchez, R., Medina-Salgado, S., Torrejón-Ramos, M., González-Mendes, S., & Alonso-Muñoz, S. (2022). The service-learning methodology as a facilitating tool for education for sustainable development (ESD). REIRE Revista d'Innovació i Recerca En Educació, 15(2), 1–9.

Hurd, C., & Stanton, T. K. (2022). Community engagement as community development: Making the case for multilateral, collaborative, equity-focused campus-community partnerships. *Community Development*, 54(6), 875–898.

Paul, A., Abdullah, H., & Liaw, J. O. H. (2023). Sowing Seeds of Social Consciousness Linking Student Engagement and Community Engagement Through Service Learning. International Journal of *Academic Research in Business and Social Sciences*. 13(2).

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Promoting Sustainable Communities Through International SULAM Projects 2023

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ABSTRACT

Service-Learning Malaysia-University for Society (SULAM) has become integral in bridging academic learning with real-world community service. This paper examines three (3) international SULAM initiatives, highlighting their effectiveness in promoting sustainable practices and enhancing student learning. The methodology involves qualitative analysis through participant observations, interviews, and surveys conducted with students, faculty, and community members. Two international projects were conducted in Indonesia, focusing on environmental conservation and waste management, while the third project, an online international symposium in collaboration with India university, featured diverse sustainable community initiatives. The analysis reveals that these projects significantly contributed to community engagement, student skills development, and environmental sustainability. Students reported improved problem-solving skills, heightened environmental awareness, and enhanced collaboration abilities. However, challenges related to scalability and evaluation were identified. The limitations include the reliance on qualitative data, which may not capture the full scope of impact, and the variability in student and community engagement levels. Recommendations for future initiatives include incorporating mixed method approaches to provide a more comprehensive evaluation, developing scalable models that can be adapted to different contexts, and enhancing stakeholder involvement to ensure sustainable impact. By addressing these challenges, international SULAM projects can maximize their contributions to both academic learning and community development.

Keywords: Community Engagement, International SULAM

INTRODUCTION

The Service-Learning Malaysia-University for Society (SULAM) initiative integrates service-learning into university curricula to foster student engagement with community issues. Various studies highlight the positive outcomes of such initiatives. For instance, a previous demonstrated significant improvements in students' comprehension, knowledge, social responsibility, personal development, and academic achievement through community volunteer programs (Zahidi et al., 2022). Similarly, it was found that volunteering among Malaysian university students led to personal growth, skill acquisition, and reduced loneliness. Another study compared service-learning with traditional teaching methods, showing better development of social and civic skills among service-learning participants. Service-learning has also been linked to promoting sustainable development by aligning educational practices with sustainability principles (Pilar & Rosario, 2023). Furthermore, SULAM projects at UKM emphasized community involvement, particularly during the pandemic, highlighting the initiative's flexibility and community impact (Ibrahim, et. al., 2022).

The analysis is based on a comprehensive review of the international SULAM activities including, physical community projects and online symposium activities. The study reviewed the project documentation provided by the symposium organizers and College of Engineering social media.

ANALYSIS AND DISCUSSION

On June 2, 2023, the College of Engineering at Universiti Teknologi MARA (UiTM) organized an international program entitled "Envirovision: Evaluating Noise and Air Particle Assessments" at Pasar Pagi Arengka in Pekanbaru, Indonesia (see Fig. 1).

Fig. 1 Evaluating Noise and Air Particle Assessments" at Pasar Pagi Arengka, Pekanbaru, Indonesia

This event, part of the Engineering in Society (ECC589) course, involved 9 UiTM students and their lecturer, alongside 10 students and 4 lecturers from Sekolah Tinggi

Teknologi Pekanbaru. Supported by Yayasan VFive, SMF from UiTM, and the Indonesian consulting firm PT. Harista Karsa Mandiri, the program aimed to conduct a comprehensive evaluation of noise levels, air quality, and visitor and seller satisfaction at the market. The primary goal of the "Envirovision" program was to gather and analyze data on environmental pollution to present a detailed report to the Riau government for effective monitoring. This international SULAM activity promotes sustainable practices and addresses environmental challenges, contributing to the betterment of society.

On June 3, 2023, an international SULAM program titled "Harnessing Sustainability Towards Engineering Technology" took place in Pekanbaru, Indonesia, to tackle a critical water purification challenge (see Fig. 2).

Fig. 2 Water Purification Challenge, Masjid Nurul Jannah, Pekanbaru, Indonesia

This initiative brought together students and lecturers from Universiti Teknologi MARA (UiTM) and Sekolah Tinggi Teknologi Pekanbaru. Sponsored by Yayasan Vfive and supported by Harista Karsa Mandiri, the program aimed to install a water filtration system at Masjid Nurul Jannah to improve the quality of water used for ablution and daily purposes. The program involved 20 students and 5 lecturers, including participants from both UiTM and Sekolah Tinggi Teknologi Pekanbaru, and was also supported by SMFFKA UiTM Shah Alam. The successful implementation of the "Harnessing Sustainability Towards Engineering Technology" program demonstrates the College of Engineering's dedication to promoting sustainable practices and addressing real-world challenges. By purifying the water at Masjid Nurul Jannah, this international SULAM program underscores the importance of providing clean water and encourages other industries to adopt effective water and air filtration systems.

The 1st International Undergraduate Symposium on Sustainable Communities through SULAM Projects 2023 (ISCOM2023) was a significant event held on June 26, 2023, from 11.00 am to 3.00 pm (MT (see Fig. 3)). Hosted by the School of Civil Engineering, College of Engineering, Universiti Teknologi MARA (UiTM), Malaysia, the symposium brought together students and staff from UiTM, Presidency University, India, and Universiti Sains Malaysia, fostering a vibrant exchange of ideas and solutions for sustainable communities.

Fig. 3 1st International Undergraduate Symposium on Sustainable Communities through SULAM Projects 2023 (ISCOM2023)

ISCOM2023 provided a dynamic platform for participants to exchange knowledge, experiences, and ideas across institutions and countries. The collaborations forged during this event hold immense potential for future advancements in sustainable design and the development of resilient communities. The symposium envisions further collaborations where students from India and Malaysia can engage and immerse themselves in each other's cultures and educational environments, enriching their learning experiences and making a lasting impact on sustainable community development.

CONCLUSION

International SULAM projects demonstrated the significant impact on community engagement and student learning. Participants reported improved skills in communication, teamwork, and problem-solving, and a deeper understanding of sustainability issues. However, challenges in scalability and evaluation were identified.

REFERENCES

Rozita I., Norfazilah A. & Puteh N. A R. (2022). Designing 'SULAM' at UKM: Experiences from Two Pilot Projects. *MALIM: Jurnal Pengajian Umum Asia Tenggara*. Vol.23 (2022): 192-203.

Azizah M.Z., Huay Woon You, Salleh Huddin Abdul Rashid, Mohd Hasrul Kamarulzaman & Vishalache Balakrishnan. (2022). Benefits of Service-Learning through Community Volunteer Programmes to Pre-University Students. *The Eurasia Proceedings of Educational & Social Sciences (EPESS),* 2022. Vol. 25, 53-67.

Aramburuzabala, P.; Cerrillo, R. Service-Learning as an Approach to Educating for Sustainable Development. Sustainability 2023, 15, 11231.

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Empowering International Education: A Case Study of an Exchange Student's Sponsorship Process

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ABSTRACT

This paper outlines the comprehensive process of navigating the sponsorship application and exchange program journey for the Canada-ASEAN Scholarships and Educational Exchanges for Development (SEED) program. This initiative, announced by Canada, targets full-time students from ASEAN countries, aiming to foster educational exchange and development. The journey begins with understanding the SEED program's background, focusing on poverty reduction and sustainable development in the ASEAN region. Following this, the eligibility criteria are detailed to ensure applicants meet all necessary requirements. The application submission phase is described, including preparation and the waiting period for decisions. Upon acceptance, the focus shifts to the offer receipt and visa processing, highlighting crucial steps for a smooth transition. The preparation phase covers logistical arrangements and cultural acclimatization, ensuring students are well-prepared for their stay in Canada. Finally, the paper discusses the experience of attending and completing the exchange program, underscoring the academic, cultural, and personal growth opportunities it provides. This structured approach guides prospective applicants (after this will be mentioned as student) through each phase of the journey, enhancing their understanding and readiness for the SEED program. The insights and recommendations presented can also benefit other scholarship programs, as the application framework tends to follow a similar pattern.

Keywords : educational exchange, sustainable development, international cooperation, international students, academic growth

INTRODUCTION

Educational exchanges enable students to broaden their perspectives, develop intercultural skills, and build networks that can last a lifetime. These kind of programs often emphasize the development of soft skills such as adaptability, communication, and problem-solving, which are highly valued in today's interconnected job market (Myhre, 2011).These programs often target students from developing regions, aiming to reduce educational disparities and contribute to the socio-economic development of their home countries. By investing in human capital, scholarship programs help build a more educated and skilled workforce, capable of driving sustainable development (Liu et al., 2022). The application process for international scholarships and exchange programs can be rigorous and demanding. It involves multiple stages, including understanding the sponsorship background, meeting eligibility criteria, submitting applications, and preparing for the exchange experience. This paper provides a comprehensive guide for student to the Canada-ASEAN Scholarships and Educational Exchanges for Development (SEED) program.

METHODOLOGY

Before delving into the detailed phases, it is essential to comprehend the structured approach that governs applicants through the Canada-ASEAN Scholarships and Educational Exchanges for Development (SEED) program.

Phase 1: Understanding the Sponsorship Background

This scholarship initiative is aimed at attracting candidates from ASEAN nations, aligning with the objective of poverty alleviation in these developing countries and contributing to the Sustainable Development Goals outlined in the 2030 Agenda. Participants are selected from ASEAN member countries. The scholarship sponsor provides financial support for participants' living expenses and covers tuition fees for the entire duration of the exchange program at Canadian institutions, typically lasting between three to six months.

Phase 2: Meeting the Eligibility Criteria

The main eligible criteria to fulfil is the home (local) institution of the student must have an exchange agreement with a Canadian institution that student want to attached with. Figure 1 illustrates an example, sourced from UiTM hub's online publication, demonstrating the

collaboration between the student home institution and a Canadian counterpart, confirming the existence of an exchange agreement.

Fig. 1 News regarding mutual understanding between local and international university- UiTM established a strategic relationship with the University of Ottawa, Canada ((UiTM Archieve Online Library (May edition) : May 25 , 2022)

Phase 3: Application Submission and Waiting Period

Since this application is offered once a year, students need to be aware of the application deadline. The deadline listed on the website is for the candidate's home institution to submit to the scholarship secretariat. Typically, the student's home institution's international office sets an earlier internal deadline to thoroughly review all documents and make selections (if there are many applicants) before submitting the final applications. All applications must be reviewed by the candidate's home institution's international office.

Phase 4: Receiving the Offer and Visa Processing

If a student is successfully selected, they will receive a notification of acceptance from the sponsoring organization and start the process of applying student visa.

Phase 5: Preparing for the Exchange Program in Canada

Once the offer has been accepted and the visa has been obtained or is being processed, it is time to start preparing for the exchange program. This involves reading extensively about local topics, culture, and any other pertinent information about their destination.

Phase 6: Attending and Completing the Exchange Program

Engaging with the local culture is another crucial aspect of the exchange experience. Students should take the time to explore their new environment, interact with local residents, and participate in community events.

FINDINGS AND DISCUSSION

Self-confidence has a substantial impact on learning and is crucial for professional growth and the development of personal competence. Di Michele et al. (2024) also supported this view, emphasizing that the skills developed during international student mobility programs, such as teamwork, communication, language proficiency, and interpersonal skills, are often linked to improved employability prospects. Figure 2 illustrates her involvement in a graduate seminar during the fall semester, where she presented her ongoing research conducted at her home university.

Fig. 2 Presenting during Civil Engineering Graduate Seminar in Winter/Fall semester 2024

CONCLUSION

Preparing for the exchange involves making logistical arrangements and adapting to the host country's culture, both of which are essential for maximizing the benefits of the program. Participating in the exchange program itself offers invaluable opportunities for academic, cultural, and personal development, fostering stronger international connections and contributing to global educational and developmental objectives.

REFERENCES

Di Michele, L., Tørris, C., Gunn, C., & Johansen, S. (2024). International student mobility in diagnostic radiography: Benefits and pitfalls. *Radiography*, *30*(4), 1093–1098. https://doi.org/10.1016/j.radi.2024.05.005

Liu, Y., Huang, Y., & Shen, W. (2022). Building Halos: How do Chinese elites seek distinction through (mis) recognising studying abroad? *International Journal of Educational Development*, *91*. https://doi.org/10.1016/j.ijedudev.2022.102589

Myhre, K. (2011). Exchange students crossing language boundaries in clinical nursing practice. *International Nursing Review*, *58*(4), 428–433. https://doi.org/10.1111/j.1466-7657.2011.00904.x

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Longitudinal Analysis: Enhancing Application Skills in Fluid Mechanics (CEW441) Curriculum Revision and Student Performance

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ABSTRACT

This study analyzes the impact of curriculum revisions on student performance in the Fluid Mechanics (CEW441) course within the Bachelor of Engineering (Hons) Civil Engineering (CEEC221) program at UiTM Pulau Pinang. Longitudinal data from two cohorts (March 2023 and October 2023) reveal a slight improvement in understanding hydrostatic and hydrodynamic concepts (PO2) but a decrease in understanding fundamental fluid properties (PO1). This decrease in PO1 is directly linked to performance in CO1, which assesses fundamental fluid properties and their application. These findings highlight the need for a targeted review of the CEW441 curriculum to address the specific challenges identified in PO1 and CO1. Overall, this study underscores the importance of a comprehensive approach to curriculum review and teaching strategies to ensure that students effectively grasp and apply fundamental fluid mechanics concepts, thereby enhancing their overall performance in the CEW441 course and their preparedness for future careers in civil engineering.

Keywords: Fluid Mechanics, Program Outcomes, Course Outcomes, Fundamental Fluid Properties, Curriculum Review

INTRODUCTION

Fluid mechanics, a critical subject in engineering, demands a strong foundation in both theoretical concepts and practical application. However, traditional teaching methods often emphasize rote learning, leading to a gap between students' theoretical knowledge and their ability to apply these concepts to real-world engineering problems. This discrepancy has been a persistent challenge in fluid mechanics education, particularly in courses like CEW441, offered to Bachelor of Engineering (Hons) Civil (Infrastructure) (CEEC221) students at UiTM Pulau Pinang. This course has two primary program outcomes (POs): PO1, focusing on fundamental fluid properties and their application, and PO2, encompassing hydrostatic and hydrodynamic concepts and their applications (detailed in Table 1). The distribution of PO components within the course's overall assessment is outlined in Table 2. To address the challenge of bridging theory and practice, a curriculum revision was implemented in CEW441, shifting the emphasis of the first learning outcome (CO1) from acquiring fundamental knowledge to applying these concepts in engineering contexts. This study investigates the impact of this revision on students' application skills in fluid mechanics using a quasi-experimental design. Data were collected from two cohorts of undergraduate engineering students enrolled in CEW441: one before the revision (March 2023) and one after (October 2023). A mixed-methods approach was employed, incorporating quantitative analysis of assessment data alongside qualitative analysis of student feedback and instructor observations to provide a comprehensive understanding of the revision's effects.

Table 1. PO and CO description for CEW441

PO	Description of CO
PO1	CO1: acquire the fundamental of fluid properties and its application to fluid problem
PO2	CO2: acquire and apply knowledge on hydrostatic concepts and buoyant force and its engineering application. CO3: acquire and apply knowledge on hydrodynamic concepts and its application to fluid flow problem

Table 2. Assessment component for CEW441 according to related PO

PO	TEST (%)	QUIZ/ ASSIGN(%)	FINAL (%)	TOTAL (%)
PO1	7	-	10	**17**
PO2	23	10	50	**83**

RESULTS AND DISCUSSION

Figure 1 illustrates individual student performance on Program Outcomes (POs) 1 and 2 in the semester March 2023. PO1, aligned with the original CO1, assessed understanding of fundamental concepts, while PO2 evaluated problem-solving abilities. The graph reveals a declining trend in PO1 scores and fluctuating PO2 scores. Figure 2 compares individual performance on PO1 and PO2 between semesters. Following the revision, most students showed improved PO2 scores, indicating enhanced application skills. However, PO1 scores declined, suggesting a need for continued emphasis on fundamental concepts. Figure 3 presents the average performance comparison. PO1 shows a slight decrease, while PO2 demonstrates a significant improvement,

confirming the positive impact of the revision on application skills.

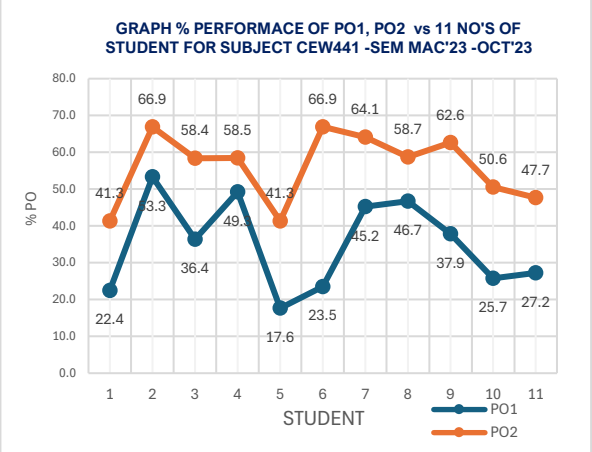

Fig 1 Percentage (%) Performance of PO1 and PO2 for subject CEW441 Semester March 2023

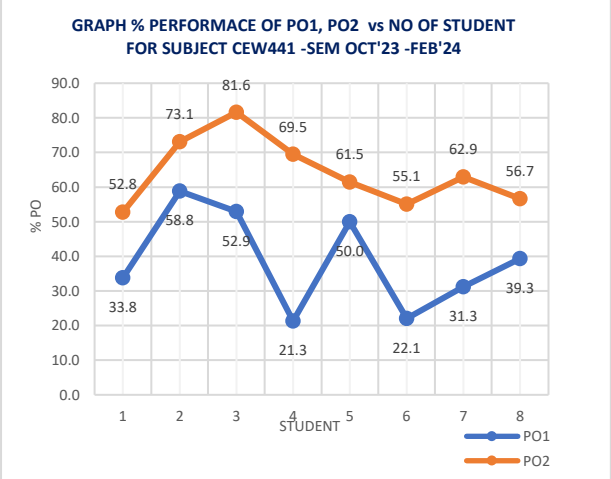

Fig. 2 Percentage (%) Performance of PO1 and PO2 for subject CEW441 Semester October 2023

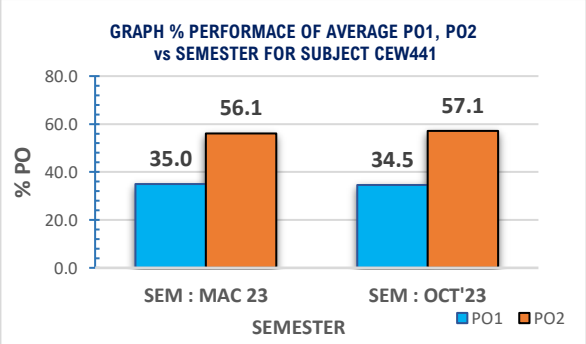

Fig. 3 Average Percentage(%) PO performance according to semester

The results of longitudinal analysis of the data revealed a slight improvement in the average student performance for PO2 from the semester March 2023 to October 2023. However, PO1 performance experienced a minor decrease of 0.5%, indicating a need for improvement in understanding and applying fundamental fluid properties. The findings of this study have important implications for the improvement of teaching and learning methods in CEW441 courses and indicate that a more comprehensive curriculum revision is needed to enhance students' application skills.

CONCLUSION

This study investigated the impact of a curriculum revision in the Fluid Mechanics (CEW441) course, a core component of the Bachelor of Engineering (Hons) Civil Engineering (CEEC221) program at UiTM Pulau Pinang. The revision shifted the course's first learning outcome (CO1) from understanding fundamental concepts to applying them in engineering problems. Longitudinal data collected over two semesters reveal a notable improvement in students' ability to apply fluid mechanics concepts to engineering problems after the revision. However, a slight decline in their grasp of fundamental concepts was observed, highlighting the need for a balanced approach that emphasizes both application and theoretical understanding to ensure the development of well-rounded civil engineers. This study demonstrates the positive impact of curriculum revision on enhancing application skills in fluid mechanics and underscores the importance of continuous curriculum evaluation and revision, as well as the development of innovative and relevant teaching methods, to ensure that teaching and learning practices remain effective in preparing students for the challenges of the engineering profession.

REFERENCES

Shi, P., Fu, X., Yang, J., & Dai, L. (2023). Development and evaluation of a virtual simulation experiment system for the course of fluid mechanics. *Journal of Computer Assisted Learning*.

Clark, R., Kaw, A., & Guldiken, R. (2023). Metacognition instruction and repeated reflection in a fluid mechanics course: Reflective themes and student outcomes. *International Journal of Engineering Education*, Volume 39, Issue 1A, 144-156.

Rahman, A. (2017). A blended learning approach to teach fluid mechanics in engineering. *Australasian Journal of Engineering Education*, *38*(1), 32-43.

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Employability Outcomes of Civil Engineering Diploma Graduates: A Survey-Based Analysis of Program Educational Objectives Achievement

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ABSTRACT

This study investigates the relationship between program educational objectives (PEOs) and employability outcomes of civil engineering diploma graduates, incorporating employer perspectives. A mixed-methods approach was used, combining survey data from alumni of a civil engineering diploma program with feedback from their employers. The study aimed to evaluate the alignment of the program's PEOs with industry needs and assess their effectiveness in preparing graduates for successful careers. Results reveal a strong correlation between alumni achievement of specific PEOs (e.g., technical competence, problem-solving, communication) and positive employability outcomes such as job satisfaction and career advancement opportunities. Employer feedback further validated the importance of these PEOs in shaping competent and adaptable professionals. However, both alumni and employer feedback identified areas for improvement within the program, particularly related to PEOs focused on professional development and lifelong learning. The findings offer valuable insights for educators, employers, and policymakers seeking to enhance the employability of civil engineering diploma graduates through targeted curriculum development, continuous assessment, and stronger industry engagement.

Keywords: Civil Engineering Diploma, Program Educational Objectives (PEOs), Graduate Employability, Alumni Survey, and Industry Needs

INTRODUCTION

The Malaysian construction industry is a significant contributor to the national economy, with civil engineering serving as a cornerstone of its growth and development. The demand for skilled civil engineers remains high, placing a responsibility on educational institutions to produce graduates equipped with the knowledge, skills, and competencies necessary to meet industry standards. Program educational objectives (PEOs), as outlined by accreditation bodies like the Engineering Technology Accreditation Council (ETAC) and the Malaysian Qualifications Agency (MQA), serve as a framework for guiding curriculum design and ensuring that graduates are prepared for successful careers. However, aligning PEOs with the dynamic needs of the industry and the diverse perceptions of employability skills held by students, academics, and employers remains a challenge (Saim et al., 2020).

Research has highlighted the importance of understanding these varied perspectives to effectively bridge the gap between educational outcomes and workforce requirements (Knight & Yorke, 2004; Saim et al., 2020). While technical competence is undeniably crucial for civil engineers, studies have also emphasized the significance of broader employability skills encompassing psychomotor and affective domains (Saim et al., 2020). These encompass practical abilities, interpersonal skills, and professional attributes that contribute to successful career outcomes. Moreover, the impact of engineering education on graduate employability extends beyond technical skills, encompassing factors such as work experience, personality traits, and career aspirations (McQuaid & Lindsay, 2005).

This study seeks to build upon this existing body of knowledge by examining the relationship between PEO achievement and employability outcomes of civil engineering diploma graduates in Malaysia. By incorporating feedback from both alumni and their employers, this research aims to provide a comprehensive evaluation of the program's effectiveness in preparing graduates for the Malaysian workforce. The findings will offer valuable insights for educators, employers, and policymakers seeking to enhance the employability of civil engineering diploma graduates through targeted curriculum development, continuous assessment, and stronger industry engagement.

RESULTS AND DISCUSSION

Fig. 1 on alumni employment status provides a valuable starting point for our investigation into the relationship between program educational objectives (PEOs) and employability outcomes of civil engineering diploma graduates in Malaysia. The demand for skilled civil

engineers and the role of PEOs in guiding curriculum development, this data offers initial insights into the program's effectiveness in preparing graduates for the workforce.

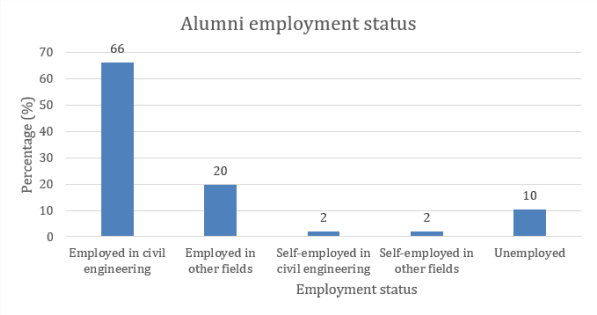

Fig. 1 Employment status of alumni from EC110

Fig. 2 and 3 illustrate the distribution of civil engineering diploma graduates across various sectors of employment and the trend from 2017 to 2020. The majority (48%) of graduates are employed by contractors, followed by a significant proportion (19%) working in other unspecified industries. Government and developer sectors each employ 7% of graduates, while consultants and manufacturing companies employ 6% and 1% respectively. Graduates working in maintenance and GLCs (Government-Linked Companies) each account for 1% of the total. This distribution reveals a preference for contractor roles but also highlights the diverse career paths pursued by civil engineering diploma holders.

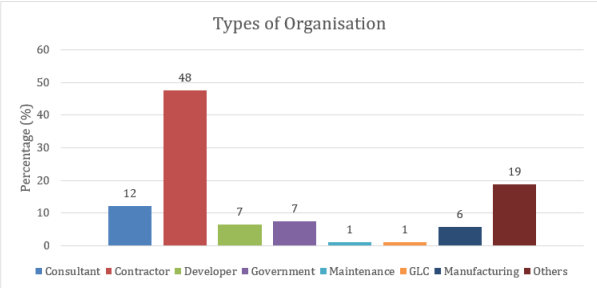

Fig. 2 Types of organisations in which alumni are involved after graduating

Fig. 3 shows that the majority of 2017 graduates work with the contractor (55%) and government sectors (23%) that contribute the highest percentage compared to others as shown in Fig. 2. However, the graph starts to decline in 2018 and continues until 2020, due to many circumstances, including the MCO (Malaysia Movement Control Order) period.

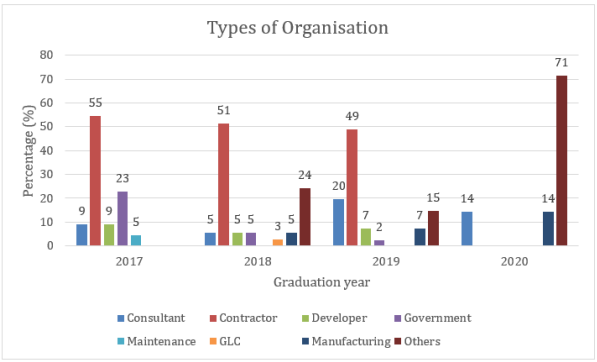

Fig. 3 Types of organisations in which alumni are involved versus graduation year.

CONCLUSION

This study concludes that a strong correlation exists between the achievement of specific program educational objectives (PEOs) in civil engineering diploma programs and positive employability outcomes for graduates.

REFERENCES

Knight, P. T., & Yorke, M. (2004). The impact of engineering education on graduate employability. *European Journal of Engineering Education*, *29*(1), 3–16.

McQuaid, R. W., & Lindsay, C. (2005). The concept of employability. *Urban Studies*, *42*(2), 197–219.

Saim, N. A. M., Mohd Yusof, N. A., & Zakaria, E. (2020a). Engineering employability skills: Students, academics, and industry professionals' perception. In *IOP Conference Series: Materials Science and Engineering* (Vol. 995, No. 1, p. 012077). IOP Publishing. [DOI:10.1088/1757-899X/995/1/012077]

Saim, N. A. M., Yusof, N. A. M., & Zakaria, E. (2020b). Evaluation of programme outcomes under the psychomotor and affective domain for diploma civil engineering students through industrial training: A statistical study from employers' perspective in Malaysia. In *IOP Conference Series: Materials Science and Engineering* (Vol. 995, No. 1, p. 012078). IOP Publishing. [DOI: 10.1088/1757-899X/995/1/012078]

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Evaluating Student Attainment of Program Outcomes in a Civil Engineering Materials Course

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ABSTRACT

Civil Engineering Materials (Course Code: ECS246) is a core course within the Diploma in Civil Engineering program, designed to provide students with a comprehensive understanding of the materials commonly used in civil engineering applications. This study examines the attainment levels of three distinct student batches across three key Program Outcomes (PO2 - Problem Analysis, PO4 - Modern Tool Usage, PO11 - Engineering Management) in an engineering education program. The analysis of the performance data reveals notable differences between the batches. Batch 1 exhibited strong, balanced scores across all three outcomes, indicating a well-rounded skillset. Batch 2 stood out with exceptional attainment in PO4, demonstrating superior abilities in applying modern engineering tools and techniques. In contrast, Batch 3 had lower scores in PO2 and PO4, suggesting areas for improvement in problem analysis and the utilization of contemporary engineering methods. All batches, however, showed consistent and solid performance in PO11, reflecting a strong grasp of engineering management principles. These findings highlight the importance of continuous monitoring and targeted interventions to address the unique strengths and development areas within each student cohort, ultimately ensuring comprehensive competency development across the engineering program.

Keywords: Civil Engineering Materials, Program Outcomes (PO), Student Performance, Competency Development Engineering Education.

INTRODUCTION

The course Civil Engineering Materials (Course Code: ECS246) is a core component of the Diploma in Civil Engineering program, aimed at providing students with a comprehensive understanding of the materials commonly used in civil engineering. This 2-credit course involves a total Student Learning Time (SLT) of 80 hours, which includes 28 hours of face-to-face (F2F) instruction, 3 hours of guided learning, and 49 hours of non-guided learning activities. This course covers the essential properties, compositions, and applications of various engineering materials, including cementitious, metallic, organic, and inorganic materials. Students will explore how these materials can be modified to improve performance under different environmental conditions and how they behave in real-world service scenarios. (Michael,2017) By the end of the course, students will be well-equipped with the knowledge and skills necessary to predict material-related problems, utilize modern engineering tools and techniques, and apply their understanding of well-established materials effectively in civil engineering projects.

In clearly defined engineering contexts, problem-solving skills, technical proficiency, and management acumen are critical, as highlighted by the program outcomes (PO2, PO5, and PO11). An overview of these POs' importance in producing qualified engineers who can take on modern engineering difficulties. PO2 focuses on defining and analyzing specific technical challenges. (Alves, 2020) In order to get well-supported conclusions, engineers need to be skilled at identifying problems that are precisely defined in their domain and using standardized analytical techniques. This result guarantees that graduates can approach problems methodically, using well-established analytical methodologies to produce solutions that are sound engineering principles-based and efficient. The capacity to achieve this result shows that an engineer can explore and solve issues with dependability and precision. (ABET).

PO5 underscores the application of appropriate techniques, resources, and modern engineering and IT tools to address well-defined engineering problems. This outcome highlights the importance of staying abreast with technological advancements and integrating them into problem-solving processes. (ABET) By achieving this outcome, graduates demonstrate their ability to harness modern tools effectively, enhancing their problem-solving efficiency and innovation potential. PO11 pertains to the understanding and application of engineering management principles. Engineers often work in multidisciplinary environments where they must manage projects, lead teams, and ensure effective collaboration. This outcome ensures that graduates are equipped with the knowledge of management principles and can apply them to their work, whether as team members or leaders. It emphasizes the ability to oversee projects, coordinate with diverse teams, and integrate

various engineering disciplines to achieve project goals successfully.

Table 1 outlines the assessment structure for the Civil Engineering Materials course (ECS246), detailing the different components, their corresponding Course Outcomes (CO) and Program Outcomes (PO), and the distribution of marks.

Table 1. Assessment marks for subject ECS246

ASSESSMENT	COPO	ASSESSMENT MARKS (%)
Assignment /Project	CO3-PO11	20
Test	CO1-PO2	20
Test	CO2-PO5	10
Final Exam	CO1-PO2	50

By helping graduates negotiate the intricacies of engineering practice, achieving these aims advances both the engineering discipline as a whole and their own professional development. Engineers are prepared to confidently and competently handle the challenges of their professions through their rigorous education and practical application.

RESULTS AND DISCUSSION

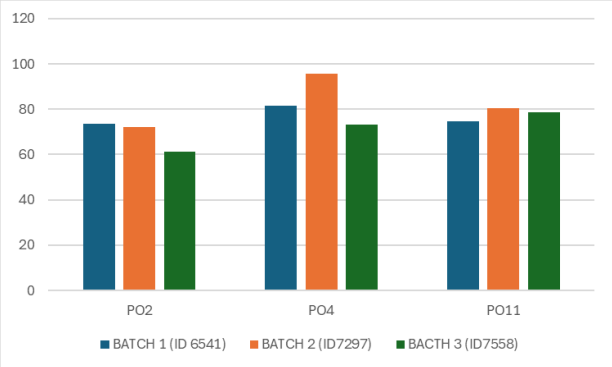

Fig. 1 Program outcome attainment for ECS246

The data presented in the graph outlines the attainment levels of three batches of students across three specific Program Outcomes (PO2, PO4, PO11). The analysis of this performance data reveals the following insights. Batch 1 (ID 6451) exhibited strong overall performance, with particularly high attainment in PO4 (81.59%). This suggests a proficient ability to apply modern engineering techniques and tools. The scores in PO2 and PO11 were also commendable, indicating a balanced understanding of problem analysis and engineering management principles.

Batch 2 (ID 7297) demonstrated exceptional capability in utilizing modern engineering tools and techniques, as evidenced by the remarkable 95.57% attainment in PO4. The batch also showed strong performance in PO11 (80.30%), reflecting solid knowledge in engineering management. The attainment in PO2 (72.02%), while slightly lower than the other outcomes, still indicates a good level of competency in problem analysis. In contrast, Batch 3 (ID 7558) had lower attainment levels in PO2 (61.33%) and PO4 (73.23%) compared to the other batches. This suggests that problem analysis and the application of modern engineering techniques are areas that require further enhancement for this group of students. However, the batch's score in PO11 (78.54%) was comparable to the other batches, showcasing a consistent understanding of engineering management principles. Overall, the data analysis highlights the strengths and areas for improvement across the three batches underscoring the need for a more focused approach to enhancing problem analysis and the utilization of modern engineering methods.

CONCLUSION

The analysis of student performance data across the three Program Outcomes (PO2, PO4, PO11) provides valuable insights that can inform educational and curricular strategies. Batch 1 (ID 6541) demonstrates a well-rounded understanding, while Batch 2 (ID 7297) stands out for its exceptional application of modern engineering techniques. In contrast, Batch 3 (ID 7558) presents opportunities for improvement, particularly in problem analysis and the utilization of contemporary engineering tools. By closely monitoring and addressing the specific strengths and areas for growth within each batch, the institution can develop targeted interventions to enhance student learning and ensure all learners are equipped with the necessary competencies for success in their engineering pursuits.

REFERENCES

Accreditation Board for Engineering and Technology (ABET). (n.d.). *Criteria for Accrediting Engineering Programs.*

Alves, A. C., Leão, C. P., Moreira, F., & Teixeira, S. (2020). *Assessing Students' Perceptions and Learning Outcomes in a Project-Based Learning Course of Materials Science*. Education Sciences, 10(7), 172.

Michael, S. M., & John, P. Z. (2017). *Materials For Civil and Construction Engineers*. (4th ed.). Pearson.

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Exploring Student Preferences in Online Distance Learning: A Survey Study in Malaysia

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ABSTRACT

As university undergraduates navigating the modern educational landscape, we are witnessing a significant shift towards online distance learning (ODL). This study evaluates student preferences regarding various ODL options and compares them with conventional face-to-face lectures. The questionnaire was distributed randomly to a few groups of students across four courses. The analysis revealed notable trends in student preferences across different questions. The preferences expressed by students reflect their diverse learning needs and priorities. The popularity of hybrid models suggests a desire for flexibility and autonomy while also valuing face-to-face interactions and campus life. This aligns with previous research highlighting the importance of blended learning approaches in catering to varied learning styles and preferences.

Keywords: Online Distance Learning, Engineering Education, Student Preferences, University Graduates

INTRODUCTION

In recent years, the landscape of education has undergone a profound transformation with the advent of online distance learning (ODL). The convergence of technology and pedagogy has facilitated a shift towards more flexible, accessible, and personalized learning experiences. As university undergraduates navigating the modern educational landscape, we are witnessing a significant shift towards online distance learning. This transformation, fueled by technology and innovation, is reshaping how students can access and engage with educational content. Besides, online distance learning offers unparalleled flexibility, allowing them to tailor their study schedules to accommodate part-time jobs, family responsibilities, or personal interests. No longer bound by the constraints of traditional classroom settings, the students can access course materials and participate in discussions from anywhere with an internet connection.

This flexibility empowers them to take control of their learning journey and strike a balance between academic pursuits and other commitments. However, transitioning to online learning isn't without its challenges. The digital divide presents a barrier for some students, highlighting disparities in access to technology and reliable internet connectivity (Maheshwari, 2021). Moreover, staying motivated and engaged in virtual classrooms requires a different set of skills and strategies compared to face-to-face interactions. Adapting to this new learning environment may require the students to develop greater self-discipline, time management skills, and technological proficiency.

Previous studies have been carried out to explore student preferences regarding conventional face-to-face courses over online learning (Bilbeisi & Minsky, 2014; Glover & Lewis, 2012; Weldy, 2018). Mixed findings were obtained from the previous studies. Weldy (2018) found that 76% of students preferred to take traditional courses, citing that they learn and retain more knowledge therefore achieving better grades. Whereas only 12% of students preferred the blended course format, and 12% indicated a preference for online courses. Conversely, Glover & Lewis (2012) reported that students' preferences for taking online courses versus face-to-face or blended courses were relatively equal.

This study explores the potential of online distance learning as a future direction for education. It aims to evaluate student preferences regarding various ODL options and compare them with conventional face-to-face lectures. The options include ODL with fixed schedule face-to-face online lessons, ODL without fixed schedule lessons (full lecture videos provided), physical face-to-face classes on the campus, and hybrid models combining online and face-to-face components.

RESULTS AND DISCUSSION

A simple survey was conducted among students in our faculty to gauge their preferences regarding different learning options (refer to Table 1). The questionnaire was distributed randomly to a few groups of students across four courses: CEG552 (Highway and Traffic Engineering), CEW541 (Engineering Hydrology), CEW441 (Fluid Mechanics), and CES420 (Statics and Dynamics), and 93 responses were collected in the survey. The survey collected responses from a diverse sample of

students, allowing for a comprehensive analysis of preferences.

Fig. 1 summarised the corresponding responses on their preferences. Based on Question 1 (only 8.6% of students prefer face-to-face learning style), and Question 4 (37.6% of students did not prefer face-to-face lectures on campus), the conventional face-to-face learning style is no longer a must in education. The analysis revealed notable trends in student preferences across different questions. For instance, in Question 6 (Q6), which asked respondents to choose their preferred learning model without the influence of the COVID-19 threat, option d, representing the hybrid model, emerged as the most favored choice, garnering 31.2% of responses. This indicates a preference for a blended approach combining face-to-face interactions with online flexibility. The preferences expressed by students reflect their diverse learning needs and priorities. In Question 2, 38.8% of students prefer ODL with an online class due to the flexibility of studying anywhere but still in a similar setting as face-to-face classes.

The popularity of hybrid models suggests a desire for flexibility and autonomy while also valuing face-to-face interactions and campus life (47.3% of students opt for this reason in preferring hybrid settings). This aligns with previous research highlighting the importance of blended learning approaches in catering to varied learning styles and preferences. Understanding student preferences is essential for designing educational experiences that are engaging, effective, and responsive to evolving needs. Educators and institutions can leverage these insights to tailor learning experiences, integrate technology effectively, and foster a supportive learning environment that meets the diverse needs of students.

Table 1. Questions on the respondents' preference in teaching and learning methods

Questions	Preferences
Q1. Based on your experience, at the current stage, which learning platform do you prefer?	a. ODL with fixed schedule face-to-face online lessons. b. ODL without fixed schedule lessons (full lecture videos provided). c. Face-to-face in the campus. d. Hybrid: part of the lectures are scheduled Face-to-Face while part of it is online.
Q2. I prefer Online Distance Learning (ODL) with a fixed schedule of face-to-face online lessons because:	a. Flexible; I can study anywhere but in a similar setting as face-to-face in campus. b. I can be more disciplined with a fixed schedule ODL. c. I don't prefer this option. d. I also can rewatch all the lecture recordings. This is very helpful.
Q3. I prefer ODL (with lecture videos provided) because:	a. Flexible; I can study anytime anywhere if there is no fixed schedule. b. I can study at my own pace (I can replay lecture videos many times). c. I contact the lecturer (as facilitator) only when I need advice. d. I don't prefer this option.
Q4. I prefer face-to-face lectures in the campus.	a. I have access to campus life. b. No internet connection disturbance. c. Easier to concentrate. d. I don't prefer this option
Q5. I prefer the Hybrid setting because:	a. I can have campus life and my own flexible time. b. It would be easier for me to get advice from the lecturer on this option. c. I don't prefer this option.
Q6. If you have a choice (without the Covid-19 threat), which of the following would you prefer?	a. Back to conventional face-to-face teaching and learning style. b. Full Online Distance Learning (without fixed schedule). c. Flexi: whenever you want to face-to-face you come to join a physical class, or else you go online. d. Hybrid: part of the lectures are scheduled to be face-to-face while part of it is online.

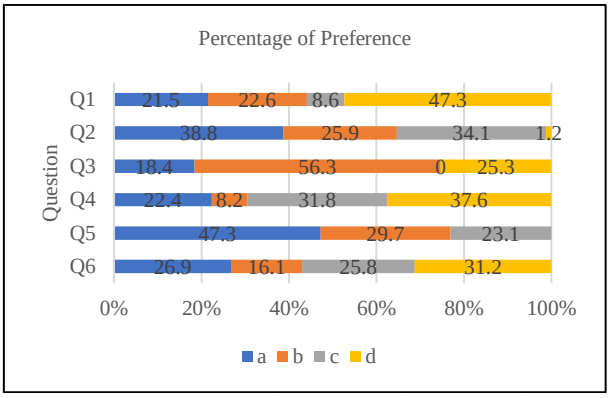

Fig. 1 Respondents' preferences in teaching and learning

CONCLUSION

The analysis of survey results sheds light on the complex interplay of factors influencing student preferences in teaching and learning methods. While hybrid models emerge as a popular choice, preferences vary based on individual needs, learning styles, and contextual factors. By recognizing and accommodating these preferences, educators, and institutions can create more inclusive and effective learning environments that empower students to succeed.

REFERENCES

Bilbeisi, K. M., & Minsky, B. (2014). Teaching online versus teaching hybrid and in class. *International Journal for Innovation Education and Research*, *2*(9), 1-9.

Glover, L.C., & Lewis, V.E. (2012). Student preference online versus traditional courses. *The Global elearning Journal*, *1*(3).

Maheshwari G. (2021). Factors affecting students' intentions to undertake online learning: an empirical study in Vietnam. *Education and Information Technologies*, *26*(6), 6629–6649. https://doi.org/10.1007/s10639-021-10465-8

Weldy, T.G. (2018). Traditional, blended, or online: Business student preferences and experience with different course formats. *e-Journal of Business Education & Scholarship of Teaching*, *12*(2), 55-62.

Assessing the Impact of Hybrid Final Year Project Workshop on Student Performance in Thesis Proposal Course

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ABSTRACT

This study investigates the impact of transitioning from a fully online to a hybrid workshop approach on student performance in a final year project (FYP1) course. The changes of workshop approach were motivated by stagnant student performance when workshop was conducted in fully online learning. The hybrid model aimed to enhance the student outcomes through program outcomes attainment and grading score of FYP1 result. The result was analyses for five semesters from 2021 to 2023 by comparing the grading score and program outcomes (POs) of student achievement. Results show a significant improvement in student performance for both cognitive and affective PO after the introduction of the hybrid workshop. This suggests that the hybrid model effectively enhanced students' problem-solving, design, teamwork, communication, and lifelong learning skills, contributing to a more comprehensive learning experience. The study concludes that the hybrid workshop approach is an effective strategy for improving student learning outcomes in the FYP1 course.

Keywords: Final Year Project, Hybrid Workshops, Thesis Proposal, Grading Score, PO Attainment.

INTRODUCTION

In the current educational landscape, online learning has gained significant interest globally since COVID-19 pandemic and is now widely used in the higher education sector (Kamraju et al, 2024). After COVID all education sectors are in transition from online back to face-to-face learning approach. However, most students prefer face-to-face interaction with lecturer and peer during the learning process with the presence of digital technology as reported by Stoian et al. (2022). Thus, blended learning or hybrid learning models, which combine traditional face-to-face approach with online learning components, are suitable to attract student interest in learning. The integration of hybrid approaches in the context of final year project (FYP) courses, particularly through workshops, presents an alternative option to enhance student learning experiences and outcomes.

At UiTM Pulau Pinang, the final year project course covers two semesters, comprising Final Year Project 1 (FYP1) and Final Year Project 2 (FYP2). However, this paper only focuses on FYP1 student performance. In FYP1, students are required to develop a research proposal in the form of a thesis report. The proposal includes several chapters, such as introduction, literature review, methodology, and expected outcomes. To assist students in preparing thesis proposal, a series of workshops or seminars are conducted, covering topics related to proposal writing and the process of searching information for project. During the COVID-19 pandemic, the learning approach for the FYP1 workshops transitioned to a fully online format. However, even after the pandemic was over and face-to-face learning resumed, the FYP workshops continued online. Despite this, student performance in FYP1 remained stagnant, without any significant improvement. Due to this situation, the university decided to modify the workshop approach from a fully online format to a hybrid approach. This hybrid model involves conducting workshops both online and face-to-face. By incorporating both approaches for FYP1 workshop, perhaps it may enhance student learning experiences and results for FYP1 through measurement of student grade and Program Outcomes (POs) attainment. Program outcomes are statements that describe the knowledge, skills, and attitudes that students are expected to attain upon completing the program. Table 1 presents the PO and learning domain mapping for the FYP1 course.

Hence, this paper aims to investigate the effectiveness of the hybrid learning approach of FYP workshop on student performance in the thesis proposal course. Perhaps, the findings from this paper will provide valuable insights for educators and institutions in searching the best learning approach to optimize student learning experiences and outcomes in FYP courses.

RESULTS AND DISCUSSION

In order to assess the impact of hybrid approach of FYP1 workshop on the student performance, data from the final result of FYP1 civil engineering student of Universiti Teknologi MARA, Pulau Pinang campus was referred. The Quantitative data used includes final grades and PO attainment scores for PO2, PO3, PO9, PO10 and PO12. This result was compared between students who

participated in fully online workshops starting from semester in mid-year of 2021 until 2022 and those who participated in hybrid workshops during semester in year 2023 through a comparison graph and table.

Table 1. Program Outcomes for FYP1 course

PO	Description	Learning Domain
2	Ability to identify, formulate, research literature and analyse complex civil engineering problems in reaching substantiated conclusions using principles of mathematics, natural sciences and engineering knowledge.	Cognitive
3	Ability to design systems, components or processes for solving complex civil engineering problems that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	Cognitive
9	Ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	Affective
10	Ability to impart effectively complex engineering activities through presentations, written and verbal communications to the engineering community and society at large.	Affective
12	Ability to recognise the need to undertake lifelong learning and acquire the capacity to do so independently in the broadest context of technological change.	Affective

Table 2 presents a comparison of average PO attainment in the FYP1 course throughout five semesters, highlighting the impact of the hybrid workshop approach on both cognitive and affective domains.

Table 2. Average PO attainment for FYP1

Semester	Workshop approach	Cognitive		Affective		
		PO2	PO3	PO9	PO10	PO12
20234	Hybrid	71	70	80	72	70
20232	Hybrid	68	68	78	70	68
20224	Online	60	69	75	70	67
20222	Online	68	68	76	69	68
20214	Online	69	68	76	70	69

Cognitive Domain (PO2 and PO3)

The data exposes a significant improvement in cognitive PO attainment after the introduction of the hybrid workshop. In the 20232 semesters, when the hybrid approach was first implemented, the average attainment for PO2 and PO3 slightly increased compared to the previous semesters when the workshop was fully online. This suggests that the hybrid workshops effectively enhanced students' cognitive skills in problem-solving and design.

Affective Domain (PO9, PO10, and PO12)

The hybrid workshop also positively impacted affective PO attainment. The average scores for PO9, PO10 and PO12 showed a consistent increase after the implementation of the hybrid approach. This indicates that the workshop not only improved students' technical skills but also improved student interpersonal, communication, and lifelong learning abilities.

Grading Scores

Fig. 1 illustrates the percentage of students achieving grading scores in the FYP1 course for five semesters from 2021 until 2023. The grading scores are categorized into three grading groups i.e Excellent (A+, A, A-), Good (B+, B, B-) and Satisfactory (C+, C).

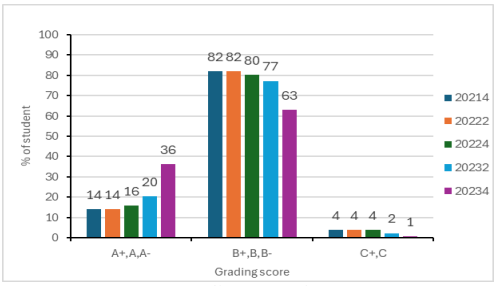

Fig. 1 Grading score for FYP1

When the workshop was still fully online, there was a slight increase in the percentage of students achieving group A grades which was from 14% to 16%, but the overall distribution remained similar. The result shows that a substantial improvement in student performance following the implementation of the hybrid workshop approach in the 20232 semesters where the Excellent grade increased from 16% to 36 %. In overall, the hybrid approach of FYP1 workshop may improve the proposal writing and result achievement. These findings are consistent with study by Tamrin et al. (2022) which shows that project-based hybrid learners are effective in improving the quality of writing thesis proposals.

CONCLUSION

Generally, in this paper, the impact of a hybrid workshop approach on student performance in a final year project (FYP1) course was assessed. The findings present a significant improvement in student performance, as evidenced by increased of excellent grade score of final FYP1 result and attainment of both cognitive and affective Program Outcomes (POs), following the implementation of the hybrid approach.

REFERENCES

Kamraju, Krishnalah, J., Durgesham, G., Shaba, N, Begum, S.A., Fatima, N. & Madhuri, Y. (2024). Exploring the Impact of Online Education on Higher Education, *Asean Journal of Educational Research and Technology*, 3(1), 27-36.

Stoian, C. E., Farcasiu, M.A., Dragomir, G.M. & Gerhes, V. (2022). Transition From Online to Face-to-Face Educations after COVID-19: The Benefits of Online Education from Students Perspective, *Sustainability*, 35(12812), 1-18.

Thamrin, Hutasuhut, S., Suhaharianto, J. & Aditia, R. (2022). Project-Based Hybrid Learning Effectiveness, Quality of Writing a Thesis Proposal, Independence and Learning Satisfaction, *International journal of Recent Educational Research*, 3(6), 651-661.

Evaluating the Impact of Assessment Components on Student Performance in Solid Mechanics at Diploma Level

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ABSTRACT

This study analyzes student performance in the Solid Mechanics course for Diploma-level in Civil Engineering students across three semesters at Universiti Teknologi MARA Pulau Pinang. The focus is on evaluating the impact of different assessment components, namely tests, assignments, and final exams, on the students Program Outcomes (PO1 and PO2). Data collected from three semesters (20222, 20232, and 20234) indicate significant variations in student performance across these assessment components. The results show that students generally perform well in assignments but struggle in tests and final exams. The primary factors contributing to these outcomes include students reliance on memorization rather than understanding key concepts, weak foundational knowledge in mathematics and physics, and insufficient practice with exam-type questions and exercises. These factors highlight the need for a more integrated teaching approach that emphasizes conceptual understanding, strengthens basic skills, and encourages regular practice. The study suggests implementing targeted interventions, such as more frequent formative assessments, enhanced support in foundational subjects, and structured practice sessions. By addressing these areas, educators can improve student performance in Solid Mechanics and better prepare them for future engineering education challenges.

Keywords: Student Performance, Assessment Components, Program Outcomes, Engineering Education, Formative Assessments

INTRODUCTION

Solid Mechanics is a fundamental subject in the curriculum of Diploma level Civil Engineering programs. It is crucial for students to grasp the core concepts and principles as these form the foundation for understanding more advanced topics in civil engineering. However, student performance in Solid Mechanics varies widely, reflecting the challenges they face in mastering the subject. According to Talib et al. (2018), evaluation is a key way to show how well students are doing and tell the difference between those who are good at something and those who aren't.

This study aims to analyze the performance of Diploma level Civil Engineering students in Solid Mechanics across three semesters, focusing on their achievement in different assessment components which are tests, assignments, and final exams. The data for Program Outcomes are PO1 and PO2 from the semesters 20222, 20232, and 20234 indicate notable disparities in performance across these components. PO1 is applying knowledge of applied mathematics, applied science, engineering fundamentals and an engineering specialization as specified in DK1 to DK4, respectively to wide practical procedures and practices. While PO2 is identifying and analyzing well-defined engineering problems, reaching substantiated conclusions using codified methods of analysis specific to their field of activity (DK1 to DK4). Several factors contribute to these variations in student performance. Firstly, students often resort to memorizing problem solving steps rather than understanding the underlying concepts, leading to superficial learning (SchoolHabits, 2023). Secondly, many students have a weak foundation in basic mathematics and physics, which are essential for comprehending Solid Mechanics. Lastly, inadequate practice with exam type questions and exercises further hampers their ability to perform well in assessments (Di Serio et al., 2013).

By examining the impact of these factors on student performance, this study seeks to identify targeted interventions that can enhance the teaching and learning of Solid Mechanics. The findings aim to provide insights into effective strategies for improving student outcomes and better preparing them for future engineering challenges.

RESULTS AND DISCUSSION

The performance of students in the Solid Mechanics course was assessed through three types of evaluations: tests, assignments, and final exams across three semesters (20222, 20232, and 20234). The results, as depicted in

Fig. 1 shows variations in Program Outcome (PO) attainments across different assessments and semesters.

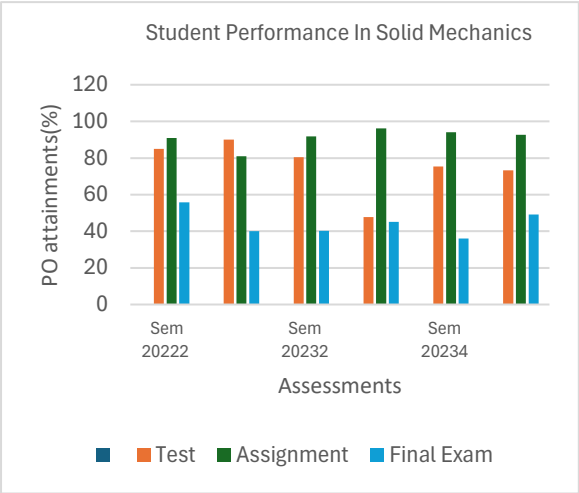

Fig. 1 Student performance in Solid Mechanics

In semester 20222, students achieved an average of 85% and 90% in PO1 and PO2 respectively for tests. However, there was a decline in semester 20232 to 80% for PO1 and a significant drop to 48% for PO2. This trend continued in semester 20234 with scores of 75% and 73% for PO1 and PO2 respectively. This decline in test scores suggests that students may struggle with retaining and applying concepts under timed conditions. It is possible that this could be attributed to a reliance on memorization rather than a deep understanding of the material, as supported by literature indicating that understanding leads to better long-term retention and application (SchoolHabits, 2023).

In contrast, performance in assignments was consistently high across all semesters. In semester 20222, students achieved 91% and 81% in PO1 and PO2 respectively. In semester 20232, scores were 92% for PO1 and 96% for PO2, showing improvement. Semester 20234 also saw high scores of 94% and 93% for PO1 and PO2 respectively. These high assignment scores indicate that students perform well in coursework that allows more time and access to resources. This suggests that students may be more comfortable and confident when they can refer to notes and other materials, which helps reinforce learning.

However, the final exam scores were notably lower than other assessments. In semester 20222, students scored 56% and 40% in PO1 and PO2 respectively. In semester 20232, scores were 40% for PO1 and 45% for PO2. Semester 20234 showed scores of 36% for PO1 and 49% for PO2. These consistently lower scores in final exams highlight a significant challenge for students. Final exams require not only a thorough understanding of concepts but also the ability to apply this knowledge under pressure. The weak foundational knowledge in mathematics and physics could be a contributing factor. Additionally, the lack of sufficient practice with exam type questions might hinder students ability to perform well in high stakes assessments (Di Serio et al., 2013).

To address these issues, several strategies could be implemented. Shifting the focus from rote memorization to understanding through interactive and applied learning techniques can enhance conceptual understanding. Providing additional support and resources to strengthen basic mathematics and physics skills is also crucial. Furthermore, incorporating more practice exams and problem-solving sessions can build familiarity and confidence with exam conditions. By adopting these strategies, educators can help improve student performance in Solid Mechanics and better prepare them for future engineering challenges.

CONCLUSION

This study analyzed the performance of Diploma-level Civil Engineering students in Solid Mechanics program at Universiti Teknologi MARA Pulau Pinang across three semesters. The results showed consistent high performance in assignments, but lower scores in tests and final exams. This indicates a reliance on memorization and insufficient understanding of concepts. Weak foundational knowledge in mathematics and physics, along with inadequate practice with exam-type questions, were identified as major factors affecting performance. To improve outcomes, a shift towards conceptual learning, enhanced foundational support, and increased exam practice is recommended.

REFERENCES

Di Serio, Á., Ibáñez, M. B., & Kloos, C. D. (2013). Impact of an augmented reality system on students' motivation for a visual art course. Computers & Education, 68, 586-596.

SchoolHabits. (2023). Memorization vs. understanding: The ultimate study secret. Retrieved from https://schoolhabits.com/memorization-vs-understanding

Talib, A. M., Alomary, F. O., & Alwadi, H. F. (2018). Assessment of Student Performance for Course Examination Using Rasch Measurement Model: A Case Study of Information Technology Fundamentals Course. Education Research International, 2018, 8719012. doi:10.1155/2018/8719012

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Enhancing Student Performance in Basic Structural Analysis: Insights from Course Outcome and Program Outcome

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ABSTRACT

In the evolving landscape of engineering education, the effectiveness of teaching methodologies and assessment strategies in fundamental courses like Basic Structural Analysis is crucial for student success. This study examines student performance across three semesters (20212, 20222, 20224) in the Basic Structural Analysis course. It is a fundamental component of the Diploma in Civil Engineering curriculum. Utilizing data from students results, the research aims to identify trends in student performance, analyze the impact of teaching methods, and evaluate the correlation between student feedback and learning outcomes. Results indicate a significant decline in both test scores and Program Outcomes (PO) and Course Outcomes (CO) attainments, particularly in semester 20224. The analysis highlights common issues such as cognitive overload due to extensive testing and inadequate student engagement in online classes. Based on these findings, the study proposes targeted interventions, including the adjustment of assessment strategies and enhanced interactive teaching methods, to address identified challenges and improve overall student performance. This research underscores the importance of continuous feedback and adaptive teaching strategies in maintaining the effectiveness of foundational courses in civil engineering education, ultimately contributing to the development of competent engineering professionals.

Keywords: Basic Structural Analysis, Civil Engineering Curriculum, Student Performance, Course Outcome, Program Outcome.

INTRODUCTION

The field of civil engineering is built on a foundation of fundamental courses that equip students with the essential knowledge and skills needed for their future careers. Among these, the Basic Structural Analysis course holds as one of the fundamental in the curriculum of the Diploma in Civil Engineering program at Universiti Teknologi MARA (UiTM). This course introduces students to the principles of structural analysis, which are essential for understanding the behavior of structures and ensuring their safety and stability through the analysis process.

Given its importance, it is essential to continuously assess and enhance the teaching and learning processes associated with this course. Recent trends in education emphasize the need for effective teaching methodologies, comprehensive assessment strategies, and the incorporation of student feedback to improve educational outcomes.

Curriculum as key in education are refers to the structured set of courses, content, and learning experiences designed to achieve specific educational outcomes within a particular field of study. It encompasses not only the subjects taught but also the teaching methods, assessments, and educational goals (Smith & Doe, 2023). By reviewing the curriculum, educators can identify areas where structural analysis concepts are introduced and reinforced throughout the program.

This study aims to analyze the performance of students enrolled in the Basic Structural Analysis course over three semesters: 20212, 20222, and 20224. There are 2 Course Outcome (CO) and 2 Program Outcomes (PO) in this course. CO1 and CO2 are to compute forces and stability in statically determinate structures and to evaluate structural analysis problems in statically indeterminate structures, respectively. While for PO1 and PO2 are to apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in DK1 to DK4 respectively to wide practical procedures and practices and to identify and analyze well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity, respectively. By examining CO and PO data, the research seeks to identify trends in student performance, assess the impact of different teaching methods, and understand the relationship between student feedback and learning outcomes.

RESULTS AND DISCUSSION

The data in this study were collected from the assessment by students from three semesters (20212, 20222 and

20224). Those assessments were assignments, test and final examinations. Assessments provide essential feedback to both educators and students, informing instructional practices and learning progress (Black & William, 2023). According to, assessments are critical to evaluate student understanding and proficiency in subject areas, which can impact future learning opportunities (Johnson, 2023). Employing a variety of assessment methods, such as quizzes, exams, projects, and practical assignments, allows educators to measure student understanding from different perspectives. Moreover, aligning assessments with course outcomes ensures that they effectively gauge the mastery of structural analysis concepts.

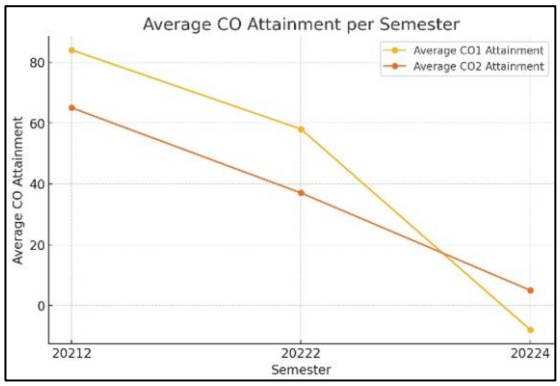

Fig. 1 Average CO attainment per semester

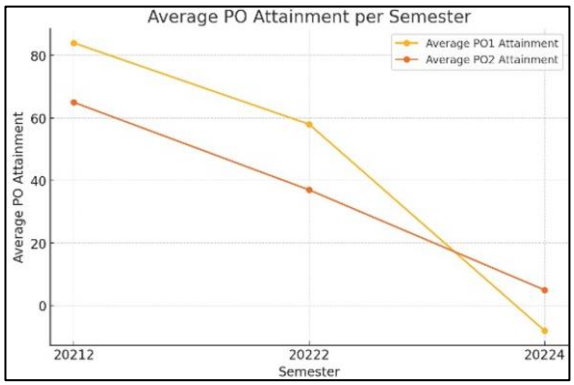

Fig. 2 Average PO attainment per semester

Fig. 1 shows the average attainment for CO1 and CO2. CO shows significant decline in semester 20224. For semester 20212 state the average CO attainment were above 80 and 60 for CO1 and CO2 respectively and it slightly decreased for semester 20222. It might be there were lack of active learning which had been proven can enhance in students' performance. Active learning has been shown to enhance student engagement, comprehension, retention, and transfer of knowledge compared to traditional passive learning approaches (Michael, 2006).

From Fig. 2 as depicted the average program outcome attainment, the graph displays the average attainment for PO1 and PO2. Similar to CO as mentioned earlier, there is a significant decline in PO1 in semester 20224. Both CO and PO show a similar pattern of decrement. Besides active learning, lack of problem-solving activities also might be a reason for the decrement of graph in student performance in basic structural analysis. Problem-solving activities present students with challenging problems or case studies that require critical thinking and analysis. By grappling with real-world scenarios, students develop problem-solving skills, decision-making abilities, and a deeper understanding of complex concepts (Hmelo-Silver et al., 2007).

CONCLUSION

This study aims is to analyse the performance of students enrolled in the Basic Structural Analysis course over three semesters: 20212, 20222, and 20224. The findings of this study will contribute to the ongoing efforts to refine educational strategies in the Basic Structural Analysis course, ensuring that it continues to meet the needs of civil engineering students and prepares them effectively for their professional roles. This research underscores the significance of foundational courses in the civil engineering curriculum and the importance of adapting teaching methodologies to foster better learning outcomes and overall student success.

REFERENCES

P. R. A. Smith & J. L. Doe. (2023). "Understanding Curriculum: Concepts, Structures, and Implications for Education." Journal of Educational Studies, 45(2), 150-165. DOI: 10.1080/00220671.2023.2145678.

Black, P., & Wiliam, D. (2023). "Assessment for Learning: An Essential Element of Classroom Practice." Educational Assessment, Evaluation and Accountability, 35(1), 1-14. DOI: 10.1007/s11092-023-09329-2.

Johnson, M. (2023). "Evaluating Student Performance: The Role of Assessment in Academic Achievement." Journal of Educational Psychology, 115(3), 456-470. DOI: 10.1037/edu0000654.

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). Educational Psychologist, 42(2), 99-107.

Michael, J. (2006). Where's the evidence that active learning works? Advances in Physiology Education, 30(4), 159-167.

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Factors Influencing the Employability Trends of CEEC221 Graduates Amidst COVID-19: A Survey-Based Analysis

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ABSTRACT

This study aims to analyze the employability trends of graduates from the CEEC221 Programme, a three-year civil engineering degree programme at Universiti Teknologi MARA, in the context of the COVID-19 pandemic. Employability data were collected through questionnaires distributed to seven graduating cohorts during convocation events and via online platforms. The collected data were then analyzed using data analysis to identify trends and variations in employability rates across different cohorts. The analysis reveals an overall positive trend, with an average employability rate of 77%, despite the challenges posed by the pandemic. The study highlights the programme's adaptability, facilitated by key components such as the Industrial Linkage Programme, Communication and Leadership training, and an emphasis on Life-Long Learning. These elements have proven instrumental in equipping graduates with the necessary skills and resilience to succeed in a dynamic job market. The findings underscore the importance of ongoing evaluation and targeted support to maintain graduates' competitiveness and industry recognition amidst evolving conditions.

Keywords: CEEC221, Employability Skills, Covid19, Employability Trends

INTRODUCTION

In today's rapidly evolving job market, the employability of graduates is important for academic institutions and industries. As the demand for skilled professionals continues to rise, academic programmed must adapt to ensure that graduates are adequately prepared for the challenges of the workforce. It is important to study the employability of civil engineering graduates because it helps to understand their preparedness for their entry-level positions in the rapidly advancing civil engineering industry. Employability, defined as developing capabilities for successful and sustainable career development, can explain students' preparedness for the workforce. Employers expect engineering graduates to be prepared for their roles, and understanding the employability of civil engineering graduates can help bridge the gap between industry expectations and academic preparation (Bae et al., 2022).

This study focuses on the employability trends of graduates from the CEEC221 programme, a critical endeavour given the importance of civil engineering in Malaysia's development landscape. Higher education needs to embed employability skills into the curriculum to equip graduates with the relevant skills and attributes to secure employment (Souppez J., 2023). By analyzing the employability trends of graduates from the CEEC221 programme, this research aims to provide valuable insights into the readiness of civil engineering graduates for the Malaysian job market. The findings of this study can inform educational institutions, policymakers, and industry stakeholders about areas of strength and areas needing improvement within the programme, ultimately enhancing the quality of engineering education and contributing to the nation's workforce development goals.

The COVID-19 pandemic has presented unprecedented challenges to many industries, including higher education and the job market. The impact of the COVID-19 pandemic on the employment outcomes of civil engineering graduates has led to disruptions in hiring processes, with many firms implementing hiring freezes or reducing recruitment efforts due to economic uncertainties caused by the pandemic. However, graduates are equipped with a diverse set of abilities, including strong communication skills, effective problem-solving capabilities, adept teamwork skills, sound decision-making competencies, the ability to perform under pressure, ICT skills, and a commitment to lifelong learning become highly attractive to employers and are readily embraced by the industry (Tushar et al., 2023).

RESULTS AND DISCUSSION

The preliminary survey conducted during the graduate convocation event and via Google Survey aimed to assess the employability of graduates from the CEEC221 Program. This analysis, spanning seven graduating cohorts, serves as an initial evaluation of the programmed effectiveness. Figure 1 illustrates the graduates' employability percentage. Examining the employability trends of CEEC221-programmed graduates in the context of the COVID-19 epidemic demonstrates that their entry into the work market is influenced by several factors. While certain cohorts, like those graduating in March

2023 and October 2022, achieved remarkable employment rates of 94% and 85%, respectively, others had difficulty, as evidenced by the March 2020 cohort's lower rate of 64%.

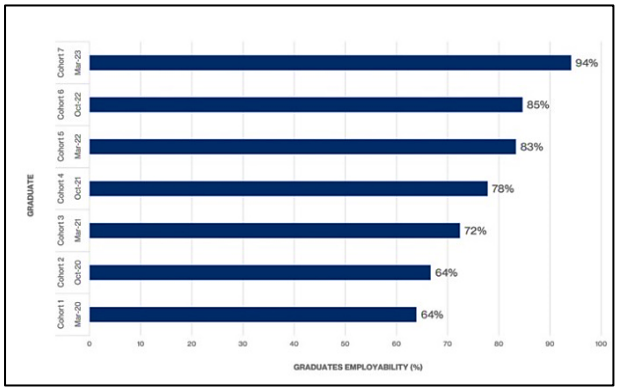

Fig. 1 Employability Trends of CEEC221

These results were most likely influenced by factors such as swings in industry demand, distant labour arrangements, and delays in construction projects caused by the epidemic. Achieving a 77% employability rate on average indicates adequate marketability for our graduates, indicating the programme competence in preparing students for civil engineering professions. Despite pandemic-related problems, the programme's adaptation and preemptive actions most likely contributed to an overall upward trend in employment. This outcome emphasizes the significance of continual monitoring and targeted assistance for graduates to overcome pandemic-related job market issues. To maintain the programme's success in preparing students for civil engineering professions in the face of changing conditions that contribute to the employability of graduates depends on developing interpersonal skills and adding value, helping them become preferred candidates for employers.

To maintain relevance and gain industry recognition, the CEEC221 Programme incorporates three essential elements: The Industrial Linkage Programme, Communication and Leadership training, and a focus on Life-Long Learning as shown in figure 2. The Industrial Linkage Programme facilitates networking and hands-on experience through industry presentations and involvement in student clubs. Communication and Leadership initiatives cultivate soft skills vital for professional achievement. Emphasizing Life-Long Learning provides flexible learning paths and opportunities for professional growth, reinforcing graduates' competitiveness and adaptability in the job market. These measures are crucial for ensuring graduates remain competitive and capable of meeting industry requirements in a constantly evolving landscape.

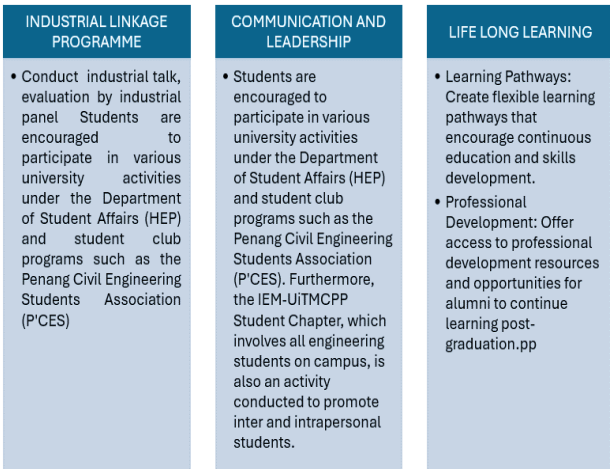

Fig. 2 Three important elements that contribute to graduates' employability

CONCLUSION

In conclusion, the CEEC221 Programme's analysis amid the COVID-19 pandemic reveals an overall positive employability trend, averaging 77%. Despite challenges, programme adaptability has proven effective, facilitated by components like the Industrial Linkage Programme, Communication and Leadership training, and an emphasis on Life-Long Learning. These facets ensure graduates are well-prepared and adaptable, enhancing their competitiveness in the dynamic job market. The programme's ability to sustain graduates' relevance and industry recognition amidst evolving conditions underscores its effectiveness in preparing civil engineering professionals for success.

REFERENCES

Bae, H., Polmear, M., & Simmons, D. R. (2022). Bridging the Gap between Industry Expectations and Academic Preparation: Civil Engineering Students' Employability. *Journal of Civil Engineering Education, 148*(3). https://doi.org/10.1061/(asce)ei.2643-9115.0000062

Souppez, J.-B. R. G. (2023). Engineering employability skills: Students, academics, and industry professional's perception. *International Journal of Mechanical Engineering Education,* 03064190231214178. https://doi.org/10.1177/03064190231214178

Tushar, H., & Sooraksa, N. (2023). Global employability skills in the 21st century workplace: A semi-systematic literature review. *Heliyon, 9*(11), e21023.https://doi.org/https://doi.org/10.1016/j.heliyon.2023.e21023

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Flexible Pavement Design Tool (FlexiPavD): Student Feedback Survey

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ABSTRACT

This study presents the findings from a survey conducted to gather student feedback on the efficacy and user experience of a teaching and learning tool for flexible pavement design. The survey aimed to evaluate the tool's impact on students' learning process and overall satisfaction. Data were collected from a diverse cohort of 50 undergraduate students through an online questionnaire. In most Malaysian universities, the Highway and Traffic Engineering course syllabus includes the design of flexible pavements. The student needs to go through a manual (more than 30 pages) to assist them in designing a flexible pavement. This process may result in human error in addition to wasting money, time, and paper. With this in mind, we develop a tool using Microsoft Excel to help assist students in carrying out the design process anytime and anywhere from hp, tablet, laptop, or pc. The results indicate a generally positive reception of the tool, with 90% of respondents being satisfied with the design tool, and 10% feeling neutral. It is concluded that the tool is pertinent to the teaching and learning process based on the fact that 92% of students concur that FlexiPavD is helpful for their learning process in flexible pavement design.

Keywords: FlexiPavD, Student Feedback, Teaching and Learning, Tools

INTRODUCTION

The integration of advanced teaching and learning tools has become a fundamental component of modern education. The shift from traditional, lecture-based instruction to more dynamic, interactive learning environments that emphasize student-centered learning can be supported by using these tools, ranging from digital platforms and simulation software to collaborative online resources and interactive multimedia (Ong et al., 2020; Ubaidillah, et.al., 2020). The incorporation of advanced teaching tools in the curriculum is essential for enhancing the learning experience and engaging student interest in the particular subject matter.

In most Malaysian universities, flexible pavement design is taught as part of the Highway and Traffic Engineering syllabus. To assist in carrying out the design process, a revised version of the guidelines ATJ 5/85 (Pindaan 2013): Manual for the Structural Design of Flexible Pavement was introduced in 2013. The revised guidelines adopt a catalogue of pavement structures method to speed up the design process and achieve a more cutting-edge road design (JKR, 2013). The student must print out the manual or scroll through a digital edition, where the process not only wastes paper, resources, and time but also increases the likelihood of human error. Therefore, a tool using Microsoft Excel was developed to assist students in carrying out the flexible pavement design process conveniently from computing devices such as desktop and laptop computers, smartphones, or tablets. The Excel spreadsheet was designed to produce the thickness of each flexible pavement layer in accordance with ATJ 5/85 (Pindaan 2013): Manual for the Structural Design of Flexible Pavement (Shah et al., 2022).

This survey aims to gather valuable feedback from students regarding the effectiveness and impact of teaching and learning tools specifically developed for flexible pavement design. The primary objective is to assess how these tools facilitate the learning process, the satisfaction of the student with the tools, and the effectiveness of the tools in contributing to a more engaging and interactive learning environment. From student perspectives, we can identify strengths and areas for improvement of the tool, ensuring that the teaching method remains aligned with student needs.

RESULTS AND DISCUSSION

Data was collected from a diverse cohort of 50 undergraduate students through an online survey platform to ensure ease of access and participation. Based on the question “How satisfied are you with FlexiPavD?”, 38% of students rated their overall satisfaction with the teaching and learning tools as "Very Satisfied”, while 52% of students rated their satisfaction as "Satisfied”. The rest 10% of the students were "Neutral" about the FlexiPavD. The high percentage of students expressing satisfaction (90% combined for "Very Satisfied" and "Satisfied") indicates a strong positive reception of the teaching and learning tools (refer Figure 1).

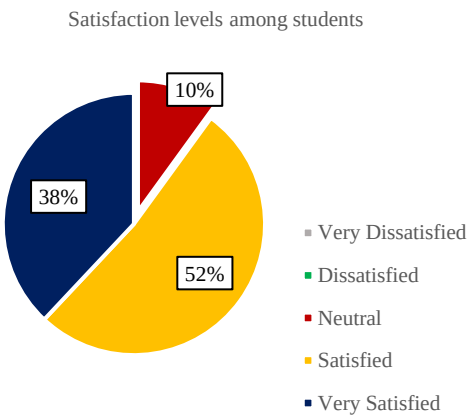

Fig. 1 Percentage of satisfaction level among students

From Figure 2, 42% of students rated the teaching tools as "Highly Relevant and Very Helpful" to their learning process in designing flexible pavement. 50% of students indicated that the tool was "Relevant and Helpful" while the remaining students had a neutral opinion of the tool, and none of them have negative opinion on FlexiPavD. A highly favorable response to the teaching and learning tool is indicated by the high number of students (92%) expressing "Highly Relevant and Very Helpful" and "Relevant and Helpful" on the relevance and helpfulness of using this tool for their learning process in flexible pavement design.

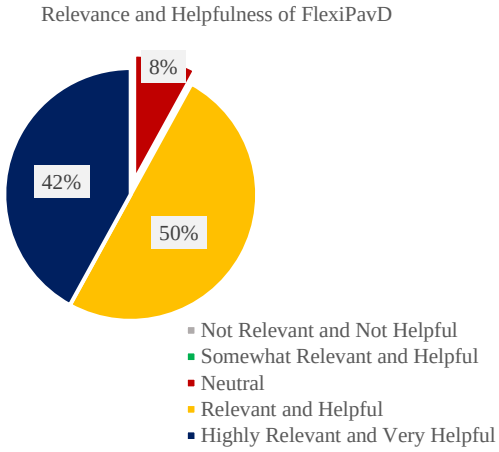

Fig. 2 The relevance and helpfulness of FlexiPavD in the process of learning flexible pavement design

Based on Figure 3, 80% of students reported that the FlexiPavD was easy to navigate and user-friendly. 84% of students appreciated the convenience and accessibility of these tools, noting that they could be accessed at anytime and anywhere. 82% of students agree that the content in FlexiPavD is relevant and assisted them in the designing of flexible pavement. 86% of the students agree that FlexiPavD helps them in saving time. 82% of students found the tools interactive. The remaining students had a neutral opinion of the tool, and none of them disagreed with its efficacy.

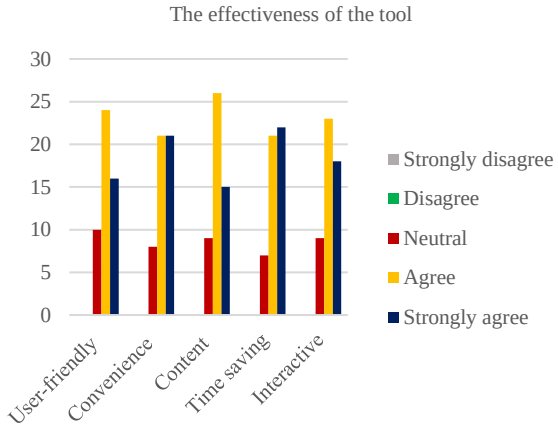

Fig. 3 The effectiveness of FlexiPavD

CONCLUSION

The survey results indicate that the teaching tools for flexible pavement design are highly relevant and helpful to students. Nonetheless, continuous improvements and updates will further maximize the benefits of FlexiPavD in the educational process.

REFERENCES

Jabatan Kerja Raya (JKR) (2013). Manual for The Structural Design of Flexible Pavement ATJ 5/85 (Pindaan 2013), Cawangan Kejuruteraan Jalan dan Geoteknik.

Ong, P., Duraippah, K., and Singh, G.S.B. (2020). Students' perceptions towards using Google Classroom in the learning process at public secondary schools in Kuala Lumpur, *ASEAN Journal of Open and Distance Learning, Special Issue*, 82 – 90.

Shah, S.M.R., Sian, T.Y., Keria, R., and Noor, S.M. (2022). FlexiPavD: Flexible pavement design tool. In Z. Idris et al (Eds.), *Information & innovation: A synthesis of ideas (Series 2)* (pp. 20-27). Universiti Teknologi MARA Cawangan Kelantan.

Ubaidillah, N.Z., Baharuddin, N.N., Kasil, N., & Ismail, F. (2020). Students' perception of the use of technology in education. *Environment-Behaviour Proceedings Journal*, *5*(15), 117–122. https://doi.org/10.21834/ebpj.v5i15.2374

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Impact of Using Adjustable Batik Frame During Batik Canting Process On Teaching And Learning

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ABSTRACT

Batik is a unique technique in that the colours are retained according to the design using wax or other ingredients like thick mud, concentrated starch, or other things. The melted wax is held in place with canting before being adorned on the stretched fabric. Stretching the fabric is necessary to get a clean, distinct pattern. If it is not completely stretched, the degree of stretch has an impact on the colouring process as well. The frame that is used to stretch the fabric is important since it has an impact on the designer's movement. Because the frame height can be adjusted, using an adjustable batik frame can help the designer feel less pain while designing the batik. In order to limit the mobility of batik designers, it also has a space for colour containers. Additionally, this frame is offered in a small form that facilitates storage and mobility. User feedback determines the frame's functionality. This study examines the impact of an adjustable frame on teaching, learning, and display processes in batik canting, considering user comfort, pattern quality, and safety.

Keywords: batik, canting, adjustable, frame, teaching and learning

INTRODUCTION

The origins of batik in Malaysia are thought to date back to the 15th century. Early development demonstrates the impact and influence of Javan batik. Malaysia's batik business expanded dramatically between the 1930s and the end of World War II. Batik entrepreneurs from Kelantan and Terengganu are pioneers in the development of batik in this country (Abdullah1990). Batik canting requires fine, smooth cloth; otherwise, the canting's spout will catch on the surface (Yunus, 2011). The fabric used varies from viscose and rayon to cotton lawn and silk (Hassan, 2018).

The adjustable frame was designed to facilitate the batik canting process for teaching and learning for DJX3052: Textile Workshop Practice 1 and also manufactured for the purpose of demonstration at the exhibition. Has two 50-inch-by-50-inch fields with legs that can be adjusted to a height of 100cm. The adjustable frame have portable features, can be adjusted in height to give user comfort, and can reduce the danger of damage during the cloth tensioning process by replacing nails with slots. Furthermore, it is designed to be compact and easy to load into a car. It may also create a neater and more organized work environment by allowing colouring supplies to be stored together rather than on separate tables.

This study involves data collection through observations of the use of an adjustable frame during the batik canting process. Data was analyzed to determine the effects of using an adjustable frame on user comfort, pattern quality, and safety factors. This methodology will require height measurements, ergonomic assessments, and observations of the entire canting process.

RESULTS AND DISCUSSION

The user response has been quite positive. As in figure 3, the claim that this frame can be raised or lowered to suit the user's comfort level supported by 52% of users overall. In order to ensure the frame is suitable to be used by all ages, the height is designed adjustable in open state as in Figure 1 Therefore, as in figure 3, up to 40% of customers concurred that using this frame can lower the chance of experiencing back pain when practicing batik canting. The user must stand while decorating on the fabric during the canting procedure. If this technique is carried out over an extended length of time, it may somewhat contribute to back pain. As a result, this frame's height can be changed to accommodate users of different heights.

Meanwhile as mentioned in figure 3, 52% of users claimed that this frame conserve workspace when doing batik canting. This is as a result of the colour containers are arranged on this frame. Different tables are no longer required, and users are spared from having to keep going back to choose their preferred colour. The percentage of respondents who think that this display is small and convenient to store is 56%. The frame is foldable and equipped with wheel as in figure 2 to accommodate its mobility and storage.

Fig. 1 Adjustable frame in open state

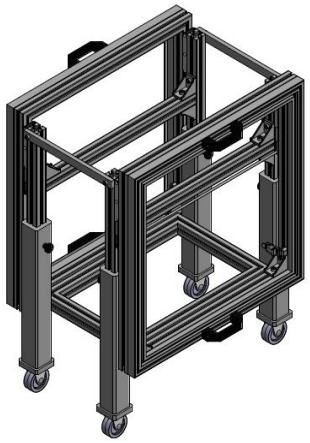

Fig. 2 Adjustable frame in folded state

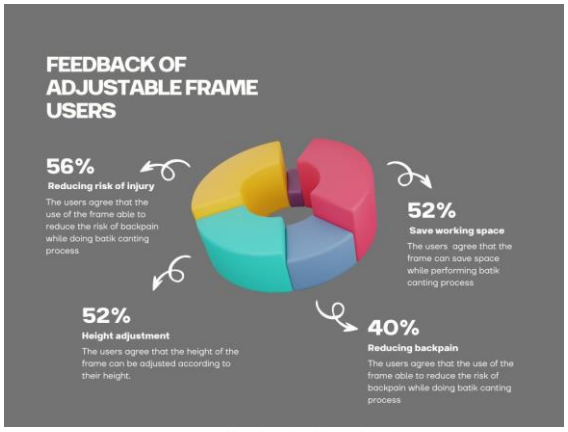

Fig. 3 Feedback of adjustable frame users

CONCLUSION

Based on the analysis of the study results, it can be concluded that the use of adjustable frame has a positive effect on the batik canting process and helps teaching and learning. This leads to increased comfort, quality, and safety in batik production. Therefore, the appropriate use of adjustable frame is crucial in effective and efficient batik production practices.

REFERENCES

Abdullah J.A.S (1990) Batik: Sejarah dan Keistimewaan Tekniknya, *Akademika 37,* 73 - 90

Hassan S.A.A (2018) Teknologi Pemprosesan Batik Melayu di Kelantan, *Jurnal Wacana Sarjana* Vol. 2(2), 1- 8

Yunus N.A (2011) *Malaysian Batik: Reinventing A Tradition.* Tuttle Publishing

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Students' Performance in Learning Air Conditioning System of Building through Experience Based Learning Method

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ABSTRACT

Building services are integral to civil engineering, contributing to the functionality, sustainability, and efficiency of a building. The Building Services course in the Civil Engineering Diploma Program at UiTM involves theoretical and practical components, emphasizing electrical and mechanical systems in buildings. Air Conditioning (AC) systems, a crucial aspect of building services, are examined in detail, given their importance in maintaining optimal indoor environments. Teaching these systems to diploma-level civil engineering students is challenging due to the technical and dynamic nature of the course. The aim of this study is to compare the performance of two groups of students from different semesters using two teaching methods: conventional teaching and experience-based learning with a site visit. The research explores the impact of these methods on students' understanding of AC systems. Data collection in this study involves information on student participation, demographics and performance in the summative assessment, focusing on air conditioning system-related questions. Statistical analysis is employed to compare the two groups of students based on teaching methods and gender. The students with one-site visit experience perform significantly better in understanding AC systems compared to those without. This research contributes to the pedagogical understanding of effective teaching methods in civil engineering education.

Keywords: Building Services, Civil Engineering Education, Air Conditioning System, Teaching Methods, Experiential Learning

INTRODUCTION

Building services play a crucial role in the field of civil engineering, contributing significantly to a building's functionality, sustainability, and efficiency. In addition, it also minimise energy usage and improve the overall performance of the built environment (Illankoon & Lu, 2019). Moreover, the design and implementation of building services require collaboration between architects, engineers, and contractors to meet the specific needs and requirements of each project (Pikas et al., 2020). However, learning building services can be a challenging task for civil engineering students (Alanne, 2016). This is due to the technical nature of building services, which requires solid understanding and principles of mechanical, electrical, and plumbing systems. The interdisciplinary nature of building services, requiring coordination with other engineering disciplines and architectural design that contribute difficulty for civil engineering students who not prior expose to these fields (Behan et al., 2015). Therefore, the aim of this study is to compare the attainment of students' performance in learning air conditioning using conventional method and experience-based learning approach.

RESULTS AND DISCUSSION

The demographic of participants is shown in Table 1.

Table 1. Number of students according to the semester and gender

Aspect	Gender	Freq	(%)
Semester 20222 One Site visit	Female	39	43.8
	Male	50	56.2%
Semester 20232 Zero Site visit	Female	53	37.9%
	Male	87	62.1%

Table 2 displays the distribution of marks categories for students with one site visit, meanwhile Table 3 displays the distribution of marks categories for students with zero site visit. Consequently, 86.5% of students of semester 20222 scored more than 10 marks in the summative assessment for the air-conditioning topic. In addition, the result shows students of semester 20232 acquired moderate understanding which 66.4% acquired poor understanding for learning the topic. It shows that students who undergo site visit attained better comprehension of

learning air conditioning systems compared to students who have no site visit experience.

Table 2. Semester 20222 (One Site Visit)

Category of Understanding	Marks	Number of Students		Total	(%)
		Male	Female		
Good	16-20	36	24	60	67.4
Better	11-15	9	8	17	19.1
Moderate	6-10	2	7	9	10.1
Poor	<5	3	0	3	3.4

Table 3. Semester 20232 (Zero Site Visit)

Category of Understanding	Marks	Number of Students		Total	(%)
		Male	Female		
Good	16-20	4	6	10	7.1
Better	11-15	5	7	12	9.6
Moderate	6-10	14	11	25	18.9
Poor	<5	63	30	93	66.4

A t-test analysis is conducted to determine whether there was a significant difference in the score marks for both groups as shown in Table 4. A p-value of 0.00, indicating statistical significance at the 0.05 level. Thus, it suggests a notable disparity in the understanding of the topic's content between the two student groups.

Table 4. T- Test value of zero site visit and one site visit

Demographic aspect	Freq (N)	Mean (M)	Std. Deviation (SD)	t	p-value
One Site visit (Sem 20222)	89	15.60	4.7	15.85	0.00
Zero Site Visit (Sem 20232)	140	5.49	4.7		

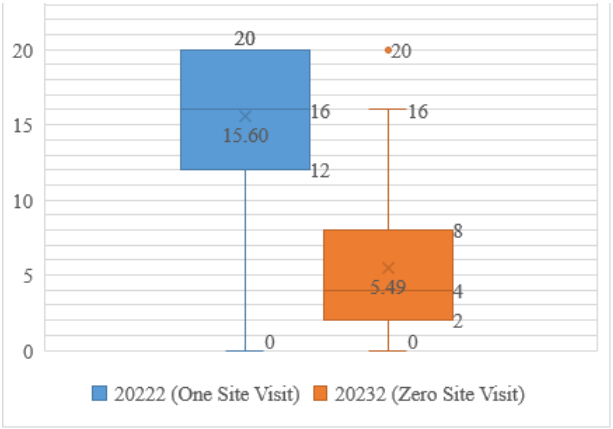

Fig. 1 The Box Plot of student's total

Furthermore, the students' marks were evaluated using the box plot technique as depicted in Figure 1. It is revealed that most of the students in semester 20222 scored marks within the range of 16-20 which specifies the students had good understanding. While, in semester 20232, most of the students in this group scored marks within the range of 0-5 which represented the students had poor understanding. It is evident that the median of the data for the one-site visit group is higher compared to the median for the zero-visit group.

CONCLUSION

This study provides valuable insights into the effectiveness of incorporating site visit activity in enhancing students' understanding of complex engineering topics. The conclusion that the one-site visit group outperformed the zero-site visit group is further supported by these t-tests and box plot analysis. These results underscore the importance of incorporating experiential learning into the teaching of complex engineering topics like air conditioning systems.

REFERENCES

Alanne, K. (2016). An Overview of Game-Based Learning In Building Services Engineering Education. *Eur. J. Eng. Educ*., 41(2), 204–219.

Behan, A., Mathews, M., Furlong K., Ahern, C., & Beagon, U. (2015). Cultural Change through BIM: Driving Lean Transformation in Education, CITA BIM Gathering, Dublin Ireland.

Illankoon, I. M. C. S., & Lu, W. (2019). Optimising Choices of 'Building Services' for Green Building: Interdependence and Life Cycle Costing. *Building Environment*, 161, 106247.

Pikas, E., Koskela, L., & Seppänen, O. (2020). Improving Building Design Processes and Design Management Practices: A Case Study. *Sustainability*., 12(3), 911.

Tran, Q. D. (2020). Challenges in Managing Green Building Projects from The View of The Contractors: An Exploratory Study in Vietnam. *IOP Conf. Ser. Mater. Sci. Eng*., 869(6).

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