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Perception of Civil Engineering Lecturers in Southern Zone Polytechnics Towards Digitalization in Teaching and Learning

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Abstract

This study aims to analyze the perceptions of Civil Engineering lecturers in the Southern Zone Polytechnics regarding digitalization in teaching and learning, in line with the demands of the Fourth Industrial Revolution (IR 4.0). The main focus of the study is to identify the level of knowledge and skills of lecturers in utilizing digital technologies such as the Internet of Things (IoT), Building Information Modeling (BIM), and digital learning systems. This study also examines the relationship between lecturers knowledge and skills and the effectiveness of digitalization integration in the educational process. A survey method with a quantitative approach was employed, collecting data through questionnaires distributed to lecturers from three polytechnics in the Southern Zone. The data were analyzed using descriptive and inferential statistical techniques to identify patterns of perception and relationships between the study variables. The findings revealed that the level of knowledge and skills among lecturers was moderate, with major challenges identified, including the lack of professional training and adequate technological infrastructure. However, there was a significant positive relationship between lecturers' knowledge and skills and the effectiveness of technology-based teaching. The findings highlight the importance of enhancing comprehensive professional training for lecturers and providing technological infrastructure that supports digital integration. This study offers guidance to Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK) and other stakeholders to strengthen the polytechnic education system in alignment with industry needs and the challenges of IR 4.0. It is hoped that this study will contribute to improving the quality of teaching and learning in technical education in Malaysia in line with current rapid developments.

1. Introduction

Education plays a crucial role in developing high-quality human capital as a key step towards achieving global education standards. The advancement of cyber technology and the rapid expansion of internet accessibility have significantly influenced the education sector. The Ministry of Education Malaysia (KPM) is committed to improving the national education system to achieve global recognition by focusing on enhancing student performance in alignment with national aspirations. Educational transformation in teaching and learning methods is essential in producing a generation equipped with relevant skills to meet the challenges of the 21st century. The Ministry of Higher Education (KPT) has established 20 public universities and 36 polytechnics to develop a skilled and competitive workforce. Enhancing graduate employability is a priority under the Graduate Employability Strategic Plan 2021-2025, which emphasizes the need for graduates to acquire additional competencies to improve their competitiveness in the job market. The quality of education is highly dependent on the effectiveness of teaching (Muhammad, 2019). Effective collaborative efforts among lecturers enhance the overall education quality. Therefore, to produce globally competitive graduates, lecturers must diversify their teaching approaches to be more engaging, interactive, creative, and structured to attract student interest. Lecturers should keep up with current trends and effectively utilize new approaches such as teaching aids integrated with technology (Mohammad, 2020).

Innovative educational environments have emerged because of the Fourth Industrial Revolution (IR 4.0) (Shahroom & Hussin, 2018). Rapid advancements in innovation have led to Education 4.0, an innovative model for future learning. Graduates must be prepared for an IR 4.0-driven future where intelligent robots replace humans in certain job categories (Sharma, 2019). This necessitates an education system that emphasizes critical skills and knowledge that machines cannot replace, as humans are the creators and operators of these technologies (Lada et al., 2023). The expansion of innovation within Education 4.0 prioritizes skill development, making future learning smarter, more mobile, global, and virtual. According to the World Economic Forum (2020), these competencies are key to addressing the evolving workforce demands of the future. Examples include collaborative learning platforms, Google Classroom, and Microsoft Teams. In addition to 21st-century skills, advanced competencies such as the Internet of Things (IoT), Artificial Intelligence (AI), Big Data Analytics, Cloud Computing, Virtual Reality (VR), and Augmented Reality (AR) are increasingly essential. These elements influence the evolution of education and the transformation of teaching into new digital and smart classroom methods (OECD, 2016).

The integration of IR 4.0 technologies is particularly significant in civil engineering education. According to study by Jaafar et al. (2024), knowledge and application of IR 4.0 technologies in the construction industry are still at a semi-automated stage, with most contractors relying on traditional tools and methods. This indicates the need for strategic planning by the government to facilitate transformation within Malaysia's construction industry. Additionally, studies by Sabri & Yahya (2020) have discussed the role of IoT in the construction industry towards IR 4.0, highlighting its impact on the civil engineering sector in Malaysia (Sabri & Yahya, 2020). The Ministry of Economy (2021) has also emphasized that IR 4.0-related technologies play a crucial role in driving transformation within the construction sector.

Malaysia polytechnic system also plays an essential role in preparing the workforce for IR 4.0 challenges. Polytechnics in Malaysia have introduced education and training programs aligned with emerging technologies, ensuring graduates possess the necessary competencies to thrive in a rapidly evolving and complex industrial landscape (Ahmad et al., 2023). Polytechnic education, particularly in civil engineering, is a crucial component in equipping students with knowledge and competencies related to IR 4.0. Polytechnic programs integrate theoretical and practical training using engineering workshops, computer labs, and studios, focusing on the latest technologies, cyber-physical systems, sustainability, and the socio-environmental impacts of engineering work. While polytechnics play a significant role, continuous improvement in teaching and learning strategies is necessary to ensure graduates meet industry demands in the IR 4.0 era.

Study conducted at a polytechnic in Sabah revealed that IR 4.0 knowledge among lecturers is at a moderate level (Sidin, 2020). Similarly, a study at a polytechnic in Perak found that lecturers' knowledge and skills regarding IR 4.0 implementation in teaching and learning are also moderate (Hamzah et al., 2021). To understand how lecturers adapt to these digital educational advancements, the Technology Acceptance Model (TAM) serves as a vital theoretical underpinning. Originally proposed by Davis (1989), TAM highlights that an individual's acceptance and usage of technology are primarily driven by two core cognitive beliefs, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). In an educational context, a lecturer's knowledge of digital tools directly influences their perception of how useful technology is in enhancing teaching quality, while their digital skills shape how easy they find the technology to operate. Integrating these TAM elements helps with conceptual frameworks in how a lecturer's baseline knowledge converts into functional skills, which ultimately dictates the effectiveness of digitalization integration in technical and vocational classrooms. Although initial preparedness exists, comprehensive efforts are needed to empower lecturers, particularly in digital education aligned with current industry requirements and IR 4.0 challenges.

2. Methodology

This study utilizes a quantitative survey design to facilitate direct data collection from participants within a short period, ensuring objectivity and statistical validity in addressing study questions and achieving study objectives. The study focuses on civil engineering lecturers from three southern zone polytechnics in Malaysia, namely Politeknik Merlimau, Politeknik Melaka, and Politeknik Port Dickson. The total population of this study is

164 lecturers, and a cluster random sampling technique was employed where all civil engineering lecturers within the three selected polytechnic clusters were included as the study sample. To determine the required size sample size, Yamane's (1967) sample selection formula was applied. Based on the population of 164 lecturers and a margin of error set at 0.10 for a 95% confidence level, the minimum required sample size calculated is 62 respondents, which is sufficient to ensure statistical reliability and accurate representation. Based on the data obtained, a total of 64 respondents provided feedback. This number exceeds the minimum required sample size and is therefore sufficient to yield meaningful study findings. However, the study acknowledges that feedback from the entire population would provide more accurate and comprehensive results.

Data collection was conducted through a questionnaire developed based on adaptations from previous studies (Sidin, 2020; Hamzah et al., 2021). This instrument consists of items that measure lecturers knowledge and skills in digitalization. The questionnaire underwent a validation process through a review by three experts in the fields of education and civil engineering. Table 1 presents the structure of the questionnaire, which is divided into several main sections: Section A covers Respondents' Demographics, Section B focuses on Knowledge of Digitalization; and Section C assesses Skills in Using Digital Technology in Teaching and Learning.

Table 1: *Sections and Items of the Questionnaire*

Sections	Item of Sections	No. of Questions
A	Respondents Demographics	5
B	Knowledge of Digitalization	15
C	Skills in Using Digital Technology in Teaching and Learning	15

Data collection was conducted via Microsoft Forms through emails, allowing respondents a two-month period to complete the survey. Follow-up reminders were sent at one-week intervals to enhance response rates. The study ensured ethical considerations by obtaining informed consent from participants and maintaining confidentiality.

For data analysis, SPSS version 29.0 was utilized. Descriptive statistics, including mean and standard deviation, were used to analyze demographic data and general responses. Pearson correlation analysis was conducted to examine relationships between knowledge and digital skills. Cronbach's Alpha was applied to assess the reliability of the questionnaire, ensuring high internal consistency. Furthermore, a pilot study was conducted with 30 respondents before the main study to validate the instrument and ensure the clarity and reliability of the questions

3. Results and Discussion

The analysis of this study is divided into three sections which is the demographics of respondents, the perception of polytechnic lecturer's knowledge in the use of digital technology, and the skills of polytechnic lecturers in using digital technology. The second part of this topic will explain the inferential analysis to identify the relationship between lecturer's knowledge and skills in using digital technology.

3.1 Respondents Demographics

Based on Table 2, which presents the demographic findings of the respondents, it can be analyzed that in terms of gender, most respondents are female, with a total of 43 individuals (67.2%), while male respondents account for only 21 individuals (32.8%). This indicates that female participation in this study is higher than that of males. In terms of educational qualifications, respondents with a master's degree constitute the highest number, with 31 individuals (48.4%), followed by bachelor's degree holders, totaling 27 individuals (42.2%). Meanwhile, the number of respondents with a Doctor of Philosophy (PhD) degree is the lowest, with only 6 individuals (9.4%). This indicates that most respondents possess a high level of education, predominantly at the master's level. Next, in terms of distribution by a polytechnic, Politeknik Port Dickson has the highest number of respondents, with 24 individuals (37.5%), followed by Politeknik Merlimau with 21 individuals (32.8%), and Politeknik Melaka with 19 individuals (29.7%). The difference in the number of respondents among these three polytechnics is not significant. In the context of areas of expertise, most respondents specialize in Civil Engineering, with a total of 45 individuals (70.3%), followed by Architecture with 11 individuals (17.2%). Other fields, such as Building Services Engineering, account for 4 individuals (6.3%), Geomatics with 3 individuals (4.7%), and Wood-Based Technology, with only one respondent (1.6%). This clearly shows that Civil Engineering dominates the sample of this study.

Overall, the demographic profile of the respondents in this study is predominantly female, mostly holding master's degrees, with the majority from Politeknik Port Dickson, and most specializing in Civil Engineering.

Table 2: *Demographic Findings of Respondents*

Demographics	Frequencies	Percentages (%)
Gender		
Male	21	32.8
Female	43	67.2
Education Level		
Bachelor's Degree	27	42.2
Master's Degree	31	48.4
Doctor of Philosophy (PhD)	6	9.4
Polytechnic		
Politeknik Merlimau	21	32.8
Politeknik Melaka	19	29.7
Politeknik Port Dickson	24	37.5
Field of Expertise		
Civil Engineering	45	70.3
Geomatics	3	4.7
Architecture	11	17.2
Wood-Based Technology	1	1.6
Building Services Engineering	4	6.3

3.2 Perception of Lecturers Knowledge on Digitalization in Teaching and Learning

Based on Table 3, the mean score obtained for the knowledge items indicates that respondents' knowledge of IoT technology related to teaching and learning is at a moderate level. Overall, the total mean score for all items is 3.67, with a standard deviation of 0.52. The item that demonstrates the highest level of knowledge is item B11, which pertains to the use of online teaching platforms such as Microsoft Teams, Google Meet, and Zoom, with a mean score of 4.50. This suggests that respondents generally possess good knowledge of these teaching platforms, which are highly relevant in today's educational context. Similarly, item B12, regarding knowledge of Learning Management Systems (LMS) such as CIDOS and Google Classroom, recorded a mean score of 4.30, indicating a strong understanding of online learning systems. Additionally, items related to knowledge of the integration of the Internet of Things (IoT), Cloud Computing, and Microsoft SharePoint recorded moderate mean scores, ranging from 3.28 to 3.94. Respondents demonstrated basic knowledge of these concepts; however, there is room for improvement in acquiring a deeper understanding and applying these technologies in teaching. Furthermore, item B15, which pertains to knowledge of using UAVs (drones) for safety monitoring or project progress tracking, recorded a mean score of 2.77, indicating that respondents have low knowledge of this technology in an educational context. The high standard deviation of 1.18 also suggests significant variation in respondents' self-assessments of their knowledge regarding UAV usage, which may be attributed to a lack of exposure or training in this technology.

Overall, these findings indicate that while respondents have a moderate level of knowledge in utilizing online teaching tools and learning management systems, they have less exposure or in-depth knowledge of emerging technologies such as IoT and UAVs.

Table 3: *Distribution of Mean Scores, Standard Deviation, and Mean Interpretation for Knowledge Items*

No.	Item	Mean Score	Standard Deviation	Mean Interpretation
B1	I know about IoT.	3.94	0.85	Moderate
B2	I know the concept of IoT.	3.72	0.85	Moderate
B3	I have attended courses related to IoT.	3.33	1.11	Moderate
B4	I know how to integrate hardware and software.	3.33	0.91	Moderate
B5	I know the potential of using communication media such as social media to improve teaching and learning quality.	4.25	0.62	High
B6	I know using IoT elements (Cloud Computing/Microsoft SharePoint) in teaching and learning.	3.73	0.80	Moderate
B7	I know how to use Cloud Computing to store information or share files.	3.89	0.78	Moderate
B8	I know using Microsoft SharePoint.	3.44	0.92	Moderate
B9	I know about IoT integration with other	3.28	0.88	Moderate

	technologies such as Cloud Computing, Big Data, or Artificial Intelligence in teaching.			
B10	I know about handling IoT-related applications/tools.	3.28	0.93	Moderate
B11	I know using teaching platforms such as Microsoft Teams/Google Meet/Zoom.	4.50	0.54	High
B12	I know using Learning Management System (LMS)-CIDOS / Google Classroom.	4.30	0.61	High
B13	I know using Building Information Modelling (BIM) software.	3.45	0.89	Moderate
B14	I know using AutoCAD software.	3.81	0.92	Moderate
B15	I know how to use UAV (Drone) in monitoring safety or student project progress related to Geographic Information System (GIS).	2.77	1.18	Low
Overall Score		3.67	0.52	Moderate

In this aspect, it was found that the level of knowledge of civil engineering lecturers in polytechnics in the southern zone regarding digitalization in teaching and learning is at a moderate level. They demonstrate a high level of knowledge in using online teaching platforms such as Microsoft Teams and Learning Management Systems (LMS), which aligns with the study by Hariyono (2023) on the importance of digital platforms in enhancing student engagement.

However, their knowledge of digitalization concepts, Cloud Computing, and Artificial Intelligence integration, as well as the use of Microsoft SharePoint, remains at a moderate level. Adilah Mutiara and Nurona Cahya (2022) emphasized the need for in-depth digital literacy to enhance confidence in using digital technology. The findings also indicate that knowledge of UAV (drone) technology is at a low level. Aisyah et al. (2024) reported that the use of drone technology in construction project monitoring can improve supervision and risk management.

Well-designed training programs are essential to enhance lecturers' knowledge and confidence in using digital technology (Ashari & Askur, 2022). Institutions must provide more comprehensive training, access to digitalization tools and software, and foster collaboration with technology industries to enhance teaching effectiveness in the digital era.

3.3 Perception of Lecturers' Skills in Digital Technology for Teaching and Learning

Based on Table 4, the mean score obtained for skill-related items reflects respondents' self-perceived skills in using IoT applications in teaching and learning. Overall, the total mean score for all skill items is 3.44, with a standard deviation of 0.62, indicating that respondents' skills are at a moderate level. The low standard deviation value suggests that most respondents provided similar assessments of their proficiency in using these technologies.

The highest mean score was recorded for item C6, "I am proficient in using various communication media (such as WhatsApp, Email, or Telegram) to facilitate interaction and information sharing in the teaching and learning process," with a mean score of 4.50 and a standard deviation of 0.62. This was followed by item C9, "I am proficient in using collaborative platforms (such as Microsoft Teams, Google Meet, and Zoom) for virtual teaching," with a mean score of 4.19 and a standard deviation of 0.69, and item C11, "I am proficient in using Learning Management Systems (LMS) such as CIDOS, Google Classroom, and Microsoft SharePoint," which recorded a mean score of 4.03 with a standard deviation of 0.67. These findings indicate that respondents are highly skilled in using communication tools and online teaching platforms, reflecting a high level of acceptance of digital teaching technologies in modern education. Most other items, such as C1, "I use IoT applications in my teaching," with a mean score of 3.37 and a standard deviation of 0.93, and C5, "I am proficient in managing student learning documents from planning, implementation, and submission using IoT applications," with a mean score of 3.50 and a standard deviation of 1.01, recorded moderate mean scores. This suggests that respondents possess basic skills in using IoT applications and devices. Meanwhile, item C3, "I am proficient in using IoT devices such as sensors, RFID, student attendance systems, and laboratory equipment control systems," and item C4, "I can handle technical issues that arise when using IoT devices in teaching," recorded mean scores of 2.81 with standard deviations of 1.08 and 1.01, respectively. This indicates low proficiency in specific IoT applications and troubleshooting related technical issues.

Similarly, item C15, "I can operate drones for monitoring student project safety or progress," had the lowest mean score of 2.48 with a standard deviation of 1.25, highlighting that respondents' skills in UAV technology are also at a low level. The high standard deviation for some of these items suggests variability in respondents' skill assessments, which may be due to differences in experience or exposure to these technologies.

Table 4: *Distribution of Mean Scores, Standard Deviation, and Mean Interpretation for Skill Items*

No.	Item	Mean Score	Standard Deviation	Mean Interpretation
C1	I use IoT applications in my teaching.	3.37	0.93	Moderate
C2	I am skilled in planning learning activities involving IoT usage.	3.34	1.01	Moderate
C3	I am proficient in using IoT devices such as sensors, RFID, student attendance systems, and laboratory equipment control systems.	2.81	1.08	Low
C4	I can handle technical problems that arise when using IoT devices in teaching.	2.81	1.01	Low
C5	I am skilled in managing student learning documents from planning, implementation, to submission stages using IoT applications.	3.50	1.01	Moderate
C6	I am proficient in using various communication media (such as WhatsApp, Email, or Telegram) to facilitate interaction and information sharing in the teaching and learning process.	4.50	0.62	High
C7	I can ensure that IoT applications used comply with ethical and privacy guidelines.	3.92	0.84	Moderate
C8	I am skilled in integrating IoT with other technologies such as Cloud Computing, Big Data, or Artificial Intelligence in teaching.	3.20	0.93	Moderate
C9	I am proficient in using collaborative platforms (such as Microsoft Teams/Google Meet/Zoom) for virtual teaching.	4.19	0.69	High
C10	I share teaching and learning materials with polytechnic colleagues using IoT applications.	3.78	0.90	Moderate
C11	I am skilled in using Learning Management Systems (LMS) such as CIDOS and Google Classroom and Microsoft SharePoint.	4.03	0.67	High
C12	I can use Building Information Modelling (BIM) software in courses involving construction project design.	3.16	1.10	Moderate
C13	I am proficient in using AutoCAD software.	3.27	1.19	Moderate
C14	I can use design software tools like Revit.	3.14	1.07	Moderate
C15	I can operate Drones to monitor safety or student project progress related to Geographic Information System (GIS).	2.48	1.25	Low
Overall Score		3.44	0.62	Moderate

The study found that the skill level of civil engineering lecturers in the Southern Zone Polytechnics regarding digitalization in teaching and learning is at a moderate level. They demonstrated high proficiency in using communication tools such as WhatsApp and online teaching platforms, in line with the perspective of Ruokamo (2021), who stated that digital skills are a critical element in modern education.

However, their skills in technical aspects, such as using IoT applications and integrating Cloud Computing, remain at a moderate level. Bentri et al. (2022) emphasized that the integration of digital technology into the curriculum requires skilled lecturers to ensure effective learning. A more critical area is proficiency in using IoT devices such as sensors, RFID, and laboratory control systems, as well as the use of UAVs (drones), which are at a low level. This aligns with the studies by Yakshina et al. (2019) and Aisyah et al. (2024), which highlighted the importance of technologies like drones and Building Information Modelling (BIM) in civil engineering education.

Diansyah et al. (2022) emphasized the importance of well-designed professional development programs to enhance lecturers' skills. Educational institutions must provide intensive training, technical support, and collaboration with industries to ensure that lecturers can meet the demands of Industry 4.0 and offer relevant learning experiences to students.

3.4 The Relationship Between Lecturers' Knowledge and Skills in Using Digital Technology for Teaching and Learning

Based on Table 5, the results of the Pearson correlation analysis for the relationship between lecturers knowledge and skills in using digital technology show a correlation coefficient (r) = 0.874, indicating a strong positive relationship between the two variables. Additionally, the significance value (p-value) < 0.001, which is smaller than the significance level of 0.05, proves that this relationship is statistically significant, thus rejecting the null hypothesis (H_0).

According to Schober & Schwarte, (2018), a value of r = 0.874 falls within the high correlation category, confirming that an increase in lecturers' knowledge of digital technology is directly related to an increase in their skills. Therefore, these findings emphasize the need to empower lecturers' knowledge to ensure they become more proficient in using digital technology in teaching and learning.

Table 5: *The Relationship Between Polytechnic Lecturers' Knowledge and Skills in Using Digital Technology*

		Knowledge	Skills
	Pearson Correlation	1	.874**
Knowledge	Sig. (2-tailed)		<.001
	N	64	64
	Pearson Correlation	.874**	1
Skills	Sig. (2-tailed)	<.001	
	N	64	64

**. Correlation is significant at the 0.01 level (2-tailed).

These findings align with the Technology Acceptance Model (TAM), which emphasizes that perceived usefulness and perceived ease of use play a crucial role in individuals' acceptance of technology (Davis, 1989). In the context of this study, lecturer's knowledge helps them understand the usefulness of digitalization technology in enhancing the effectiveness of teaching and learning. Furthermore, a deeper understanding of technology also boosts lecturer's confidence in actively using technology in the classroom (Adilah Mutiara & Nurona Cahya, 2022). Good digital literacy enables lecturers to integrate technology effectively and critically (Diansyah et al., 2022).

Lecturer's technological skills reflect their acceptance of digitalization technology. According to Technology Acceptance Model (TAM), these skills develop through an increased perception of usefulness and ease of use, which can be strengthened through training and support from educational institutions (Riwayati et al., 2021). For example, skills in using virtual reality (VR) and e-learning systems help lecturers create more interactive learning experiences that align with the needs of Industry 4.0 (Ruokamo, 2021). The findings of this study highlight the need to enhance lecturers' training and professional development to ensure simultaneous improvements in their knowledge and skills. The Polytechnic Transformation Framework 2023-2030 emphasizes the importance of collaboration with the industry to ensure that lecturers gain exposure to the latest technologies and meet the future workforce demands (Jabatan Pendidikan Politeknik dan Kolej Komuniti, 2023).

Overall, the findings of this study support to TAM by demonstrating that lecturers' perceptions of the usefulness and ease of technology use are influenced by their level of knowledge. Educational institutions must provide continuous support through training and technological infrastructure to enhance lecturers' ability to adapt digital technology in teaching. These efforts not only improve technology acceptance but also contribute to the success of educational transformation in the era of Industry 4.0.

4. Conclusion

This study found that civil engineering lecturers at Polytechnics in the Southern Zone possess a moderate level of knowledge and skills in utilizing digital technology. While they are proficient in online teaching platforms, their exposure to advanced technologies such as IoT, UAV, and Cloud Computing remains limited. The significant positive correlation between knowledge and skills indicates that an increase in knowledge enhances their competencies. Therefore, comprehensive training, infrastructure support, and industry collaboration must be strengthened to ensure that lecturers are well-prepared to meet the educational demands of the IR 4.0 era and to produce competent graduates. To enhance the integration of technology in teaching, lecturers are encouraged to improve their digital literacy through training programs and professional development focused on technologies such as IoT, UAV, Cloud Computing, and BIM. They should also utilize digital teaching platforms such as CIDOS, Google Classroom, Microsoft Teams, and Zoom to enhance interactivity in learning. Additionally, collaboration with industry is essential to gain practical exposure to the latest technologies used in the civil engineering sector.

Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK) is recommended to provide more intensive and relevant periodic training programs aligned with current technological advancements, particularly in IR 4.0 fields such as BIM, IoT, and UAV. Moreover, the department should strengthen polytechnic infrastructure by supplying adequate equipment and software, such as simulation tools and IoT devices, to enable lecturers to develop their skills in a more conducive environment. The polytechnic curriculum should also be updated to align more closely with industry needs, emphasizing the application of digital technology in civil engineering education while enhancing strong partnerships with industry to ensure graduates possess relevant skills.

The civil engineering sector can also play a role in supporting the adoption of digital technology in education through collaborative training with polytechnics. This initiative can help lecturers and students understand the real-world applications of technologies such as UAV, IoT, and BIM. Additionally, the sector can contribute to curriculum development by providing guidance on the skills and technologies required in the industry and offering incentives to lecturers who successfully implement digital technology in teaching.

For future study, more in-depth studies can be conducted to evaluate the effectiveness of digital technology training programs for lecturers, focusing on specific technologies such as UAV, IoT, and BIM to identify challenges and opportunities in technical education. Further studies can also develop a more suitable technology acceptance model for technical and vocational education, considering factors such as digital literacy, infrastructure, and technical support. International comparative studies are also recommended to understand best practices in technical education from developed countries and to adopt relevant approaches in Malaysia. Additionally, study evaluating the impact of digital technology adoption on students' learning outcomes should be conducted to assess the effectiveness of these approaches and propose relevant improvements for the future.

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Conflict of Interest

The authors declare that there is no conflict of interest related to the publication of this manuscript.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Muhammad Azh Zhahiirullah Ismail, Yusmarwati Yusof;* ***data collection:*** *Muhammad Azh Zhahiirullah Ismail;* ***analysis and interpretation of results:*** *Muhammad Azh Zhahiirullah Ismail;* ***draft manuscript preparation:*** *Muhammad Azh Zhahiirullah Ismail, Yusmarwati Yusof. All authors reviewed the results and approved the final version of the manuscript.*

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