OJ-TP

ONLINE JOURNAL FOR TVET PRACTITIONERS
e-ISSN: 2289-7410

Vol. 11 No. 1 (2026) 114-125
https://publisher.uthm.edu.my/ojs/index.php/oj-tp

The Relationship Between Digital Competence and Facilities with Digital Efficacy of Lecturers in Teaching Engineering Subjects

Amirah Abdul Kamil[1]*, Mohd Zulfadli Rozali[1], Zeng Xiuzhen[2]

[1] *Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat, Johor, 86400, MALAYSIA*

[2] *UNESCO Chair on Digitalization in TVET/UNEVOC Center, Shenzhen Polytechnic University, No. 7098, Liuxian Avenue, Nanshan District, Shenzhen, Guangdong Province, CHINA*

*Corresponding Author: amirahabdulkamil@gmail.com
DOI: https://doi.org/10.30880/ojtp.2026.11.01.011

Article Info

Received: 21 July 2024
Accepted: 8 April 2026
Available online: 30 March 2026

Keywords

Digital competency, facilities, digital efficacy, lecturer, teaching

Abstract

Lecturers must not only be familiar with technology but also be proficient in applying digital tools in teaching. However, previous studies show that the knowledge level among engineering lecturers regarding Building Information Modelling (BIM) requires improvement in both awareness and competency in using this technology effectively. This deficiency in digital skills can negatively impact the overall effectiveness of teaching and learning (T&L), potentially leading to a decrease in lecturers' confidence and a subsequent reduction in the quality of education and student performance. This study aims to identify the level of digital competency and the facilities provided by the institution, as well as to assess the digital efficacy of lecturers using digital technology in teaching engineering subjects. Additionally, this study aims to identify the relationship between digital competency and the provided facilities with the digital efficacy of lecturers. This survey-based study uses a quantitative approach, and a total of 83 respondents provided feedback through a questionnaire. Descriptive analysis was used to identify the level of digital competency of lecturers, the level of facilities, and the digital efficacy of lecturers. Pearson correlation analysis was used to observe the relationship between digital competency and facilities with the digital efficacy of lecturers. The findings show that the level of digital competency of lecturers is high with a mean score of M=4.14 and SD=0.40, meaning they can effectively integrate digital resources into teaching strategies and use diverse channels to communicate with students. The level of facilities is also high with a mean score of M=4.12 and SD=0.54, indicating that the institution provides adequate infrastructure, such as digital systems and support staff, that successfully encourages technological use. Finally, the level of digital efficacy is high with a mean score of M=4.14 and SD=0.56, which translates to lecturers feeling comfortable and confident in their ability to provide immediate feedback and adapt to various digital teaching situations. The study findings from the Pearson correlation test show a significant relationship between digital competency and facilities with the digital efficacy of lecturers, with Pearson correlation coefficients of r=0.77 and r=0.71, respectively. In conclusion, engineering lecturers at the studied institution possess a high level of digital competency, which is crucial because it enables them to effectively integrate digital resources into teaching strategies and use diverse digital channels to collaborate with students and colleagues. Specifically, this mastery allows lecturers to foster innovative talent and utilize industry-standard tools like MATLAB to enhance the quality of engineering education. The implication of this study is that by fostering such competencies alongside adequate institutional facilities, universities can significantly enhance lecturers' digital efficacy, thereby ensuring a high-quality, resilient learning environment that meets the demands of the Fourth Industrial Revolution.

1. Introduction

The evolution of Information and Communication Technology (ICT) has brought significant transformations and impacts on society. ICT enhances the sharing of knowledge and the flow of information and communication (Al-Rahmi et al., 2020). Advances in communication media and internet technology accelerate information transfer and increase interaction. This rapid development opens opportunities in sectors such as business, health, education, industry, and agriculture, benefiting the national economy (Das, 2019). The Fourth Industrial Revolution (IR 4.0) combines digitalization and smart technology, encompassing various aspects of life and industry, leading towards a more advanced digital society (Maskuriy et al., 2019). Education 4.0 prioritizes digital skills and technological proficiency in the education system (Hussin, 2018), preparing students with digital skills and critical thinking.

Digital technology in education enhances the quality of teaching and learning (Haleem et al., 2022). The use of digital tools such as 3D printing, augmented reality, and virtual reality in teaching and learning can improve student understanding (Noor et al., 2022). Digital competence of teachers is crucial to ensure quality and relevant education (Liesa-Orus, Blasco & Arce-Romeral, 2023). The use of digital technology in teaching engineering subjects is essential to ensure students acquire the necessary skills in the industry (Henderson, 2020). Lecturers need to be proficient in technologies such as AutoCAD, STAAD Pro, and MATLAB to deliver lessons effectively.

In conclusion, the mastery of digital technology by lecturers is crucial to providing quality learning experiences to students, increasing their motivation towards engineering subjects (Bujang et al., 2020). The relationship between digital competence and facility availability needs to be studied to ensure quality teaching relevant to the current digital era.

2. Research Background

The use of digital technology in education is not just about technical capability but also a deep understanding of integrating these innovations into the curriculum, especially in engineering subjects. Lecturers' proficiency in incorporating technology into the teaching and learning process (T&L) is crucial to ensuring an effective learning experience. According to Artacho et al. (2020), 21st-century teachers need to possess various skills that enable them to guide students in using technology. Digital competence is essential as it helps teachers acquire and update necessary skills, thereby enhancing student learning and preparing them for a digital society (Santos et al., 2022).

However, according to a study by Garcia et al. (2020), 85% of teachers lack sufficient skills to effectively implement information and communication technology (ICT) (Bariu, Chun & Boudouaia, 2022). This skill deficiency can negatively impact the effectiveness of T&L. A study by Surya & Mulyanti (2020) also shows that online learning is hindered by low technological skills and knowledge among teachers. In China, the digital technology transformation faces challenges such as a lack of incentives, funding, and digital competence training for teachers (Wang & Chu, 2023). According to Saienko, Lavrysh & Lukianenko (2020), curriculum changes in line with technological developments cause difficulties for teachers to adapt.

Providing good infrastructure and adequate training ensures that teachers can effectively apply digital technology in T&L, thereby enhancing the quality of education and student performance. Consequently, this study aims to identify the levels of digital competency and institutional facilities, as well as their influence on the digital efficacy of lecturers in teaching engineering subjects. Specifically, the research seeks to answer the following questions: (1) what are the current levels of digital competency, institutional facilities, and digital efficacy among engineering lecturers; and (2) what is the relationship between digital competency and facilities with the lecturers' digital efficacy? By addressing these questions, the study provides insights into how these factors collectively ensure quality education relevant to the digital era.

3. Methodology

The design of this study is quantitative with a survey approach using a questionnaire form with descriptive and inferential analysis. The study population involved lecturers from the Faculty of Engineering at Universiti Tun Hussein Onn Malaysia (UTHM), which includes the Faculty of Civil and Environmental Engineering (FKAAB), the Faculty of Electrical and Electronic Engineering (FKEE), and the Faculty of Mechanical and Manufacturing Engineering (FKMP). The study population consisted of N=489 lecturers from FKAAB, FKEE, and FKMP. Based on the sample size determination guidelines introduced by Green (1991), a minimum sample of n=76 was required to achieve sufficient statistical power for the analysis. Although a larger participation was sought, the final sample of 83 respondents was obtained due to the limited time frame allocated for data collection. Despite the time constraints, this sample size remains statistically valid as it exceeds the minimum threshold required by the Green (1991) formula, ensuring the reliability of the descriptive and Pearson correlation results. Furthermore, the 83 respondents provided a balanced representation across the three engineering faculties, with 38.6% from FKEE, 31.3% from FKMP, and 30.1% from FKAAB. The questionnaire form is divided into four sections: Sections A, B, C, and D. Section A of the questionnaire contain items for collecting respondents' demographic data related to gender, age, teaching experience, and faculty. Section B contains 46 items designed to assess the level of digital competence among lecturers, adapted from Wang & Chu (2023) and Dias-Trindade & Ferreira (2020). Meanwhile, 8 items in Section C are questions related to the availability of facilities for enhancing lecturers' digital competence, adapted from studies by Wang & Chu (2023) and Dias-Trindade & Ferreira (2020). Section D of the questionnaire contains 10 items related to lecturers' digital efficacy in integrating digital technology, adapted from studies by Ogundare et al. (2022), Wang & Chu (2023), and Dias-Trindade & Ferreira (2020). To measure the level of digital competence in Section B, the level of facility availability in Section C, and the level of digital efficacy of lecturers in Section D, a five-point Likert scale was used, referring to Hassan (2020).

4. Result

4.1 Demographic Analysis of Study Respondents

The demographic section of the distributed questionnaire is divided into four categories which are gender, age, teaching experience and faculty. Before performing the primary descriptive analysis, a rigorous pre-analysis process was conducted to ensure data integrity. The raw data collected via the survey were first exported into a spreadsheet for data screening. This process involved checking for duplicate entries, incomplete responses, and outliers to ensure the data was clean and ready for software input. The final cleaned dataset was then imported into SPSS (Statistical Package for the Social Sciences) for further processing. A total of 83 respondents provided valid feedback, representing the final sample for this study. This sample size exceeds the minimum threshold of n=76 required by the Green (1991) formula, ensuring the statistical power of the results. Exploratory Data Analysis (EDA) was performed to examine the distribution of the data, and normality tests were conducted to confirm that the data were suitable for the subsequent Pearson correlation analysis. To ensure the internal consistency of the instrument, reliability analysis was performed on the constructs for digital competence, facilities, and digital efficacy, which were adapted from established frameworks. The validated data were then analyzed descriptively and translated into frequencies (N) and percentages (%).

Table 1 shows the frequency (N) and percentage (%) for the categories of gender, age, teaching experience, and faculty of respondents. Overall, a total of 83 respondents were involved in this study. The findings from the study indicate that 38.6% (32 people) were lecturers from FKEE, while 31.3% (26 people) were lecturers from FKMP, and 30.1% (25 people) were lecturers from FKAAB. For the gender category, the majority of respondents were female lecturers, accounting for 53.0% (44 people), while male lecturers accounted for 47.0% (39 people). For the age category, 47.0% (39 people) of the respondents were lecturers aged between 36 and 45 years, 41.0% (34 people) were aged between 46 and 55 years, and lecturers aged 25 to 35 years as well as those aged 56 and above each accounted for 6.0% (5 people). Furthermore, for the teaching experience category, 7.2% (6 people) of the respondents had 1 to 5 years of teaching experience. There were 19.3% (16 people) with 6 to 10 years of teaching experience, and 22.9% (19 people) with 11 to 15 years of teaching experience. The highest percentage, 50.6% (42 people), indicated that the lecturers had more than 16 years of teaching experience.

Table 1 *Demographics of respondents*

Category			N	%
Faculty	FKEE		32	38.6
	FKMP		26	31.3
	FKAAB		25	30.1
		Total	83	100.0
Gender	Male		39	47.0
	Female		44	53.0
		Total	83	100.0
Age	25 to 35 years old		5	6.0
	36 to 45 years old		39	47.0
	46 to 55 years old		34	41.0
	56 years old and above		5	6.0
		Total	83	100.0
Teaching experiences	1 to 5 years		6	7.2
	6 to 10 years		16	19.3
	11 to 15 years		19	22.9
	16 years and above		42	50.6
		Total	83	100.0

4.2 Descriptive Analysis of Lecturers' Digital Competence Level Using Digital Technology in Teaching Engineering Subjects

Table 2 shows a detailed descriptive analysis of the lecturers' digital competence level using digital technology in teaching engineering subjects. This construct consists of 46 items and received feedback from 83 respondents. Generally, the items in this construct scored mean values between 3.66 and 4.47, interpreted as moderately high to high. Of the 46 items used, 37 recorded high mean scores, ranging from 4.02 to 4.47, while 9 recorded moderately high mean scores, ranging from 3.66 to 4.00. Item 7, which states, "digital competence plays an important role in lifelong learning and professional development of lecturers," recorded the highest mean score of M=4.47 with a standard deviation of SD=0.69. Conversely, item 16, which states, "can modify existing digital resources to suit needs," obtained the lowest mean score of M=3.66 with a standard deviation of SD=0.97, interpreted as moderately high. Overall, the average mean score for the construct of lecturers' digital competence level using digital technology in teaching engineering subjects is M=4.14 with a standard deviation of SD=0.40, placing it in the high interpretation group.

Table 2 *Lecturers' digital competence level*

No	Items	Mean (M)	Standard Deviation (SD)	Interpretation
1	I believe that effective use of digital technology is very important in improving the quality of teaching.	4.42	0.67	High
2	I believe that effective use of digital technology is very important in fostering innovative talent.	4.46	0.70	High
3	I believe that effective use of digital technology plays an important role in enhancing the quality of scientific research.	4.46	0.70	High
4	I believe that effective use of digital technology plays an important role in creating research innovations.	4.46	0.69	High
5	I believe that effective use of digital technology is very important for achieving lifelong learning.	4.42	0.68	High

Online Journal for TVET Practitioners Vol. 11 No. 1 (2026) p. 114-125

No	Items	Mean (M)	Standard Deviation (SD)	Interpretation
6	I believe that effective use of digital technology is very important for the sustainable development of students.	4.36	0.71	High
7	I believe that digital competence plays an important role in lifelong learning and the professional development of lecturers.	4.47	0.69	High
8	I am aware of the potential risks of digital technology such as network fraud or information leaks.	4.40	0.58	High
9	I understand the ethics in a digital environment and I can adhere to them.	4.34	0.52	High
10	I am aware of the laws and regulations related to the use of digital technology, including the Internet Fraud/Cybercrime Act.	4.06	0.63	High
11	I can consciously comply with the laws and regulations related to the use of digital technology, including the Internet Fraud/Cybercrime Act.	4.13	0.60	High
12	I know how to protect myself and my students in a digital environment.	3.99	0.60	Moderately High
13	I can take the initiative to protect myself and my students in a digital environment.	4.00	0.58	Moderately High
14	I use various websites and search strategies to find and select various digital resources.	4.37	0.51	High
15	I can develop my own digital resources.	3.31	0.90	Moderately High
16	I can modify existing digital resources to suit my needs.	3.66	0.97	Moderately High
17	I integrate digital resources or technology into teaching strategies to enhance the quality of digital teaching.	4.06	0.69	High
18	I carefully evaluate my digital teaching strategies to adapt them into teaching strategies.	4.04	0.71	High
19	I carefully evaluate my digital teaching strategies to create innovations in teaching strategies.	4.02	0.64	High
20	I use digital technology to answer students' questions or doubts, such as in assignments.	4.06	0.67	High
21	I create teaching activities using digital technology to meet students' needs.	4.06	0.59	High
22	I use digital technology to enable students to plan, document, and monitor their own learning, such as using learning planning apps.	4.11	0.63	High
23	I use digital technology to offer learning opportunities according to students' suitability, such as providing different digital tasks to students based on individual learning needs, preferences, and interests.	4.08	0.59	High

No	Items	Mean (M)	Standard Deviation (SD)	Interpretation
24	I am confident that when students work in groups, they use digital technology to help them learn and complete coursework effectively.	4.22	0.59	High
25	I provide coursework assignments that require students to use digital technology to communicate and collaborate with each other or with an external audience.	4.10	0.62	High
26	I use digital technology such as quizzes in formative assessments of students.	4.20	0.68	High
27	I use digital technology such as implementing online testing systems in summative assessments of students.	3.89	0.86	Moderately High
28	I analyze all available data, such as student attendance, to identify students who need additional support/assistance.	4.02	0.68	High
29	I use digital technology to provide effective feedback.	4.16	0.63	High
30	I analyze all data generated from digital teaching practices to monitor, reflect on, and improve my teaching practices.	4.02	0.64	High
31	I use digital technology to obtain accurate academic information and manage it effectively.	4.37	0.58	High
32	I use digital technology such as SPSS and MATLAB to process data effectively and explore information further.	3.78	0.99	Moderately High
33	I create my own researcher account where I can add and assess my research achievements.	3.81	0.89	Moderately High
34	I publish my research in open access journals and provide my research data when needed.	4.12	0.67	High
35	I use digital technology such as Zoom to enhance academic communication and collaboration both domestically and internationally.	4.25	0.66	High
36	I use the project application system to apply for research projects.	4.36	0.53	High
37	I use digital technology to improve the quality of collaboration among team members.	4.27	0.59	High
38	I use various digital channels to communicate with students and colleagues at appropriate times.	4.31	0.60	High
39	I use digital technology to collaborate with colleagues within and outside my educational organization to produce creative products.	4.23	0.61	High
40	I use digital technology to continually update my knowledge and skills to support lifelong learning and professional development.	4.25	0.54	High

Online Journal for TVET Practitioners Vol. 11 No. 1 (2026) p. 114-125

No	Items	Mean (M)	Standard Deviation (SD)	Interpretation
41	I participate in various types of online training and professional development opportunities such as Massive Open Online Courses (MOOCs) and conferences.	4.02	0.72	High
42	I teach students how to behave safely and responsibly online to help them develop the correct attitudes and values in a digital society.	3.98	0.64	Moderately High
43	I encourage students to use digital technology creatively to solve concrete problems, such as overcoming obstacles and challenges that arise in the learning process.	4.20	0.58	High
44	I ensure that students are aware of the latest developments in digital technology in their field.	4.08	0.59	High
45	I teach students how to critically assess the appropriate use of digital technology in their field to help them select the right digital technology.	4.00	0.64	Moderately High
46	I encourage students to actively participate in innovative activities related to digital technology in their field.	4.14	0.63	High
The overall average value of lecturers' Digital Competence		4.14	0.40	High

4.3 Descriptive Analysis of the Level of Facilities Provided by the Institution to Support the Use of Digital Technology in Teaching Engineering Subjects

Table 3 shows a descriptive analysis of the mean scores for the level of facilities provided by the institution to lecturers to support the use of digital technology in teaching engineering subjects. This construct includes 8 items and received 83 responses from the participants. Generally, the mean scores for these 8 items range from 3.82 to 4.31, with interpretations falling into the moderately high and high categories. There are 6 items that recorded high mean scores, while the remaining 2 items recorded moderately high mean scores. Item 8 recorded the highest mean score of M=4.31 with a standard deviation of SD=0.66. In contrast, item 7 recorded a moderately high mean score of M=3.82 with a standard deviation of SD=0.84. Overall, the average mean score obtained from the analysis is M=4.12 with a standard deviation of SD=0.54. From the mean scores obtained, it can be concluded that the level of facilities provided by the institution to lecturers to support the use of digital technology in teaching and learning (T&L) engineering subjects is in the high interpretation group. This indicates that the facilities provided are adequate and satisfactory for most lecturers in effectively supporting the use of digital technology in teaching. The item with the highest mean score highlights the most satisfactory aspect, while items with moderately high mean scores are still considered good but have room for improvement.

Table 3 *Level of facilities*

No	Items	Mean (M)	Standard Deviation (SD)	Interpretation
1	There is a policy to enhance lecturers' digital competence at my university to support the development of their digital skills.	4.13	0.60	High
2	There is a related system at my university to encourage lecturers to use digital technology effectively.	4.20	0.58	High

3	I can access ongoing training or communication opportunities for digital competence improvement provided by my university.	4.23	0.65	High
4	My university has provided excellent support for free access to digital resources for lecturers.	4.24	0.66	High
5	There are specific departments or staff at my university to ensure that lecturers receive prompt assistance with digital technology.	4.17	0.56	High
6	My university has adequate digital facilities such as interactive whiteboards, smart classrooms, or laboratory equipment.	3.84	0.79	Moderately High
7	My university provides sufficient software for digital teaching and research, such as online teaching software or research tools.	3.82	0.84	Moderately High
8	Services provided by third parties such as Google or Web of Science have facilitated my digital technology applications.	4.31	0.66	High
The overall average value of Facilities		4.12	0.54	High

4.4 Descriptive Analysis of Lecturers' Digital Efficacy Using Digital Technology in Teaching Engineering Subjects

Table 4 presents a descriptive analysis of lecturers' digital efficacy in using digital technology for teaching engineering subjects. This construct comprises 10 items and has received feedback from 83 respondents. Generally, the mean scores recorded for each item range from 3.96 to 4.23, placing each item within the moderately high and high interpretation groups. Nine items achieved mean scores exceeding 4.01 and fall into the high interpretation group. Item 10 recorded the highest mean score for this construct, M=4.23 with a standard deviation of SD=0.61. Meanwhile, Item 3 recorded the lowest mean score of M=3.96 with a standard deviation of SD=0.80 and only achieved a moderately high interpretation. Overall, the average mean score obtained from the analysis is M=4.14 with a standard deviation of SD=0.56. From the mean scores, it can be concluded that this analysis indicates a high and favorable level of digital efficacy among engineering lecturers in using digital technology for teaching. This also reflects that most lecturers are comfortable and confident with their technology skills, which is a crucial aspect in ensuring the effectiveness of teaching and learning (PdP) using digital technology.

Table 4 *Level of lecturers' digital efficacy*

No	Items	Mean (M)	Standard Deviation (SD)	Interpretation
1	I acquire digital technology skills if I try with persistent effort.	4.22	0.65	High
2	I can use digital technology to effectively complete my work if I have sufficient time at the workplace.	4.20	0.64	High
3	I can overcome difficulties using digital technology in my work if there is no one around to tell me what to do while using it.	3.96	0.80	Moderately High
4	I can handle difficulties using digital technology in my work if I can contact someone for help.	4.17	0.66	High
5	No matter what happens, I can easily respond to various situations involving digital technology usage.	4.01	0.76	High

6	I am confident in using digital technology to support student learning outcomes.	4.19	0.61	High
7	I am confident in applying instructional design principles to create an engaging and supportive digital learning environment.	4.13	0.62	High
8	I am confident in using digital technology to address student needs through personalized adjustments and differentiation in the classroom as part of my teaching practice.	4.14	0.65	High
9	I am confident in teaching students to think critically, adhere to safety, and be responsible in the digital world.	4.18	0.61	High
10	I am confident in using digital technology tools to provide immediate feedback to students.	4.23	0.61	High
The overall average value of Lecturers' Digital Efficacy		4.14	0.56	High

4.5 Pearson Correlation Analysis of the Relationship Between Digital Competency and Digital Efficacy in Using Digital Technology in Engineering Subject Teaching

Before conducting the Pearson correlation analysis, several statistical assumptions were verified to ensure the appropriateness of this parametric test. The variables (Digital Competency and Digital Efficacy) were measured using a five-point Likert scale. The mean scores were treated as interval data, which is a prerequisite for Pearson's, r. The distribution of scores was assessed for normality. Given the sample size of n = 83, which exceeds the minimum threshold of 76 required for statistical power in this study, the data distribution allows for robust parametric analysis. The preliminary scatterplot inspections or theoretical alignment with previous studies by Wang & Chu (2023), suggested a linear relationship between competency and efficacy, justifying the use of a linear correlation coefficient.

Pearson correlation analysis was performed to identify the relationship between two primary variables which were lecturers' digital competency and digital efficacy in teaching engineering subjects. The results of this analysis are summarized in Table 5. The study revealed a Pearson correlation coefficient of $r = 0.77$ with a significance level of $P = 0.001$ ($p < 0.05$). This value indicates a strong positive correlation between the two variables. Consequently, Null Hypothesis 1, which posited no relationship between these factors, is rejected. In summary, the results demonstrate a statistically significant and strong relationship between the digital competency of lecturers and their digital efficacy. This suggests that as a lecturer's mastery of digital tools and resources increases, their confidence and perceived ability to effectively integrate technology into the engineering curriculum also significantly improve.

Table 5 *Relationship between lecturers' digital competency and digital efficacy*

Construct	Pearson Correlation Coefficient (r)	Significant Level	Interpretation of Correlation/Relationship Strength
Lecturers' Digital Competency with Digital Efficacy	0.77**	0.001	Strong Positive Relationship

4.6 Pearson Correlation Analysis of the Relationship Between Facility Provision and Digital Efficacy in Using Digital Technology for Engineering Subject Teaching

Pearson correlation analysis was conducted to identify the relationship between two variables: the facilities provided by the institution to lecturers and the lecturers' digital efficacy in using digital technology for teaching engineering subjects. Table 6 shows the correlation coefficient values obtained from the analysis. The study found that the Pearson correlation coefficient between the facilities provided and lecturers' digital efficacy is $r = 0.71$, $P = 0.001$ ($p<0.05$). This indicates a positive correlation between the two variables with a strong correlation strength. Therefore, the null hypothesis 2 of the study is rejected. In summary, the results indicate a significant relationship between the facilities provided by the institution to lecturers and their digital efficacy in using digital technology for teaching engineering subjects.

Table 6 *Relationship between facilities and lecturers' digital efficacy*

Construct	Pearson Correlation Coefficient (r)	Significant Level	Interpretation of Correlation/Relationship Strength
Facilities Provided by the Institution with Lecturers' Digital Efficacy	0.71**	0.001	Strong Positive Correlation

5. Discussion

The study results indicate that the level of digital competence among engineering lecturers is high. This aligns with recent findings by Liesa-Orus et al. (2023), who emphasize that university lecturers have significantly improved their digital skills to ensure quality and relevant education in the post-pandemic era. While early frameworks like technological, pedagogical, and content knowledge (TPACK) were foundational, recent studies by Hani et al. (2024) suggest that modern digital competence in TVET and engineering now requires specific models focusing on digitization and industry standard software. However, challenges remain, Wang & Chu (2023) highlight that even with high competence, lecturers still face difficulties due to rapid curriculum changes and the need for continuous professional development.

The analysis shows that institutional facilities are at a high level, providing adequate infrastructure for digital teaching. Previous research by Haleem et al. (2022) supports this, noting that the integration of digital technologies like 3D printing and virtual reality is highly dependent on the availability of robust institutional infrastructure. Furthermore, Bariu (2020) and previous research by Noor et al. (2022) emphasize that providing high-quality interactive multimedia and smart classrooms is essential for TVET-based engineering education. Despite high facility levels, Elayyan (2021) warns that facilities must be constantly updated to align with the Fourth Industrial Revolution to avoid technological obsolescence.

Lecturers in this study demonstrate high digital efficacy, reflecting confidence in using digital tools to enhance learning. Saienko et al. (2020) and Ogundare et al. (2022) confirm that high self-efficacy is a critical predictor of how effectively a lecturer will employ digital technologies for curriculum instruction. Modern studies show that this efficacy is no longer just about basic ICT use but includes confidence in providing immediate digital feedback and personalized learning adjustments. Nevertheless, Mulyani et al. (2021) argue that the complexity of IR 4.0 can still cause efficacy gaps if lecturers are not supported by a culture of innovation.

A strong positive relationship ($r = 0.77$) exists between digital competence and digital efficacy. Previous empirical evidence from Wang & Chu (2023) validates this, showing that a lecturer's self-perception of their digital skills directly boosts their confidence to innovate in the classroom. Santos et al. (2022) further explain that as lecturers update their skills through digital literacy programs, their anxiety toward new technology decreases, thereby increasing their teaching efficacy. This suggests that mastery of industry specific tools, such as MATLAB or AutoCAD, is a primary driver of professional confidence.

The study also found a strong positive correlation ($r = 0.71$) between institutional facilities and digital efficacy. Ambarwati et al. (2020) and Haleem et al. (2022) highlight that facilitating conditions such as technical support and high-speed internet are mandatory for maintaining high lecturer confidence. Previous studies by Liesa-Orus et al. (2023) suggest that when universities provide free access to advanced digital resources, lecturers feel more empowered to experiment with instructional designs. In conclusion, while infrastructure provides the hardware for education, it is the combination of these facilities with ongoing technical support that truly solidifies a lecturer's digital efficacy.

6. Conclusion

In conclusion, this study aimed to identify the level of digital competence and the facilities available that influence lecturers' digital efficacy in teaching engineering subjects. The study used a questionnaire adapted from the European Union studies (Dias-Trindade & Ferreira, 2020; Wang & Chu, 2023) and Ogundare et al. (2022), with 46 items for digital competence, 8 items for facilities, and 10 items for digital efficacy. Descriptive analysis was used to assess the levels of digital competence, facilities, and digital efficacy, while Pearson correlation tests determined the relationships between digital competence, facilities, and digital efficacy. The findings indicate that the levels of digital competence, facilities, and digital efficacy among lecturers are high, with significant relationships between digital competence, facilities, and digital efficacy. Overall, engineering faculty lecturers demonstrate high levels of digital competence and efficacy, effectively addressing the research questions.

Acknowledgement

The communication of this research was made possible through financial support from Universiti Tun Hussein Onn Malaysia and the UTHM Publisher's Office via the Publication Fund (E15216), and was also partially supported by the 2025 Shenzhen Education Science Planning Project (Grant No. zdzz25007).

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Amirah Abdul Kamil, Mohd Zulfadli Rozali, Zeng Xiuzhen;* ***data collection:*** *Amirah Abdul Kamil;* ***analysis and interpretation of results:*** *Amirah Abdul Kamil, Mohd Zulfadli Rozali, Zeng Xiuzhen;* ***draft manuscript preparation:*** *Amirah Abdul Kamil, Mohd Zulfadli Rozali, Zeng Xiuzhen. All authors reviewed the results and approved the final version of the manuscript.*

References

Agyei, D. D., & Voogt, J. (2011). ICT use in the teaching of mathematics: Implications for professional development of pre-service teachers in Ghana. Education and information technologies, 16, 423-439.

Al-Emran, M., Elsherif, H. M., & Shaalan, K. (2016). Investigating attitudes towards the use of mobile learning in higher education. Computers in Human behavior, 56, 93-102.

Al-Rahmi, W. M., Alzahrani, A. I., Yahaya, N., Alalwan, N., & Kamin, Y. B. (2020). Digital communication: Information and communication technology (ICT) usage for education sustainability. Sustainability, 12(12), 5052.

Ambarwati, R., Harja, Y. D., & Thamrin, S. (2020). The role of facilitating conditions and user habits: a case of Indonesian online learning platform. The Journal of Asian Finance, Economics and Business (JAFEB), 7(10), 481-489.

Bariu, T. N. (2020). Status of ICT Infrastructure Used in Teaching and Learning in Secondary Schools in Meru County, Kenya. European Journal of Interactive Multimedia and Education, 1(1), e02002. https://doi.org/10.30935/ejimed/8283.

Basri, S. N. A., Ahmad, F., Abidin, N. I. A., Baba, I., Harun, H., Hamid, N. H. A., & Kamaruzaman, M. (2020). Digital campus. International Journal of Engineering & Technology, 9(2), 382-389.

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. Eurasia Journal of Mathematics, science and technology education, 5(3), 235-245.

Bujang, S. D. A., Selamat, A., Krejcar, O., Maresova, P., & Nguyen, N. T. (2020, April). Digital learning demand for future education 4.0—Case studies at Malaysia education institutions. In Informatics (Vol. 7, No. 2, p. 13). MDPI.

Das, K. (2019). The role and impact of ICT in improving the quality of education: An overview. International Journal of Innovative Studies in Sociology and Humanities, 4(6), 97-103.

Dias-Trindade, S., & Ferreira, A. G. (2020). Digital teaching skills: DigCompEdu CheckIn as an evolution process from literacy to digital fluency. Icono14, 18(2), 162-187.

Elayyan, S. (2021). The future of education according to the fourth industrial revolution. *Journal of Educational Technology and Online Learning*, *4*(1), 23-30.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & education*, *59*(2), 423-435.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of research on Technology in Education*, *42*(3), 255-284.

Hani, M. H. M., Ismail, A., Razali, S. S., Bakar, M. N. A., Rosman, N. L., Nasir, N., & Mohamad, Z. (2024). The Development of Digital Competence Model Among TVET Educators Towards Digitization: A Concept Paper. Journal of TVET and Technology Review, 2(1), 1-18.

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. Sustainable Operations and Computers, 3, 275-285.

Howard, S. K., Chan, A., & Caputi, P. (2015). More than beliefs: Subject areas and teachers' integration of laptops in secondary teaching. British Journal of Educational Technology, 46(2), 360-369.

Hussin, A. A. (2018). Education 4.0 made simple: Ideas for teaching. International Journal of Education and Literacy Studies, 6(3), 92-98.

Hu, X., Gong, Y., Lai, C., & Leung, F. K. (2018). The relationship between ICT and student literacy in mathematics, reading, and science across 44 countries: A multilevel analysis. Computers & Education, 125, 1-13.

Inan, F. A., & Lowther, D. L. (2010). Factors affecting technology integration in K-12 classrooms: A path model. *Educational technology research and development*, *58*, 137-154.

Johnson, L., Becker, S. A., Cummins, M., Estrada, V., Freeman, A., & Hall, C. (2016). NMC horizon report: 2016 higher education edition (pp. 1-50). The New Media Consortium.

Liesa-Orus, M., Lozano Blasco, R., & Arce-Romeral, L. (2023). Digital Competence in University Lecturers: A Meta-Analysis of Teaching Challenges. Education Sciences, 13(5), 508.

Louis, J., & Lather, J. (2020). Augmented Reality Sandboxes for Civil and Construction Engineering Education. In ISARC. Proceedings of the International Symposium on Automation and Robotics in Construction (Vol. 37, pp. 750-756). IAARC Publications.

Maskuriy, R., Selamat, A., Ali, K. N., Maresova, P., & Krejcar, O. (2019). Industry 4.0 for the construction industry—how ready is the industry? Applied Sciences, 9(14), 2819.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers college record*, *108*(6), 1017-1054.

Moore-Adams, B. L., Jones, W. M., & Cohen, J. (2016). Learning to teach online: A systematic review of the literature on K-12 teacher preparation for teaching online. Distance education, 37(3), 333-348.

Mulyani, M. A., Yusuf, S., Siregar, P., Nurihsan, J., Razzaq, A., & Anshari, M. (2021, August). Fourth industrial revolution and educational challenges. In 2021 International Conference on Information Management and Technology (ICIMTech) (Vol. 1, pp. 245-249). IEEE.

Noor, S. F. M., Mohamed, H., Zaini, N. A., & Daiman, D. (2022). Use of Interactive Multimedia e-Learning in TVET Education. International Journal of Advanced Computer Science and Applications, 13(9).

Ogundare, S. A., Animasahun, V. O., & Abidoye, J. A. (2022). Lecturer' Knowledge and Self-efficacy to Employ Digital Technologies for Curriculum Instruction in Tertiary Institutions in North-east, Nigeria. Ilorin Journal of Education, 42(1), 72-79.

Santos, C., Pedro, N., & Mattar, J. (2022). Digital Competence of Higher Education Professors in the European Context: A Scoping Review Study. International Journal of Emerging Technologies in Learning, 17(18).

Saienko, N., Lavrysh, Y., & Lukianenko, V. (2020). The impact of educational technologies on university teachers' self-efficacy. International Journal of Learning, Teaching and Educational Research, 19(6), 323-336.

Scherer, R., & Teo, T. (2019). Unpacking teachers' intentions to integrate technology: A meta-analysis. Educational Research Review, 27, 90-109.

Selwyn, N. (2016). Education and technology: Key issues and debates. Bloomsbury Publishing.

Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. Computers & Education, 57(4), 2432-2440.

Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. Educational technology research and development, 65, 555-575.

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013). Challenges to learning and schooling in the digital networked world of the 21st century. Journal of computer assisted learning, 29(5), 403-413.

Wang, Z., & Chu, Z. (2023). Examination of higher education teachers' self-perception of digital competence, self-efficacy, and facilitating conditions: An empirical study in the context of China. *Sustainability*, *15*(14), 10945.