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Attitude and its relationship toward information and communication technology competency among vocational engineering students

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Abstract: There are gaps between vocational engineering curricula and industry competency needs, especially in information and communication technology (ICT) competency. However, limited studies have been conducted on factors affecting ICT competency among vocational engineering students, particularly attitudes toward ICT utilization. Thus, this study aims to determine the attitude and the relationship toward ICT competency among vocational engineering students based on the Unified Theory of Acceptance and Use of Technology II (UTAUT II). It was conducted in Higher Education Institutions in West Sumatera, Indonesia. It was a survey study with a quantitative method that used one set of questionnaires to collect data. Respondents are 805, covering first-year and last-year students enrolled in those institutions by purposive sampling. Data were analyzed descriptively for mean and standard deviation, and inferentially by employing Pearson Correlation. Findings showed that the ICT competency among vocational engineering students was lower than their attitude toward ICT utilization. A high attitude only is not enough to support the competency. Thus, this study can be used as a guide by the relevant authorities such as the Ministry of Education Affairs to take action to enhance the ICT competency among vocational engineering students from other aspects.

Keywords: Quality education; 21st century skill; Vocational engineering; Technology competency

1. Introduction

The attitude of engineering students toward Information and Communication Technology (ICT) competency can significantly impact their learning and competency in this field. Attitude refers to an individual's thoughts, feelings, and beliefs about a particular subject, in this case, ICT competency. The attitude of engineering students can be influenced by various factors, including personal experiences, educational environment, societal norms, and perceived usefulness of ICT skills in their future careers (Copriady, 2015; Lestari et al., 2023). Attitude plays a crucial role in shaping students' motivation, engagement, and willingness to learn ICT competencies. A positive attitude toward ICT can enhance students' interest in the subject, leading to increased effort and dedication to acquiring the necessary skills. Conversely, a negative attitude can create resistance and hinder the learning process. Attitudes towards the use of ICT can have an impact on student learning outcomes. This is because in today's modern era, learning resources and learning media have used technology that requires students to be ready to accept the use of ICT. This attitude

readiness will impact the learning outcomes, as well as vocational engineering students who are required to master the latest technology. Furthermore, this attitude will affect employability in engineering education. Workers who are accustomed to a good attitude in accepting the use of technology will also have good work skills because they are accustomed to a technological environment.

ICT is a rapidly evolving field, with new technologies and tools constantly emerging. Vocational engineering students need to develop a mindset that embraces continuous learning and adapts to technological changes (Rozan et al., 2024). Studying the relationship between attitude and ICT competency can provide insights into the factors that facilitate or hinder students' ability to keep up with the evolving landscape, enabling educators to design strategies that promote lifelong learning and adaptability (Haleem et al., 2022; Kamalov et al., 2023; Timotheou et al., 2023). The relationship between attitude and ICT competency is often reciprocal. As students develop their ICT skills, their attitude toward the subject can improve, as they perceive themselves as competent. On the other hand, a positive attitude can motivate students to invest time and effort in acquiring and honing their ICT competencies, leading to improved competency (Normaliza et al., 2024; Wiersma, 2000). Studying the attitude and its relationship toward Information and Communication Technology (ICT) competency among engineering students is of significant importance and holds several urgent reasons such as (i) increasing reliance on technology; (ii) skills gap and employability; (iii) enhancing learning outcomes; (iv) technological innovation and advancement; and (v) equity and inclusivity. In today's digital era, technology is pervasive and rapidly advancing. Engineering fields are heavily reliant on ICT competencies, and engineers need to possess the necessary skills to thrive in their professions. Understanding the attitude of engineering students toward ICT competency can help identify gaps in their preparedness and design interventions to bridge those gaps (Chen et al., 2024).

There is a growing demand for engineers with strong ICT competencies in various industries. However, the curricula of vocational engineering do not meet the actual requirements of the job market, particularly in terms of ICT competency. This study aims to bridge the gap between curricula and industry needs in ICT competency. Previous studies reported that many factors affected ICT competency including attitudes, curricula content, institution policy, accessibility, and technical support (Ashraf et al., 2022; Saimi & Yamat, 2021). Factors such as curricula content, institution policy, accessibility, and technical support are external factors, meanwhile, the attitude of students is an internal factor. There are limited studies on attitudes toward ICT utilization among vocational engineering students. Thus, this study aims to determine the attitude of ICT utilization and the relationship toward ICT competency based on the Unified Theory of Acceptance and Use of Technology II (UTAUT II) among vocational engineering students.

Based on the Unified Theory of Acceptance and Use of Technology (UTAUT II), competency in ICT can be influenced by the attitude of the users of technology (Venkatesh et al., 2012). UTAUT II is to date and comprehensive theory that combines 8 theories and models in examining the acceptance of ICT. it is appropriate to be adopted in this study (Mahmud et al., 2010). Studies on the relationship between attitude and competency in ICT that involved a large number of Higher Education Institution vocational engineering students are limited. Thus, this study was conducted to determine the level of attitude toward ICT utilization and ICT competency and the relationship among vocational engineering students. By studying the attitude of vocational engineering students toward ICT competency, educational institutions can align their curricula and teaching methodologies to ensure students are adequately prepared and meet industry needs, thereby improving their employability (Chigbu & Nekhwevha, 2022; Ng et al., 2023). By understanding the students' attitudes, educators can design interventions and create an environment that fosters

positive attitudes and maximizes learning outcomes (Bryman & Cramer, 2004). Some students may face barriers, such as gender stereotypes or lack of exposure, which can affect their attitudes and access to ICT opportunities (Méndez et al., 2023; Nilholm, 2021; Rini et al., 2024; Soeharto et al., 2024). Given the urgency and relevance of ICT competencies in engineering fields, studying the attitude and its relationship toward ICT competency among vocational engineering students is crucial for equipping the future workforce with the necessary skills, enhancing employability, improving learning outcomes, fostering innovation, and promoting inclusivity in the field of engineering.

2. Methods

2.1 Research design

This study is a survey study using a quantitative method. A survey study was chosen for this study because it is appropriate to collect data from a large number of respondents (805 respondents) (Wiersma, 2000). It provides a high level of general capability in representing a large population, easier to find statistically significant results, saves money, and is not limited by geographical restrictions (Palinkas et al., 2015). The procedure for conducting the study is as follows:

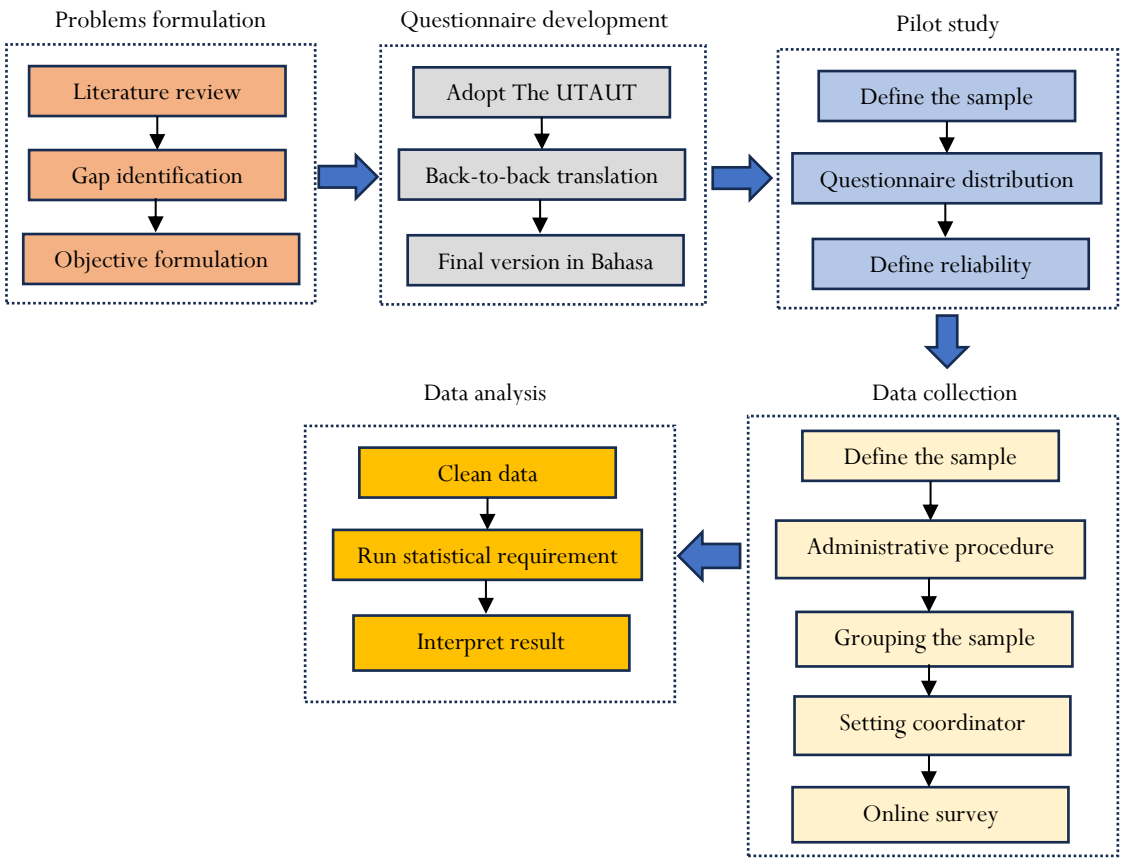

Figure 1. Research flow diagram

2.2 Sampling method

This study used Krijcie and Morgan Table to determine the size of samples where based on the number of population (Krejcie & Morgan, 1970). The population of vocational engineering students in research area and sample determination is presented in Table 1.

Table 1. Sample size determination based on population

Institution	Population	Sample size
Institution A	600	234
Institution B	1300	297
Institution C	1044	274
Overall	**2944**	**805**

Thus, this study was conducted on 805 students from Higher Education Institutions located in West Sumatera, Indonesia as samples. Samples were chosen purposively, consisting of first-year and final-year engineering students. This because to gain representative data about ICT competency diffusion between crucial stages in the early and final year as students.

2.3 Instrument and its reliability

A questionnaire was prepared to collect data. It consists of three parts, Part A (profile of sample), Part B (Attitude toward ICT utilization), and Part C (ICT Competency). Part B and Part C were using 5-point Likert-type scales that noted as 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree) toward each item of the questionnaire. The questionnaire was adopted from the Unified Theory of Acceptance and Use of Technology II (UTAUT II). It was translated using back-to-back translations, done by two English experts and one Bahasa expert. Final version of the questionnaire in Bahasa was used in pilot study.

Attitude of ICT utilization is divided into 8 aspects; (1) performance expectancy; (2) effort expectancy; (3) social influence; (4) facilitating condition; (5) hedonic motivation; (6) habit; (7) behavioral intention; and (8) price value. Performance expectancy (PE) is defined as the level of benefits or benefits obtained by consumers when using technology to carry out their daily activities. Performance expectancy includes usefulness, quickness, and productivity related to the user's work when using a technology. Effort expectancy (EE) is the level of effort or effort associated with the use of a system or technology by the students. There are 2 dimensions in effort expectancy; complexity and ease of use. Complexity is how complex a technology is to learn. Meanwhile, ease of use is the ease felt when using technology.

Social influence (SI) is the influence of the immediate environment (e.g., family and friends) to use a particular system or technology that includes 2 dimensions of social influence, social factors and subjective norms. Social factors are the surrounding environment of the students. Meanwhile, subjective norms are the important people related to students such as teachers. Facilitating conditions (FC) are the university's resources and support as well as the technical infrastructure available to support the use of ICTs. There are 3 dimensions of facilitating conditions, namely resources, knowledge, and compatibility. Resources are external sources that affect the use of technology. Knowledge is a source of knowledge from outside to use technology, and the third is compatibility, which is the level of compatibility of the system with the technology currently used.

Hedonic motivation (HM) is the pleasure that comes from the use of technology and has been shown to play an important role in determining the acceptance and use of technology. There are 3 dimensions of hedonic motivation. The first is fun, which is the pleasure obtained by using technology. The second is enjoyment, which is obtained when using technology. Third is entertainment, which is the feeling of being entertained when using technology. Habit (H) is to determine whether the individual believes the behavior to be automatic (because of learning from

a technological system. There are 2 dimensions of habit, addictiveness and must. Addictiveness is the level of addiction that users get by using the system. Must is the feeling of necessity from the user to use the system. Price value (PV) is defined as the cognitive value of the with the perceived benefits of the application and the monetary cost of using it. There are 2 dimensions in price value, including reasonable which means the system has a reasonable price, and worth which means the value obtained from using the system is proportional to the price paid.

The final Bahasa version of questionnaire was used in the pilot study to the 30 students to determine its reliability. The result of the pilot study showed that the questionnaire got alpha Cronbach's of 0.83 for the construct of attitude and 0.88 for the construct of competency, respectively. Alpha Cronbach coefficients showed that all items of each construct were reliable or had high reliability since the alpha Cronbach coefficients are more than 0.7 (Bryman & Cramer, 2004).

2.4 Data analysis

Each response of questionnaire scored 1, 2, 3, 4, and 5 based on Likert Scale. Then, the data were analyzed descriptively and inferentially. The descriptive analysis consisted of frequency, percentage, mean, and standard deviation. Frequency and percentage were used to identify the profile of respondents, concerning gender and year of study. Meanwhile, mean and standard deviation were used to determine the level of attitude and skill. Levels of attitude and competency were categorized into 3 levels, based on the mean score obtained. A mean of 1.00 to 2.33 was identified as a low level, a mean of 2.34 to 3.66 was identified as a moderate level, and a mean of 3.67 to 5.00 was identified as a high level Ab Halim et al., (2021). Inferential analysis by using Pearson correlation, r and significant level, $p < 0.05$, was used to determine the relationship between attitude and competency in ICT.

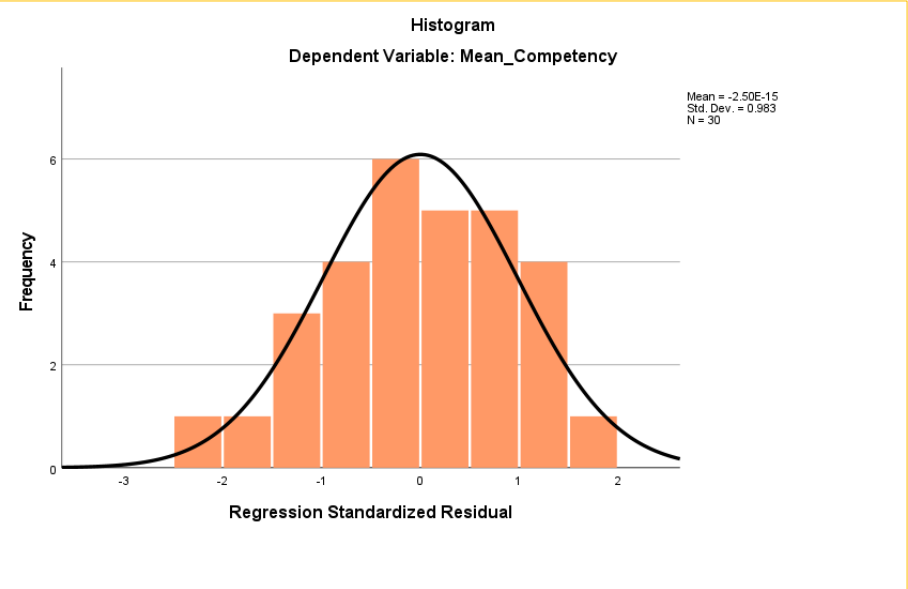

Figure 2. Histogram of data distribution

Figure 2 shows that the graph is approximately bell-shaped and symmetric about the mean. Thus, the data is normally distributed.

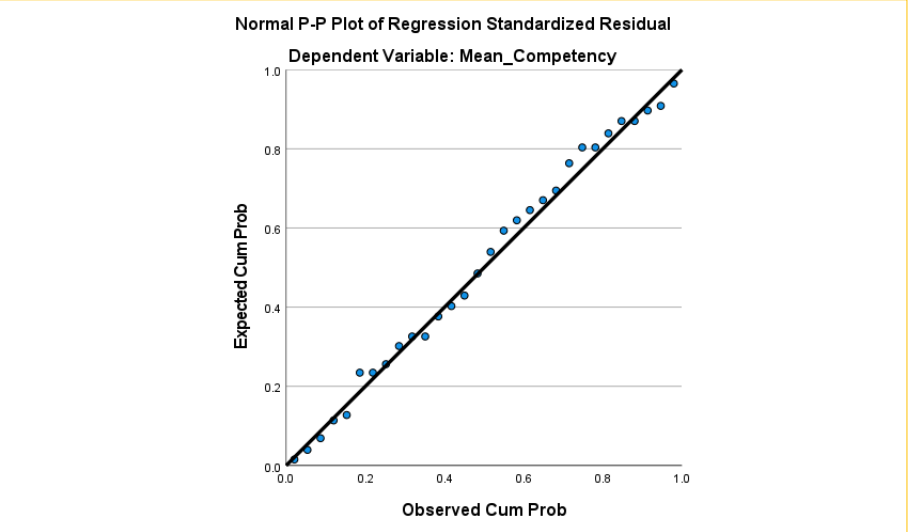

Figure 3. Normal P-P plot of data distibution

Another method to determine normality is using a percent-percent plot or probability-probability plot (P-P plot). It is a graphic to determine how close are the two data sets (seen and predicted). Figure 3 shows that the data is normally distributed. It creates an approximately straight line. Figure 2 and Figure 3 show that the data fulfil the requirement of the Pearson Correlation assumption.

3. Results and discussion

3.1 Attidude toward ICT utilization

This study was conducted on 805 students from various Higher Education Institutions in West Sumatera, Indonesia, and covers gender and year of study. Samples consist of 390 male students (48.4%) and 415 female students (51.6%). This composition is almost balanced between genders. Findings show that gender has a significant difference in ICT competency. The findings of this study are supported by Cai et al., (2017), Qazi et al., (2022) and Vázquez-Cano et al., (2017) that male students have higher ICT competency than female students. Male students have higher knowledge, attitude, and competency than female students. Female students tend to have negative attitudes as reported in Qazi et al., (2022) because they are not confident in using ICT.

From aspect year of study, samples are 343 first-year students (42.6%) and 462 last-year students (57.4%). This composition is almost balanced in term of year of study (first and last year). This finding is also aligned with the studies of Luo et al., (2024) and Olatoye et al., (2021) that final-year students usually have higher ICT competency than first-year students. This is because there is a process of technology diffusion from social influence. The findings of this study are supported by the theory of technology diffusion by Roger, (2003) that technology can develop depending on a person's acceptance attitude. If a person's attitude is positive, then technology can diffuse, and conversely, technology will be abandoned if a person's acceptance attitude is negative. The findings of the study are also in line with the UTAUT II theory proposed by Venkatesh et al (2012). that gender and year of study have significant influence on the acceptance and use of ICT, especially the internet.

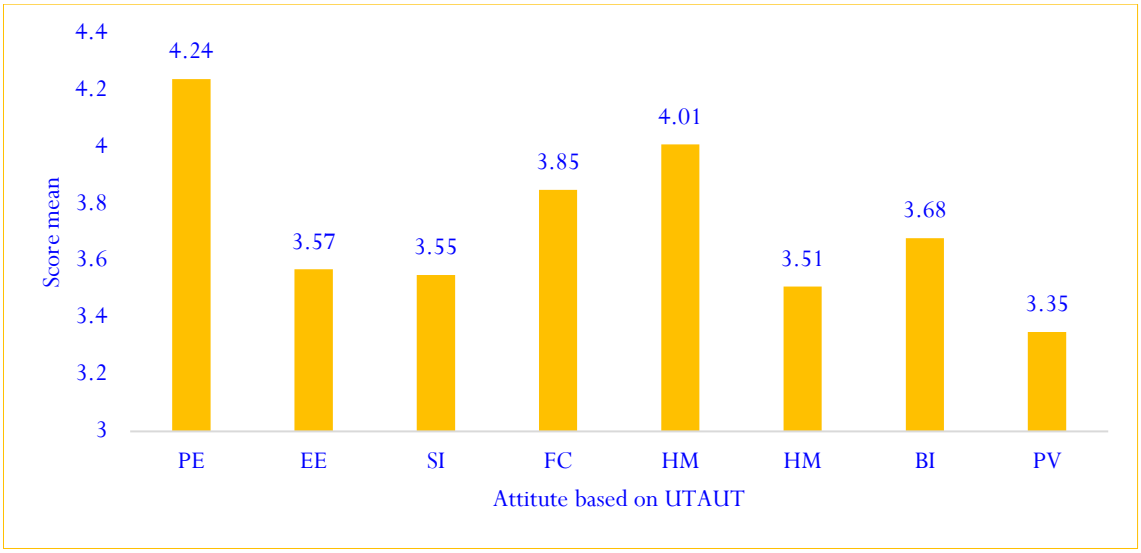

Figure 4. Score mean of Attitude toward ICT utilization among students

The level of attitude among vocational engineering students based on score mean is presented in Table 2.

Table 2. Level of attitude toward ICT utilization based on UTAUT II

Aspect	Level
Performance expectancy (PE)	High
Effort expectancy (EE)	Moderate
Social influence (SI)	Moderate
Facilitating condition (FC)	High
Hedonic motivation (HM)	High
Habit (H)	Moderate
Behavioral intention (BI)	High
Price value (PV)	Moderate
Overall	**High**

Figure 4 and Table 2 show that performance expectancy, facilitating condition, hedonic motivation, and behavioral intention are at high levels. Meanwhile, effort expectancy, social influence, habit, and price value are at moderate levels. This means students have a high attitude toward ICT utilization even though the ICT price is still considered fairly expensive among students.

Based on descriptive analysis, the performance expectancy aspect is at a high level. Students admit that ICT is very useful in life and can help students complete work faster, thus increasing productivity. This also aligns with Ferrero & Álvarez Sainz, (2024) and Slechtova, (2015). These studies also report that students are aware that ICT is useful in helping them complete assignments and understand the concepts of difficult subjects. However, the findings of this study contradict the study of Rhema & Miliszewska, (2014) which found that students' attitudes are at a moderate level. This is because students refer to books more than information from the internet which is sometimes found to contradict books. The hedonic motivation and behavioral intention also received high perception because ICT is entertaining besides educating. This is also reinforced by the UTAUT II theory (Venkatesh et al. 2012) which confirms that the hedonic motivation factor is a key factor in the acceptance and use of ICT.

Indonesia is a developing country. Facilitating conditions are also an important factor in accepting and using technology. However, the explosion of information in the modern era and globalization make it easy for students to use ICT on campus. However, ICT is still relatively expensive when provided by individuals, especially by students themselves. This is in line with students' perceptions of the price value aspect which is at a moderate level. Therefore, when referring to the price value aspect, ICT is still considered expensive by students. The price has not been fully assessed as having the same price as money and the price is not under what is offered. In the end, the effort expectancy aspect is at a moderate stage. Price affects the effort expectancy aspect.

3.2 Level of ICT competency

ICT competency covers students' competency in Microsoft Office, internet, and email as shown in Table 3. It shows that students have moderate level in Microsoft Word, Microsoft Excel, Microsoft PowerPoint, and email, but have high level in exploring the internet. Thus, overall, students' competency is at a moderate level. The skill needs to be improved because an important aspect for engineering students to face the modern era. Based on the mean score, competency in using Microsoft Excel obtained the lowest mean score, followed by email and Microsoft Word. However, this study found that students have high competency in operating basic internet.

Table 3. Level of ICT competency

Aspect	Mean	Level
Microsoft word	3.43	Moderate
Microsoft excel	3.32	Moderate
Microsoft powerpoint	3.45	Moderate
Internet	3.70	High
Email	3.35	Moderate
Overall	**3.45**	**Moderate**

Overall, this study found that the skills of engineering students are still at a moderate level. The results of this study support the study of Nazari et al., (2021) and Urhahne & Wijnia, (2023) who also found the level of knowledge of most students is still at a moderate level. Even this study was reinforced by the study of Siddiq et al., (2017) which examined more detailed ICT skills that cover hardware and software in rural students. The students' competencies are still at a moderate level. These skills include information-seeking skills using the internet, identifying computer software, using word processing, electronic presentations, spreadsheets, and anti-virus software. Additionally, the skills in using electronic mail and copying files from the computer to the handset are also found to be moderate.

Even though Internet skills are mostly at a high level, email skills are at a moderate level. This is because most students have not been familiar yet with email. Not all students have an active email account and only few of them are able to create an email. Despite having an active email, most students rarely use it. The description of the phenomenon of skills that are still at a moderate level is related to the level of knowledge that is also still low and ineffective training (Otsuka, 2021).

3.3 Relationship between attitude and ICT competency

The relationship between attitude and ICT competency is analyzed using Pearson correlation as shown in Table 4. It shows that there was a significant relationship between attitudes and ICT competency of engineering students. Based on the value of r (Pearson Correlation

coefficient), it is identified the strength of the relationship. Thus, the relationship is at a moderate level (r = 0.43). This means attitude toward ICT utilization will enhance the competency of ICT moderately. However, the findings of this study contradict to Courtney et al., (2022) which found no significant relationship between attitude toward ICT utilization and competency of ICT. Their study found that whether high attitude toward ICT did not make the proficiency of the students better but when examined more clearly, the ICT competency referred to Mahmud et al., (2010) is social media which certainly has no relation to the ICT competency that is used in the teaching and learning process.

Table 4. Pearson correlation results of relationship between attitude and ICT competency

Variable	R	P	Strength
Attitude Competency	0.43	0.00	moderate

*significant at $p<0.05$

Findings show that a good attitude toward ICT utilization will enhance students' motivation, engagement in the learning process, and motivation to learn ICT competencies (Haleem et al., 2022; Kamalov et al., 2023; Timotheou et al., 2023).

4. Conclusion

This study has determined the level of attitude toward ICT utilization at a high level, meanwhile the level of ICT competency is at a moderate level. However, there was a significant relationship at a moderate level between attitude and competency in ICT. Even though they have a moderate relationship, this study revealed that other factors have a more significant effect on improving competency of ICT. Thus, this study provides insight into the potential strategies to address the skill gaps identified between engineering curricula and job market requirements, thereby improving student employability. Further study is needed to explore another factor, including the effect of knowledge and workshops on the competency of ICT. Hence, the findings of this study should be taken into consideration by those whom it may concern, especially for Higher Education Institutions which are under the responsibility of the Ministry of Education to improve the curriculum and enrich the curriculum activities of the ICT. These findings can be utilized by educational institutions or policymakers to enhance curriculum and teaching methodologies.

Author's declaration

Author contribution

Rinaldi: Conceptualization, investigation, writing -original draft & revise the manuscript. **Putri Gemala Sari**: Validation & editing. **Mohd Isa Hamzah**: Conceptualization. **Masnaini Alimin**: Investigation & analysis.

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Conflict of interest

The authors declare no conflict of interest.

Ethical clearance

The involvement of students who are the subjects of this research follows the Declaration of Helsinki (MWA).

AI statement

This article is the author's original work, written from original research, and no sections or figures were generated by AI. English has been checked using Grammarly and has been verified by the authors.

Publisher's and Journal's note

Universitas Negeri Padang as the publisher, and the Editor of Jurnal Pendidikan Teknologi Kejuruan state that there is no conflict of interest towards this article publication.

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