From Adoption to Continuance: Understanding Self-Efficacy's Role in TVET Digital Learning

Mohd Hafizul Ismail[1]*, Siti Haryani Shaikh Ali[1], Husna Sarirah Husin[2], Sallaudin Hassan[3], Siti Nur Dina Mohd Ali[4]

[1] *Malaysian Institute of Information Technology, Universiti Kuala Lumpur,*
    1016 Jalan Sultan Ismail, Kuala Lumpur, 50250, MALAYSIA

[2] *School of Computer Science, Taylor's University,*
    Jalan Taylors, Selangor, 47500, MALAYSIA

[3] *Malaysian Institute of Industrial Technology, Universiti Kuala Lumpur,*
    Bandar Seri Alam, Johor, 81750, MALAYSIA

[4] *Universiti Teknologi MARA, Cawangan Negeri Sembilan,*
    Kampus Kuala Pilah, Negeri Sembilan, 72000, MALAYSIA

*Corresponding Author: mhafizul@unikl.edu.my
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Article Info

Abstract

This study explores how lecturers' self-efficacy affects their satisfaction and willingness to continue using digital technologies (DT) in Technical and Vocational Education and Training (TVET) teaching and learning (T&L). A survey was conducted with 150 lecturers from the Malaysian TVET Higher Learning Institution. It aimed to assess how self-efficacy influences both satisfaction and the continuance use of DT in TVET education. The study employed a quantitative research design, with structured questionnaires measuring self-efficacy, satisfaction, and continuance intention. Using the Structural Equation Model (SEM) analysis, the results showed that self-efficacy has a strong and significant positive impact on both satisfaction and continuance use of DT in TVET settings. Lecturers with higher self-efficacy were more satisfied with technology use, which strengthened their commitment to ongoing adoption. The findings also indicated that satisfaction partially mediated the relationship between self-efficacy and continuance intention. This indicates that while self-efficacy directly supports long-term technology use, satisfaction further enhances the continued use of DT in TVET T&L.

1. Introduction

The rapid evolution of technology has significantly impacted educational practices worldwide, including TVET. In Malaysia, the integration of digital technologies into TVET teaching is seen as crucial for preparing students to meet the demands of the modern workforce (Ridhuan et al., 2024; Tshong & Yasin, 2023). The digitalization of education has transformed traditional teaching methods, requiring educators to adopt new pedagogical approaches that incorporate technology effectively. The Malaysian government has emphasized the importance of digital transformation in education through various initiatives, such as the Malaysia Education Blueprint (2013-2025), which outlines strategies for integrating technology into all levels of education, including TVET (Ministry of Education Malaysia, 2015). These efforts aimed at fostering a technologically competent workforce equipped with 21st-century skills such as digital literacy, problem-solving, and critical thinking.

The Malaysia Digital Economy Policy Blueprint released by the Prime Minister Department in 2021 set forth an ambitious vision to empower the digital economy and cultivate a digitally skilled generation, aiming to elevate

the quality of education in Malaysia and position the nation as a global leader in the educational sector (Economic Planning Unit, 2021). This policy is designed to bridge the digital divide, ensuring that students acquire essential digital skills to thrive in a technology-driven world. For TVET institutions, the policy presents a unique opportunity to adopt digital pedagogy and integrate advanced digital tools that enhance traditional T&L methods. As DT advances, the Malaysian TVET sector is well-positioned to reap significant long-term benefits from a more comprehensive and systematic integration of this technology. The transformative potential of DT in TVET goes beyond simply digitizing course content; it enables a more flexible, interactive, and efficient approach to skill-based education, making learning accessible anytime and anywhere.

However, despite these policies, the successful adoption and continuance use of DT in TVET T&L remains a challenge for many educators. Several factors contribute to the uneven implementation of technology in TVET institutions, including infrastructural constraints, lack of proper training, and resistance to change among lecturers (Yeap et al., 2021). A key determinant of effective technology adoption is lecturers' self-efficacy: their confidence in their ability to integrate and utilize technological tools in their teaching. Self-efficacy, defined as an individual's belief in their ability to execute tasks and achieve goals, has been found to play a crucial role in shaping educators' willingness to embrace digital tools (Callo & Yazon, 2020). Lecturers with high self-efficacy are more likely to explore and implement innovative teaching strategies, adapt to new technological advancements, and improve student engagement (San-Martín et al., 2020; Xie et al., 2023). Conversely, those with lower self-efficacy may experience anxiety, reluctance, or even avoidance of technology, limiting their ability to leverage digital tools effectively in their teaching.

Self-efficacy in teaching strategies reflects a lecturer's confidence in utilizing a diverse range of DT and methodologies to enhance the learning experience. This concept encompasses key skills such as seamlessly integrating DT into lesson plans, leveraging interactive tools to foster student engagement, and adapting traditional teaching approaches to suit virtual and hybrid learning environments. A high level of efficacy in these areas not only enhances instructional quality but also promotes a more dynamic, interactive, and student-cantered learning experience (Paetsch et al., 2023). Lecturers with strong teaching efficacy are better equipped to create engaging, flexible, and innovative learning spaces that cater to diverse student needs, ultimately leading to improved academic outcomes and a more effective technology-driven education system.

Integrating DT into TVET education is essential because vocational training relies heavily on practical, hands-on learning (Samah et al., 2022). Tools like video conferencing (VCT), virtual reality (VR), augmented reality (AR), and simulation software can transform the T&L experience (Ismail et al., 2023). They give students immersive, real-world experiences that connect theory with practice. DT allows students to build technical skills in a safe and interactive environment, helping them become more competent and job-ready. However, the successful use of these tools depends on lecturers' confidence and ability to integrate them into their teaching. Without strong self-efficacy, lecturers may hesitate to adopt or continue using DT, reducing its benefits for students. To ensure long-term success in technology-based TVET, institutions must strengthen digital skills and self-efficacy among educators. This can be achieved through focused training, ongoing professional development, and strong institutional support.

This study aims to examine the relationship between lecturers' self-efficacy, their satisfaction with technology use, and their continuance intention to integrate DT into TVET T&L. By focusing on Malaysian TVET HLIs, this research contributes to a better understanding of the local educational context and offers insights for enhancing technology adoption in TVET. It also provides valuable recommendations for policymakers, educational leaders, and stakeholders on how to support lecturers in overcoming barriers to technology use, thereby fostering a more effective and innovative teaching environment. The findings from this study can serve as a foundation for developing targeted professional development programs that enhance lecturers' self-efficacy, ensuring that technology integration is both effective and enduring in the TVET sector.

2. Literature Review

The concept of self-efficacy, introduced by Bandura (1991), has been widely explored in the context of educational technology adoption, with numerous studies emphasizing its pivotal role in shaping individuals' attitudes and behaviors toward new technology or tools (Prasetya et al., 2021; Rekha et al., 2022; Sadam & Al Mamun, 2024). Bandura asserted that self-efficacy affects the choices individuals make, the effort they invest, their persistence in overcoming obstacles, and their resilience in the face of setbacks. This theory has been applied across various domains, particularly in education, where it has been shown to significantly impact teaching methodologies, instructional design, and the successful integration of technology in learning environments (Pressley & Ha, 2021). Educators with higher self-efficacy are more likely to embrace digital tools, experiment with innovative pedagogical strategies, and persist in refining their technological skills, ultimately fostering more dynamic and effective learning experiences for students.

Previous research has indicated that educators with high self-efficacy are more likely to embrace and effectively use technology in their classrooms (Baroudi & Shaya, 2022). High self-efficacy correlates with a

willingness to experiment with new teaching methods, such as blended learning, flipped classrooms, and the use of digital assessment tools. This is particularly relevant in TVET, where practical application and hands-on experience are integral to the learning process. In the TVET context, where practical and technical skills are paramount, the ability of lecturers to confidently integrate technology can enhance teaching effectiveness and student outcomes. When utilized strategically, digital tools such as virtual labs, simulation software, and online collaborative platforms can provide students with immersive, real-world learning experiences that strengthen their technical competencies and problem-solving skills. By fostering self-efficacy among TVET educators through targeted training, mentorship, and institutional support, institutions can ensure the successful integration of technology, ultimately creating a more engaging, interactive, and industry-relevant learning environment (Siraj et al., 2023).

Research has consistently demonstrated that self-efficacy plays a crucial role in both the initial adoption and continuance use of technology, often mediated by user satisfaction (Sadam & Al Mamun, 2024). The Social Cognitive Theory (SCT) and the Expectation Confirmation Model (ECM) frameworks emphasize the crucial role of satisfaction in technology adoption and continued use (Yao & Wang, 2024). ECM suggests that user satisfaction is a primary determinant in technology acceptance and long-term engagement, as individuals who perceive that their expectations are met are more likely to continue using the technology. Meanwhile, SCT extends this perspective by incorporating the influence of social and environmental factors, such as peer encouragement, institutional support, and cultural attitudes towards technology adoption (Marangunić & Granić, 2019). Together, these frameworks suggest fostering self-efficacy through targeted interventions such as mentorship, professional development, and organizational support. These interventions can enhance satisfaction and drive sustained engagement with educational technology, ultimately leading to more effective and transformative learning experiences.

Furthermore, user satisfaction is not only a function of perceived usefulness but also closely linked to an individual's confidence in their ability to navigate and maximize the benefits of technological tools. Educators with high self-efficacy are more likely to explore advanced features of technology, experiment with innovative pedagogical approaches, and actively seek professional development opportunities to enhance their skills. In contrast, educators with low self-efficacy may avoid using technology altogether or use it minimally due to fear of failure or uncertainty about its benefits (Razak et al., 2022). By integrating SCT and ECM, researchers have been able to explain how self-efficacy interacts with cognitive and environmental factors to influence technology continuance behaviors. These insights emphasize the necessity for institutions to provide continuous training, mentorship programs, and accessible technical support to build confidence among TVET educators, ensuring the long-term sustainability of technology integration in teaching practices.

On another note, Compeau and Higgins (2012) suggest that individuals with higher self-efficacy are more likely to perceive technology as beneficial and less intimidating, leading to higher satisfaction and continuance use. Their study highlighted that computer self-efficacy directly influences an individual's ability to perform specific tasks using technology, which in turn affects their overall satisfaction and intention to continue using technological tools. More recent studies have reaffirmed these findings, with scholars emphasizing the role of continuous professional development, peer mentoring, and institutional support in enhancing self-efficacy among educators (Hatta et al., 2024; Pressley & Ha, 2021). These interventions help mitigate technological anxiety, encourage innovation in teaching practices, and ultimately improve the effectiveness and integration of technology in educational settings. As digital transformation accelerates, fostering self-efficacy through structured training programs and collaborative learning environments remains essential for ensuring sustained adoption and meaningful use of technology across various domains.

However, there is limited research focusing specifically on Malaysian TVET lecturers, highlighting the need for studies that explore these dynamics within this unique educational setting. Given the cultural, institutional, and technological differences, it is crucial to understand how self-efficacy operates in the Malaysian context. Factors such as access to resources, institutional policies, and cultural attitudes toward technology can all influence self-efficacy and technology adoption (Hatta et al., 2024; Sukri et al., 2022). This study aims to fill this gap by providing empirical evidence on the role of self-efficacy in technology use among TVET lecturers in Malaysia. By doing so, it offers practical recommendations for enhancing technology integration in TVET, contributing to the broader goal of educational transformation in Malaysia. Furthermore, by identifying barriers to technology adoption and proposing solutions tailored to the Malaysian TVET landscape, this study provides valuable insights that can inform policy decisions and faculty development programs.

Building on insights from previous research, this study introduces a comprehensive model integrating three critical components derived from Social Cognitive Theory (SCT) and the Expectation-Confirmation Model (ECM). Specifically, the model incorporates self-efficacy from SCT, alongside satisfaction and continuance intention from ECM, to examine their collective influence on the adoption and sustained use of DT in TVET T&L. This conceptual framework, illustrated in **Figure 1**, provides a structured approach to understanding how educators' confidence in their technological abilities, their satisfaction with digital tools, and their intention to continue using them interact to shape long-term engagement with educational technology.
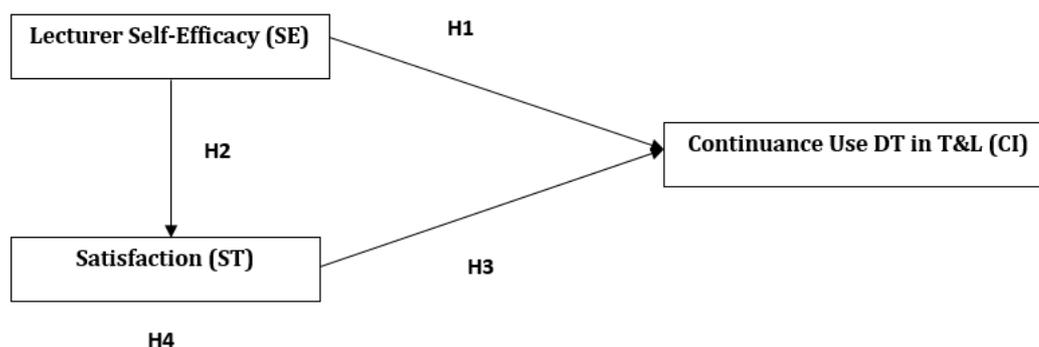
Fig. 1 *Conceptual model of the research*

This study aims to examine the impact of lecturer self-efficacy as a key cognitive variable on TVET lecturers' intentions to continue using educational technology in teaching and learning by extending the Expectation-Confirmation Model (ECM). The authors argue that lecturer self-efficacy may directly and indirectly affect their continuance intention to use DT. Additionally, this study explores the moderating role of satisfaction in shaping the relationship between self-efficacy and technology adoption. Specifically, this study proposes that higher self-efficacy enhances lecturers' confidence and motivation to integrate DT, leading to greater satisfaction and a stronger commitment to continued use. Satisfaction, in turn, may not only directly influence continuance intention but also moderate the relationship between self-efficacy and technology adoption, amplifying or altering its effects. To empirically validate these relationships, the following hypotheses are formulated:

H1: Lecturer self-efficacy significantly influences the continuance intention to use DT.
H2: Lecturer self-efficacy significantly influences satisfaction with using DT.
H3: Satisfaction significantly influences the continuance intention to use DT.
H4: Satisfaction partially moderates the relationship between lecturer self-efficacy and continuance intention to use DT.

3. Methodology

This study adopted a descriptive research design, employing a structured questionnaire to collect data from lecturers at Universiti Kuala Lumpur (UniKL), Malaysia's largest institution of TVET. A convenience sampling strategy was utilized to facilitate efficient access to participants and to ensure a diverse representation of lecturers across various disciplines, levels of teaching experience, and degrees of technological proficiency. This approach was deemed suitable due to its practicality and alignment with the study's timeline and resource constraints. Although convenience sampling may limit the broader generalizability of the findings, several measures were taken to minimize potential sampling bias. Notably, UniKL comprises multiple campuses across different regions in Malaysia, each specializing in distinct fields of study. This geographical and disciplinary diversity within the institution enhances the representativeness of the sample and helps mitigate some of the limitations typically associated with non-probability sampling methods.

The survey instrument was carefully adapted from the ECM and SCT to effectively examine the interplay between lecturer self-efficacy, satisfaction, and continuance intention in using educational technology. To enhance clarity and analytical precision, the questionnaire was systematically divided into two main sections: Section A collected demographic data to contextualize respondents' backgrounds, while Section B assessed the study's key constructs, including self-efficacy, satisfaction, and continuance intention. A 5-point Likert scale was employed, ranging from 1 ("strongly disagree") to 5 ("strongly agree"), allowing for in-depth insights into lecturers' perceptions and attitudes toward educational technology adoption in TVET settings.

The study focused on a population of 160 UniKL lecturers involved in teaching TVET subjects or programs, achieving an exceptionally high response rate of 93.8%, with 150 completed questionnaires returned. This robust response rate enhances the reliability and representativeness of the findings, reflecting strong engagement and interest in the survey among participants. The collected data were subjected to rigorous statistical analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS 3. The sample size of 150 respondents is deemed adequate and methodologically sound based on established statistical guidelines. Cohen (1988) recommended that for a statistical power of 80% (0.80) with an effect size of 0.15 (moderate effect) and a significance level of 5% ($\alpha = 0.05$), a minimum sample size of 76 respondents is required for detecting R^2 values in models with a single predictor, with larger sample sizes necessary for more complex models. Given this

benchmark, the sample size in this study provides sufficient statistical power to support the robustness and validity of the research findings.

PLS-SEM was chosen for its ability to estimate complex cause-effect relationships in research, making it particularly suitable for this study which involves multiple interconnected variables (Ramayah et.al, 2018). This method is well-regarded for its flexibility in handling small to medium sample sizes and its robustness in analyzing models with latent constructs, thereby providing reliable insights into the factors driving lecturers' continuance intention to use DT in a TVET context. The combination of descriptive and inferential statistical techniques ensures a comprehensive analysis of the data, facilitating a deeper understanding of the factors that influence the ongoing use of DT among TVET lecturers.

4. Results and Findings

The PLS-SEM analyses conducted in this study followed the two-step approach as outlined by Hair et al. (2019), ensuring a robust and systematic evaluation of the proposed model. Smart PLS version 3.3.3 was utilized to simultaneously assess the measurement model and the structural model, offering a comprehensive framework for examining the relationships between constructs. The first step focused on the measurement model, where construct reliability and validity were assessed to ensure that the measurement items accurately represented their respective constructs. This step confirmed the robustness of the measurement model, ensuring it met the required thresholds for reliability and validity. Once the measurement model was validated, the second step involved testing the structural model to evaluate the hypothesized relationships among the constructs.

4.1 Measurement Model

To ensure the accuracy, reliability, and validity of the data collected, this study conducted a rigorous evaluation of the measurement model using well-established statistical techniques. Reliability was assessed through Cronbach's Alpha and Composite Reliability (CR), both of which are widely recognized indicators of internal consistency. The findings revealed that the values for Cronbach's Alpha and CR for all three key constructs of self-efficacy (SE), satisfaction (ST), and continuance intention (CI) exceeded the recommended threshold of 0.7, indicating strong reliability across the variables (Hair et al., 2019). These high values suggest that the measurement items for the constructs under study exhibit excellent internal consistency, meaning that the items consistently reflect the same underlying concept.

Furthermore, the study examined convergent validity, which determines whether a set of indicators accurately represents the construct it is intended to measure. This was evaluated using the Average Variance Extracted (AVE) metric, where all constructs achieved AVE values above the recommended threshold of 0.5, confirming satisfactory convergent validity (Ramayah et.al, 2018). These results imply that the survey items effectively capture the theoretical constructs being studied, with each construct explaining a substantial portion of the variance in the observed variables. The robust reliability and validity of the measurement model enhance the credibility of the study's findings and ensure that the constructs are both conceptually sound and empirically supported. A detailed summary of these statistical outcomes is provided in Table 1, demonstrating that all values meet or exceed the acceptable thresholds, further reinforcing the robustness of the measurement model.

Table 1 *Convergent validity and reliability*

Constructs	Cronbach's Alpha	CR	AVE
Self-efficacy (SE)	0.816	0.873	0.584
Satisfaction (ST)	0.922	0.945	0.810
Continuance use (CI)	0.951	0.964	0.871

Discriminant validity is a measure that ensures each latent variable in a model is distinct from others, meaning that the constructs are truly different from one another. It is evaluated by comparing the square root of the AVE for each construct with the correlation coefficients between that construct and others in the model. Specifically, suppose the square root of the AVE for a given variable is greater than its correlations with any other variable. In that case, it indicates that the discriminant validity is strong, confirming that the construct is measuring something unique and not overlapping significantly with other constructs (Fornell & Larcker, 1981). In this study, discriminant validity was rigorously assessed using the criterion suggested by Fornell and Larcker. According to their approach, a model demonstrates good discriminant validity when the square root of the AVE for each latent variable exceeds the highest correlation with any other variable in the model. The results, presented in Table 2, show that all the latent variables in this study have AVE square roots greater than their respective inter-construct correlations. This indicates that each construct is sufficiently distinct from the others, thereby confirming that the measurement model possesses strong discriminant validity.

Table 2 *Discriminant validity (Fornell-Larcker criterion)*

Constructs	CI	SE	ST
CI	0.933		
SE	0.668	0.764	
ST	0.794	0.681	0.900

4.2 Structural Model

The structural model illustrates the relationships between the constructs within the proposed study framework. To determine the significance level, bootstrapping is applied through SmartPLS and results are revealed by the output of path coefficient in Table 3. According to Hair et al., (2019), the significant value of one-tailed is **p<0.001 and **p<0.005. All hypotheses in this study were supported based on the structural model analysis. The results revealed that self-efficacy is positively associated with continuance intention (β=0.238, p<.002) and satisfaction (β=0.681, p<.000). Satisfaction is also found to positively influence continuance intention to use educational technology (β=0.631, p<.000). Figure 2 presents the path relationships and Table 3 summarizes the results of the above hypotheses.

Table 3 *Hypotheses testing*

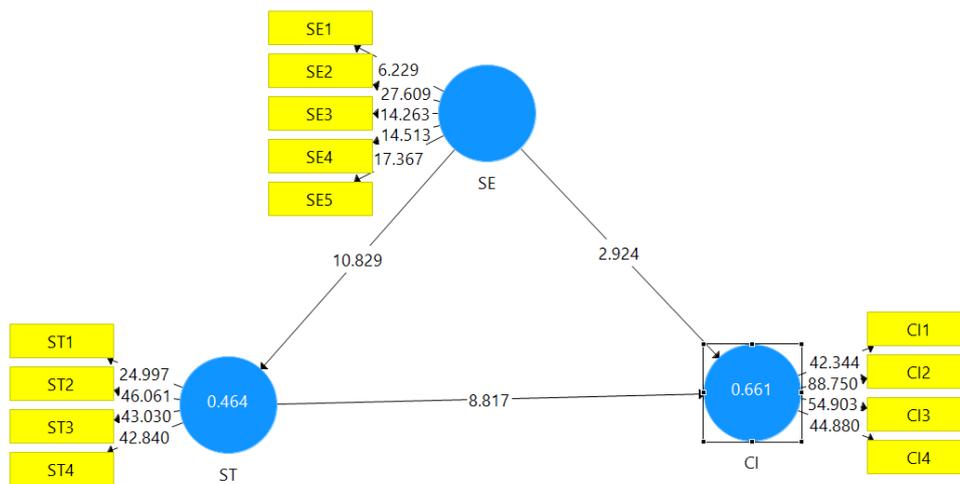| Hypothesis	β	t-value	p-value	Decision
H1:SE -> CI	0.238	3.043	0.002	Accepted
H2:SE -> ST	0.681	10.839	0.000	Accepted
H3:ST -> CI	0.632	8.817	0.000	Accepted

Fig. 2 *Path relationship*

The mediation analysis was performed to assess the mediating role of ST on the linkage between SE and CI. The results (Table 4) revealed that the total effect of SE on CI was significant (β=.668, t=9.904 and p<.000). With the inclusion of the mediating variable (ST), the direct effect became significant (β=.238, t=3.043 and p<.005). The indirect effect of SE on CI through ST was found significant (β=.431, t=6.643, and p<.000). This shows that the relationship between SE and CI is partially mediated by ST. Hence H4 is accepted.

Table 4 *Mediation analysis*

Total effect (SE-CI)		Direct effects (SE-CI)		Indirect effects of SE on CI (SE-ST-CI)		
Coefficient	p-value	Coefficient	p-value	Coefficient	t-value	p-value
0.668	0.000	0.238	0.000	0.431	6.643	0.000

The findings of this study confirm that lecturer self-efficacy has a strong, positive, and significant influence on both satisfaction and the continuance intention to use DT in TVET T&L. This underscores the important role of self-efficacy in shaping lecturers' overall experience and long-term engagement with DT in TVET settings. When lecturers possess a high level of confidence in their ability to integrate technology into their teaching effectively, they are more likely to find the experience satisfying and beneficial, leading to sustained adoption. This relationship highlights the importance of fostering self-efficacy through targeted professional development programs, hands-on training, and institutional support. By enhancing lecturers' technological confidence, institutions can not only improve their satisfaction with DT but also encourage long-term commitment to integrating technology into pedagogy, ultimately leading to more effective and innovative teaching practices in TVET education.

5. Conclusion

This study highlights the critical role of lecturer self-efficacy in influencing satisfaction and the continuance intention to use DT in TVET T&L. The findings confirm that when lecturers possess confidence in their technological abilities, they are more likely to find the use of digital tools both effective and rewarding, leading to sustained adoption. By integrating components from the SCT and the ECM, this study provides a comprehensive framework for understanding the factors that drive long-term engagement with educational technology. The results underscore the need for institutions to invest in continuous professional development, digital competence workshops, peer mentoring, and institutional support to enhance lecturers' self-efficacy. Strengthening these areas can lead to increased satisfaction, reduced resistance to technology, and more innovative teaching practices in TVET education. Future research could further explore additional factors, such as institutional policies and student engagement, that may mediate the relationship between self-efficacy and technology adoption. By fostering a supportive environment for digital integration, educational institutions can enhance the overall effectiveness of technology in teaching and learning, ensuring a more resilient and future-ready TVET system.

Despite the valuable insights gained from this study, several limitations should be acknowledged to provide a more comprehensive understanding of its scope and applicability. First, the study employed a convenience sampling method, which, while practical, may limit the generalizability of the findings beyond the specific context of TVET lecturers at Universiti Kuala Lumpur. The sample may not fully represent the broader population of TVET educators across different institutions, disciplines, or geographic locations. Second, the study relied on self-reported data, which, although valuable for capturing individual perceptions, may be subject to social desirability bias and personal interpretation. Respondents may have overestimated their self-efficacy or satisfaction with technology use due to perceived expectations, leading to potential discrepancies between reported and actual behavior.

To overcome the limit of the generalizability of scope, future research could enhance external validity by adopting a random or stratified sampling approach. Expanding the study to include lecturers from various educational institutions, regions, and specializations would provide a more holistic perspective on the factors influencing educational technology adoption. Future studies could also incorporate qualitative or mixed methods, such as interviews or classroom observations, to gain deeper insights into lecturers' experiences with educational technology. Third, this study focused primarily on the influence of self-efficacy on satisfaction and continuance intention, without considering other potential mediating or moderating factors, such as institutional policies, digital readiness, technical support, or student engagement. Future research could explore these additional variables to provide a more holistic understanding of the factors influencing technology adoption in TVET education.

Lastly, given the rapid and ongoing evolution of educational technology, future research would benefit from longitudinal studies that track changes over time. Such studies could provide deeper insights into how emerging digital tools and evolving teaching methodologies influence lecturer self-efficacy and patterns of long-term technology adoption. By observing these dynamics across different time intervals, researchers can better understand the sustainability of technology use in education and identify factors that support or hinder its continued integration. Addressing these aspects in future research will not only help overcome the current study's limitations but also enrich the theoretical and practical understanding of self-efficacy. Ultimately, this knowledge can inform the design of more adaptive, forward-looking strategies to promote effective and enduring technology integration in TVET and broader educational settings.

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Conflict of Interest

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

Author Contribution

The authors confirm their contributions to this paper as follows: **Study conception and design**: *Mohd Hafizul Ismail, Husna Sarirah Husin;* **Data collection**: *Mohd Hafizul Ismail, Sallaudin Hassan;* **Analysis and interpretation of results**: *Mohd Hafizul Ismail, Siti Haryani Shaikh Ali;* **Draft manuscript preparation**: *Mohd Hafizul Ismail, Siti Nur Dina Mohd Ali. All authors actively participated in reviewing the findings, providing critical revisions, and approving the final version of the manuscript for submission.*

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