

# Exploring The Determinants of the Learning Management System (LMS) Quality of Use in TVET Institutions

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## Abstract

Learning Management Systems (LMS) have emerged as a vital tool in the modern educational landscape by providing a platform for seamless teaching and learning experiences. However, the factors influencing LMS quality of use remain under-explored, particularly in TVET settings. This study aims to explore the factors influencing the quality of LMS use with an emphasis on three key dimensions: information, system, and service quality. The study draws on the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Social Cognitive Theory, Diffusion of Innovations Theory, and DeLone and McLean Information System Success Model by incorporating constructs such as compatibility, application self-efficacy, subjective norm, technological complexity, perceived usefulness, and perceived ease of use. The data was analysed using structural equation modelling (SEM) on a sample of 372 students from Malaysian Polytechnic institutions. The findings indicated compatibility, subjective norm, technological complexity significantly influence perceived usefulness and perceived ease of use. Application self-efficacy was observed to have a significant effect on perceived ease of use, but not on perceived usefulness. Perceived usefulness and perceived ease of use demonstrated a significant relationship on the LMS quality of use. This study highlights the various factors of LMS quality of use, providing useful insights for stakeholders seeking to improve the utilisation of LMS in academic settings, especially in TVET environments.

## 1. Introduction

Technical and Vocational Education and Training (TVET) has emerged as a crucial component of the educational landscape in response to the growing demand for skilled professionals in various technical and vocational domains. TVET emphasises practical training, ensuring students acquire relevant hands-on experience in their chosen fields. The approach equips students with the tangible skills and knowledge required for career success. In Malaysia, polytechnics play an essential role in the ecosystem of TVET by offering various technical programmes tailored to the needs of the modern workforce (Nalathambi et al., 2023).

The COVID-19 pandemic disrupted education and labour markets, resulting in increasing youth unemployment and mismatches between skills (UNESCO, 2022). This crisis highlighted the necessity of transforming education in response to the rapidly changing digital landscape. In fostering the digital transformation within the TVET environment, Learning Management Systems (LMS) are notable tools that provide a platform for educators and students to engage in virtual interactions, resource sharing, and collaborative activities (Edeh et al., 2021; Ginaya et al., 2020; Prihantoro, 2021; Tezer & Çimşir, 2018). LMS platforms are specifically developed to possess the qualities of accessibility and flexibility by enabling students to engage in learning activities from different locations (Alfalah, 2023; Saadati et al., 2015). The LMS functionality not only focuses on delivering educational content but also offers a range of tools and features that promote personalised learning.

Although significant studies have been conducted on the implementation of LMS in higher education (Baleghi-Zadeh et al., 2017; Noorbhai & Ojo, 2023; Utamachant et al., 2023; Virtue & Pinter, 2023), there is a lack of studies that particularly examine its usage within the TVET environments. In light of the unique pedagogical needs and challenges associated with TVET, it is imperative to comprehend the factors that impact the LMS quality of use (Ahmad et al., 2023). The primary objective of this study is to address the existing disparity by examining the factors that influence the quality of use (system quality, information quality and service quality) of LMS in Premier and Conventional polytechnic institutions in Malaysia.

Drawing upon established theoretical foundations such as the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), Technology Acceptance Model (TAM) (Davis, 1989), Diffusion of Innovations Theory (Rogers, 1962), Social Cognitive Theory (Bandura, 1986), and DeLone and McLean Information System Success Model (DeLone & McLean, 1992), the present study aims to examine the relationships between factors, such as compatibility, application self-efficacy, subjective norms, technological complexity, perceived usefulness, and perceived ease of use. Specifically, this research endeavours to elucidate how these factors collectively impact the LMS quality of use (system quality, information quality, and service quality) in Malaysian polytechnic institutions. The research framework is shown in Fig. 1.

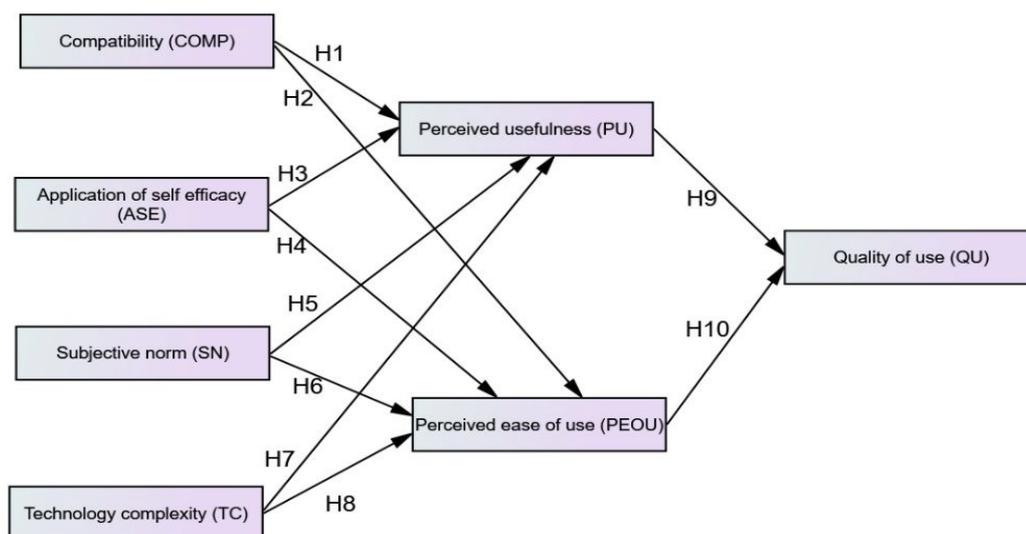


Fig. 1 The research framework

## 2. Literature Review and Hypothesis Development

### 2.1 Compatibility

Drawing upon the Diffusion of Innovations Theory, compatibility pertains to the extent to which an invention is considered to align with the existing values, previous experiences, and requirements of prospective adopters (Rogers, 2003). Previous studies have shown that compatibility significantly influences individuals' perceptions of the usefulness and ease of use of technological innovations (Al-Bashayreh, 2022; Huang, 2018). When students use an LMS that aligns with their current practises, learning styles, and technological preferences, they are inclined to perceive it as useful and easy to incorporate into their daily routines. This phenomenon occurs because a system that effectively corresponds with a student's prior experiences and personal preferences reduces the cognitive effort required for utilisation. Therefore, we hypothesise:

- H1: Compatibility (COMP) has a significant positive effect on perceived usefulness (PU)
- H2: Compatibility (COMP) has a significant positive effect on perceived ease of use (PEOU)

## 2.2 Application Self-Efficacy

Application self-efficacy refers to an individual's confidence level to effectively use a particular application or system to accomplish desired goals. This concept is based on Bandura's Social Cognitive Theory (Bandura, 1986). In the context of LMS, students who believe in their competence and proficiency in properly navigating and using the system are more inclined to regard it as useful for their educational pursuits. This phenomenon may be attributed to the fact that persons who possess greater levels of self-efficacy are more inclined to adopt a problem-solving mindset when faced with challenging tasks, as they believe they can overcome any possible obstacles (Sayaf, 2021). Furthermore, the level of confidence users possess in their ability to use the system might directly impact their perception of its ease of use (Nurchayati, 2023; Tsai, 2021). Consequently, students with higher confidence are less prone to seeing obstacles or experiencing a sense of being overwhelmed when navigating the Learning Management System (LMS). Hence, we hypothesise:

- H3: Application Self-Efficacy (ASE) has a significant positive effect on perceived usefulness (PU)
- H4: Application Self-Efficacy (ASE) has a significant positive effect on perceived ease of use (PEOU)

## 2.3 Subjective Norm

The Theory of Reasoned Action (TRA) suggests that subjective norms, defined as the perceived social pressures to engage or refrain from a particular behaviour, substantially influence an individual's behavioural intentions (Fishbein & Ajzen, 1975). A previous study on mobile phone technology indicated that subjective norms substantially impacted perceived usefulness and perceived ease of use (Mushi, 2022). In the context of Learning Management Systems (LMS), when a widespread notion exists within a community or peer group about an LMS's usefulness and ease of use, students are inclined to conform to this perspective. This phenomenon may be attributed to students often seeking guidance from their peers or social circles which shapes their attitudes and inclinations toward specific actions. Henceforth, we hypothesise:

- H5: Subjective Norm (SN) has a significant positive effect on perceived usefulness (PU)
- H6: Subjective Norm (SN) has a significant positive effect on perceived ease of use (PEOU)

## 2.4 Technology Complexity

Technology adoption may be hindered by its complexity or difficulty (Rogers, 2003). A system that is considered complicated may be seen as unwieldy or difficult to manage, therefore discouraging users from fully participating in it. Technology Acceptance Model (TAM) suggests that the perception of ease of use plays a crucial role in determining the perceived usefulness of a system (Davis, 1989). This implies that if a system is considered complicated and difficult to use, users' perceived usefulness may be severely impacted. Previous studies suggest that technology complexity has a negative impact on students' perception of ease of use (Teo et al., 2019). Thus, if students consider an LMS complex and difficult, they may doubt its simplicity and effectiveness in accomplishing their learning objectives. Henceforth, we hypothesise:

- H7: Technological Complexity (TC) has a significant negative effect on perceived usefulness (PU)
- H8: Technological Complexity (TC) has a significant negative effect on perceived ease of use (PEOU)

## 2.5 Perceived Usefulness and Perceived Ease of Use

The Technology Acceptance Model (TAM) asserts that perceived usefulness and perceived ease of use play a crucial role in determining the acceptance and continued use of technology (Davis, 1989). In the present study, the construct of "quality of use" pertains to the comprehensive measure of the system quality, information quality and service quality in the LMS. Recent research shed light on the significant direct effect of information quality, system quality, and service quality on behavioural intention in an e-government platform (Nookhao & Kiattisin, 2023). Furthermore, perceived ease of use was shown to be influenced by system quality (Zheng et al., 2023). These relationships, in turn, resulted in positive behavioural intentions and actual use. Hence, we hypothesise:

- H9: Perceived Usefulness (PU) has a significant positive effect on Quality of Use (QU)
- H10: Perceived Ease of Use (PEOU) has a significant positive effect on Quality of Use (QU)

## 3. Research Methodology

The study employed a survey design. All the respondents have had previous experiences with CIDOS LMS. CIDOS LMS is a platform that supports teaching and learning activities in the blended learning environment for Malaysian Polytechnics students. The population of the study consists of second-year engineering students at Malaysian Polytechnics. The population of this study consisted specifically of 3,570 engineering students from five Malaysian polytechnics.

This study employed a two-stage cluster sampling technique, which is particularly appropriate for research encompassing a large geographical area with a non-homogenous population and when a comprehensive sampling

frame is unavailable (Chua, 2020). In the first phase, five polytechnics were selected using a simple random sampling technique based on institutional zones in Malaysia: northern, central, and southern. The second phase involved selecting student programs, including civil, mechanical, and electrical engineering.

The sample size required in this study was 248 respondents (Cochran, 1977). Nevertheless, considering the requirement of Structural Equation Modelling (SEM) concerning the need for higher sample sizes (Kline, 2011), the sample size was increased by 50%. An additional 124 participants were included, resulting in a total sample size of 372 respondents. The addition of sample size ensures the reliability and robustness of the SEM analysis.

Before conducting the pilot test and actual data collection, permission was obtained from the Office of Research and Graduate Studies. Additionally, approval was secured from relevant authorities, including Polytechnic Innovation Research Center (*Pusat Penyelidikan Inovasi Politeknik (PPIP)*), the Ministry of Higher Education (MOHE), and polytechnic institutions. After obtained the permission, a pilot test involving 100 undergraduate technical students was conducted. After accumulating the responses, the instrument's reliability was evaluated using Cronbach's alpha coefficient. This coefficient yields an estimate of the internal consistency of the items in the instrument where values greater than 0.70 are generally accepted (Nunnally, 1978). The results confirmed that all constructs in the instrument exhibited good internal consistency, with Cronbach's alpha values ranging from 0.828 to 0.933.

The survey consists of 7 constructs: (1) compatibility (COMP), (2) application self-efficacy (ASE), (3) subjective norms (SN), (4) technological complexity (TC), (5) perceived usefulness (PU), and (6) perceived ease of use (PEOU), and (7) quality of use (QU). Quality of use (QU) is divided into three (3) sub-constructs: system quality, information quality and service quality. All measures selected in this study were drawn from previously validated scales, with all items utilising a five-point Likert scale. COMP was measured using items adopted from Chang and Tung (2008) and Wu and Wang (2005). ASE was assessed using scales adapted from Coskuncay and Ozkan (2013). SN was adapted from Coskuncay and Ozkan (2013) and Venkatesh et al. (2012). TC was measured using items adapted from Thompson et al. (1991), Coskuncay and Ozkan (2013), and Han and Han (2014). PU was adapted based on the work of Venkatesh and Davis (2000), while PEOU adapted scales from Fathema et al. (2015), as well as Bhatiasevi and Naglis (2016). Finally, Quality of Use was assessed in three dimensions: System Functionality, adapted from Pituch and Lee (2006); Information Quality, adapted from Roca et al. (2006); and Service Quality, also adapted from Roca et al. (2006).

A total of 372 participants responded to the survey and were deemed appropriate for inclusion in the analysis. The data were subsequently subjected to analysis using the Confirmatory Factor Analysis (CFA) approach. The examination is conducted by conducting a second-order construct for quality of use before integrating all seven constructs into a single measurement model.

## 4. Results

### 4.1 Measurement Model

This study conducted the CFA procedure separately for the second-order construct (quality of use). After completing the CFA evaluation for the second-order construct, the study utilised the item-parcelling method (Hall et al., 1999). This method seeks to transform second-order constructs into first-order constructs by using the mean scores of items in each component. Consequently, all second-order constructs will be redefined as first-order constructs by the end of this procedure.

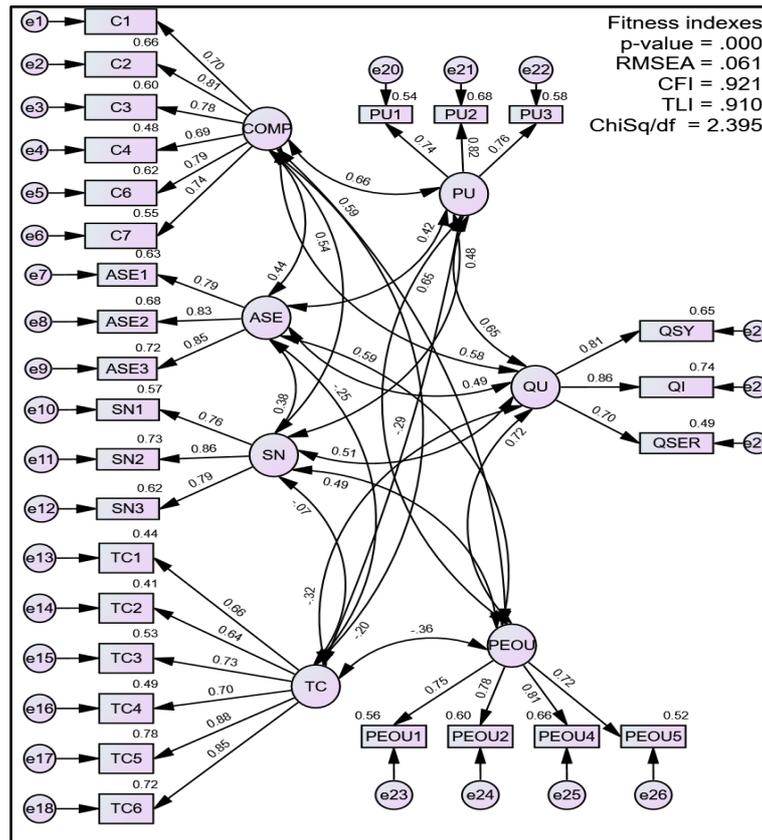


Fig. 2 The procedure to validate all constructs using pooled-CFA

Before proceeding to the SEM, the assessment for unidimensionality, validity (construct, convergent, and discriminant validity) and composite reliability are required. Unidimensionality is achieved when all items have factor loadings of more than 0.6 (Hair et al., 2010). Construct validity is assessed through fitness indexes, as indicated in Table 1. Meanwhile, convergent validity is achieved when AVE for all constructs is above 0.50 (Hair et al., 2010). In discriminant validity assessment, all constructs must be distinct and not highly correlated, particularly among the exogenous constructs (Fornell & Larcker, 1981). If two exogenous constructs exhibit a strong correlation bigger than 0.85, this indicates a severe problem known as multicollinearity. Composite reliability, on the other hand, is achieved when CR is above 0.60 (Hair et al., 2010). Upon conducting CFA, all requirements described above are satisfied (refer to Fig. 2). Hence, the data analysis is ready to proceed with the structural model discussed in the following section.

Table 1 The fitness categories and their level of acceptance (Shi & Maydeu-Olivares, 2020)

Fitness category	Name of Index	Acceptance level
Absolute fit	Chi-square	P-value > 0.05
	RMSEA	RMSEA < 0.08
Incremental fit	CFI	CFI > 0.90
	TLI	TLI > 0.90
Parsimonious fit	Chisq/df	Chi-Square/df < 5.0

### 4.2 Structural Model

After evaluating the measurement model using CFA and goodness-of-fit tests, a structural model and path analysis were established to identify the causal relationships among the variables. The overall fit of the structural model was first assessed. The model demonstrates the inter-relationships between the constructs in the research. The endogenous variable is quality of use (QU). QU comprises system quality (QSYS), information quality (QI) and service quality (QSER).

As depicted in Fig. 3., the structural model demonstrated satisfactory fit levels, as summarised in Table 1, evidenced by the following values: RMSEA = 0.062, CFI = 0.917, TLI = 0.906, and ChiSq/df = 2.444. Table 2 reports the regression weights and standard regression weights for the structural model. The students' perceived

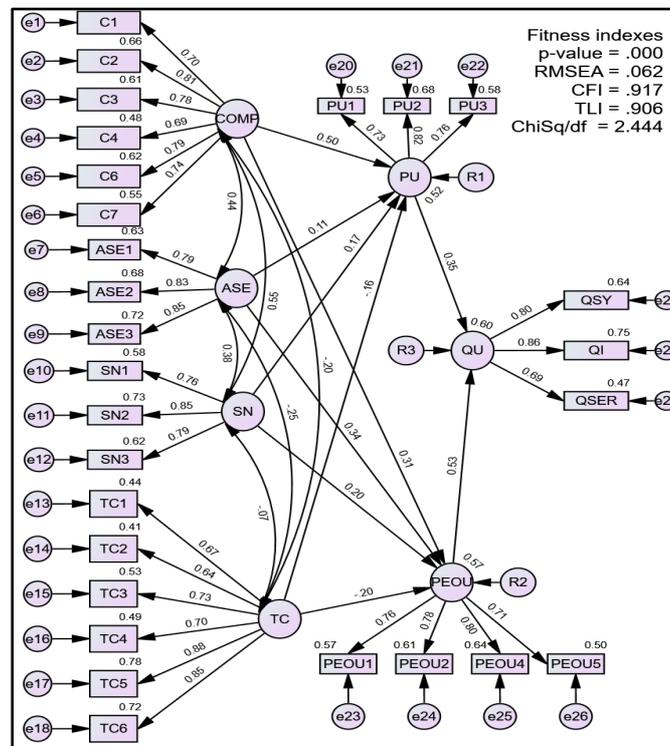
usefulness is positively influenced by compatibility ( $\beta = .539, p < .001$ ), subjective norm ( $\beta = .144, p < .05$ ), and negatively influenced by technology complexity ( $\beta = -.132, p < .05$ ). These three determinants account for 52% of the variance explained in perceived usefulness. Consequently, H1, H5, and H7 are supported. Conversely, the direct effect between application self-efficacy and perceived usefulness is not significant ( $\beta = .094, p > .05$ ), leading to the rejection of H3.

Meanwhile, the student's perceived ease of use is positively influenced by compatibility ( $\beta = .317, p < .001$ ), application self-efficacy ( $\beta = .268, p < .001$ ), subjective norm ( $\beta = .160, p < .001$ ), and negatively influenced by technology complexity ( $\beta = -.156, p < .001$ ). These four factors contribute 57% of the variation explained in perceived ease of use. As a result, hypotheses H2, H4, H6, and H8 are supported.

**Table 2** Regression weights and standard regression weights for the structural model

Hypothesis	Path	Beta	SE.	CR.	P	Results
H1	COMP → PU	.539	.079	6.848	***	Significant
H2	COMP → PEOU	.317	.065	4.908	***	Significant
H3	ASE → PU	.094	.049	1.925	.054	Not Significant
H4	ASE → PEOU	.268	.045	5.936	***	Significant
H5	SN → PU	.144	.053	2.722	.006	Significant
H6	SN → PEOU	.160	.047	3.398	***	Significant
H7	TC → PU	-.132	.042	-3.174	.002	Significant
H8	TC → PEOU	-.156	.037	-4.221	***	Significant
H9	PU → QU	.297	.057	5.203	***	Significant
H10	PEOU → QU	.485	.063	7.735	***	Significant

Additionally, Hypothesis H9 and H10 are supported, indicating that the quality of use is significantly and positively influenced by perceived usefulness ( $\beta = .297, p < .001$ ) and perceived ease of use ( $\beta = .485, p < .001$ ). This implies that the students' quality of use, regarding system, information and service quality, rises when they deem the LMS useful and easy to use. The percentage of variance explained by perceived usefulness and perceived ease of use to the quality of use is 60%.



**Fig. 3** The structural model

### 5. Discussions

The study's findings indicate that compatibility, subjective norm, and technological complexity have a significant relationship with both perceived usefulness and perceived ease of use. While application self-efficacy does not

significantly affect perceived usefulness, it does significantly affect perceived ease of use. In addition, perceived usefulness and perceived ease of use significantly affect the LMS quality of use among technical undergraduates in Malaysian polytechnic institutions.

The statistically significant positive relationship between compatibility on perceived usefulness and perceived ease of use echoes past investigations (Al-Bashayreh, 2022; Huang, 2018). The findings indicate that technologies that align with users' current practises and values are more likely to be perceived as useful. This is due to a compatible system aligning well with users' preferences and requiring minimal modification to their current practices, thereby making the transition require less mental effort but is useful for the students. The findings are aligned with the Diffusion of Innovation Theory that emphasizes compatibility as an important factor (Rogers, 2003). This is due to the fact that compatibility has a significant effect on users' perceived usefulness and ease of use; hence, it is crucial for adoption.

In the present study, application self-efficacy is shown to influence perceived ease of use but not perceived usefulness significantly. The outcomes echo earlier investigations in different settings (Nurchayati, 2023; Sayaf, 2021; Tsai, 2021). The possible explanation for the insignificant relationship is that students might possess prior knowledge of similar innovations that may not necessarily depend on their perceived self-efficacy when assessing the usefulness of a new system. The influence of students' past experiences may have a more significant impact on their views than their level of confidence in utilising the new technology. Thus, application self-efficacy predominantly affects students' perceptions of ease of use rather than their perceived usefulness.

The positive relationship between subjective norms on perceived usefulness and perceived ease of use reflects earlier studies (Mushi, 2022; Şimşek & Ateş, 2022). The findings are supported by the Theory of Reasoned Action (Fishbein & Ajzen, 1975), highlighting the significance of society and peer influences in moulding individuals' perceptions. This indicates that when evaluating LMS's usefulness and ease of use, students frequently look to their social or professional circle.

Nonetheless, it is vital to acknowledge the negative effects of technological complexity on perceived usefulness and perceived ease of use. The finding serves as a reminder that complicated systems have the potential to discourage students. The discoveries are in accordance with earlier findings in a Moodle-based LMS study (Teo et al., 2019) and cloud provider's performance (Xu & Mahenthiran, 2021). The noteworthy impact of perceived usefulness and perceived ease of use on the quality of use should be emphasized and it resonates with previous literature (Zheng et al., 2023). This implies that when students perceive an LMS as useful and user-friendly, they are more inclined to engage effectively with the platform, leading to an enhanced quality of utilisation.

## 6. Conclusion and Implication

This study concludes by emphasising the significance of compatibility, application self-efficacy, subjective norms, technological simplicity, perceived ease of use and perceived usefulness in shaping students' perceptions of LMS quality of use. As educational institutions continue to rely on LMS for teaching and learning purposes, it is crucial to grasp these factors to ensure effective and high-quality utilisation, particularly in terms of information quality, system quality, and service quality.

The findings of the study have several implications. For LMS developers and educators, compatibility with students' present practises, and values should be of utmost importance. In addition, efforts should be made to simplify and intuitively improve the user interface. Institutions should also consider the role of social and peer connections in shaping perceptions. This can potentially be addressed through awareness campaigns or peer-led training. The gamified lesson with peers in the LMS settings could also provide engaging and quality lessons for the students (Cheng, 2021).

This study contributes to the existing body of knowledge by offering a nuanced understanding of the factors influencing students' perceptions of LMS quality of use, especially in TVET settings. By integrating insights from multiple theories, such as the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Diffusion of Innovations Theory, Social Cognitive Theory, and DeLone and McLean Information System Success Model, this study provides a comprehensive understanding of the factors influencing LMS optimal utilisation.

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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 contribution to the paper as follows: **study conception and design:** Norhafizah Ismail; **data collection:** Norhafizah Ismail; **analysis and interpretation of results:** Jazihan Mahat, Norliza Ghazali; **draft***

**manuscript preparation:** Jazihan Mahat, Norliza Ghazali, Akhmad Habibi. All authors reviewed the results and approved the final version of the manuscript.

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