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Factors Influencing the Effectiveness of Online Learning Among University Students at a University in Malaysia

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ABSTRACT

Online learning continues to remain an important mode of delivery in higher education, including at Universiti Sains Malaysia (USM), even after the return to physical classroom settings. However, the effectiveness of online learning is still debated, as different studies have reported mix outcomes. Therefore, this study aims to identify the factors influencing the effectiveness of online learning among students at USM. This study uses a quantitative research design. An online questionnaire was distributed to 150 USM students who have participated in online learning. The data will be analyzed using SPSS to examine the relationships between the factors studied. The findings show that teaching presence ($\beta = 0.119$, $p < 0.01$) and technology usability ($\beta = 0.244$, $p < 0.01$) significantly influence student satisfaction. In addition, technology usability ($\beta = 0.276$, $p < 0.01$) and student satisfaction ($\beta = 0.371$, $p < 0.01$) significantly influence the effectiveness of online learning. However, online student engagement does not show a statistically significant effect.Overall, this study provides valuable insights that can help USM and Malaysian higher education improve online learning strategies, enhance digital teaching practices, and strengthen the delivery quality of online education within Malaysian higher education.

Keywords: Higher Education; Online Learning; Student Engagement; Teaching Presence; Technology Usability

INTRODUCTION

The rapid advancement of digital technologies has fundamentally reshaped higher education by transforming how knowledge is delivered, accessed, and managed. Online learning has become a central component of contemporary learning ecosystems, driven by technological innovation and the growing demand for flexible and inclusive learning environments (Zou et al., 2025). In Malaysia, this transformation was significantly accelerated during the COVID-19 pandemic, when higher education institutions were required to transition from face-to-face instruction to fully online teaching. At Universiti Sains Malaysia (USM), platforms such as Microsoft Teams, USM e-Learn, Google Classroom, and Zoom were widely adopted to ensure continuity in teaching and learning. Even in the post-pandemic context, these platforms remain embedded in instructional practices as part of universities' broader digital transformation and work-based learning initiatives (Lim et al., 2024). Despite this widespread adoption, the extent to which online learning effectively enhances students' academic performance and learning experiences remains uncertain.

Prior studies conducted in Malaysia and comparable contexts indicate that students' online learning experiences are shaped not only by technological access but also by psychological, motivational, and social factors. For example, Munir et al. (2021) found that students' fear of COVID-19 significantly influenced their engagement and perceived effectiveness of online learning in both Malaysia and Pakistan. Similarly, psychological motivation and peer collaboration have been shown to play critical roles in enhancing students' problem-solving skills and learning outcomes in e-learning environments (Anwar et al., 2024). These findings suggest that online learning effectiveness is a multidimensional construct influenced by emotional readiness, motivation, and social interaction.

Although online learning offers advantages such as flexibility, accessibility, and self-paced learning, empirical findings on its effectiveness remain mixed. Malaysian studies highlight that effective e-learning management, clear instructional design, and meaningful interaction can enhance engagement and learning outcomes (Anwar et al., 2024; Kadir, 2023). In contrast, other studies report challenges such as reduced hands-on learning, cognitive overload, and uneven learning outcomes among students (Zulkifli et al., 2024). These inconsistencies indicate that online learning effectiveness is contingent upon the interaction between pedagogical quality, student engagement, and technological support. Technology usability and system quality have also emerged as critical determinants of online learning effectiveness. Research grounded in the DeLone and McLean information systems success model demonstrates that system quality, information quality, and service quality significantly influence students' satisfaction and learning outcomes in e-learning contexts (Sabeh et al., 2021; Ullah et al., 2022). Furthermore, Adeel et al. (2023) argue that technology alone is insufficient to ensure effective learning unless students possess adequate cognitive and knowledge absorption capacities. These findings reinforce the importance of aligning technological usability with learners' capabilities and instructional design.

Course quality and instructional effectiveness are further identified as key contributors to positive learning outcomes in digital environments. Studies focusing on Malaysian youth reveal that high-quality online courses enhance student satisfaction, perceived employability, and overall learning effectiveness, particularly when supported by relevant digital skills development (Kee et al., 2023). Beyond employability outcomes, well-structured online learning environments also support continuous learning and adaptability in the new normal of higher education (Hu & Kee, 2022). Existing literature consistently emphasizes the importance of teaching presence (Fiock et al., 2021),

student engagement (Kee et al., 2021), and technology usability (Alia et al., 2022) in shaping online learning outcomes. However, many prior studies examine these factors in isolation, limiting understanding of how pedagogical, behavioral, and technological elements jointly influence learning effectiveness. There remains a lack of integrated empirical research that simultaneously examines teaching presence, online engagement, and technology usability within a single framework, particularly in Malaysian public universities.

This study aims to examine the factors influencing the effectiveness of online learning among university students at USM. Specifically, the study investigates the role of teaching presence based on the Community of Inquiry (CoI) model, online student engagement as conceptualized by Dixson (2015), and technology usability measured using the System Usability Scale (Brooke, 1995). Online learning effectiveness is conceptualized in terms of students' academic performance and their effective use of digital learning tools. By adopting an integrated approach, this study aims to provide practical insights for strengthening digital teaching strategies, enhancing student engagement, and improving the overall effectiveness of online learning in Malaysian higher education. Moreover, the study contributes to the growing body of literature by offering evidence-based recommendations to support more effective and student-centered online learning environments.

LITERATURE REVIEW

Effectiveness of Online Learning

The effectiveness of online learning depends on how pedagogy, learner engagement, and technological tools interact within the learning environment. Studies consistently report that well-designed online courses with clear structure, timely feedback, and meaningful interaction enhance student motivation, satisfaction, and academic performance. In contrast, weak instructor support, insufficient interaction, and complex or poorly functioning platforms can significantly reduce learners' engagement and learning outcomes (Sanusi et al., 2022). These findings collectively suggest that online learning becomes effective only when instructional quality, engagement processes, and technological usability function in an integrated and supportive manner.

Hypotheses Development

Teaching Presence

Teaching presence, based on the CoI framework, refers to the design, organization, and facilitation of meaningful online learning experiences (Anderson et al., 2001). Empirical evidence indicates that clearly defined instructor responsibilities and effective institutional guidance play a significant role in supporting students' online academic performance (Ng et al., 2023). Leong et al. (2022) further highlighted that proactive instructional behaviors can explain a substantial proportion of the variance in students' perceived learning outcomes. In contexts such as USM, where learners rely heavily on structured guidance in digital environments, teaching presence plays a pivotal role in shaping learning quality. Based on this, the study proposes that teaching presence significantly influences student satisfaction and online learning effectiveness.

H1: Teaching presence has a significant and positive relationship with student satisfaction.
H4: Teaching presence has a significant and positive relationship with the effectiveness of online learning.

Student Engagement

Student engagement encompasses behavioral, emotional, and cognitive dimensions, each contributing to meaningful learning outcomes (Dixson, 2010; Fredricks et al., 2004). Courses that incorporate collaborative tasks, interactive discussions, and consistent instructor feedback have been found to generate higher learner engagement and improved academic performance (Khairul et al., 2021). Engagement also mediates the relationship between instructional quality and academic success, suggesting that students learn more effectively when they are actively involved in the learning process. Therefore, student engagement is expected to influence both satisfaction and the effectiveness of online learning.

H2: Online student engagement has a significant and positive relationship with student satisfaction.
H5: Online student engagement has a significant and positive relationship with the effectiveness of online learning.

Technology Usability

Technology usability refers to how easily students can navigate and interact with online learning systems. High usability reduces cognitive overload and frustration, increases participation, and supports timely completion of tasks (Alqurashi, 2019). Systematic evidence shows that clear navigation, responsive interfaces, and mobile accessibility are strong predictors of successful online learning experiences (Mazlan et al., 2022). Malaysian studies further indicate that positive perceptions of system usability encourage acceptance and continued use of digital learning platforms (Asenahabi et al., 2022). These findings suggest that technology usability plays a major role in improving student satisfaction and overall learning effectiveness.

H3: Technology usability has a significant and positive relationship with student satisfaction.
H6: Technology usability has a significant and positive relationship with the effectiveness of online learning.

Student Satisfaction

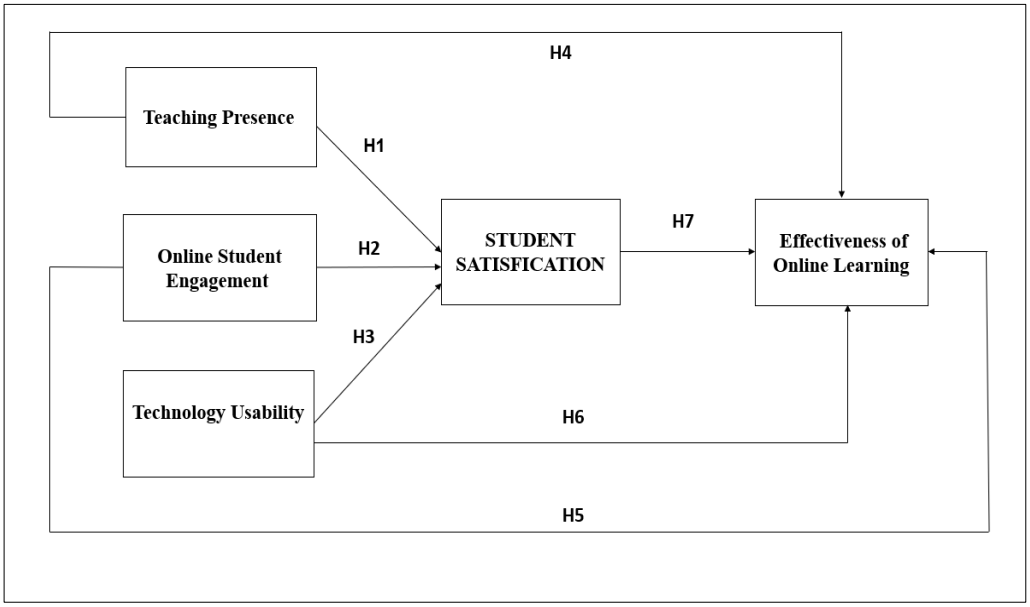
Student satisfaction reflects learners' perceptions of the relevance, quality, and value of their online learning experience. Satisfaction is influenced by instructional clarity, engagement activities, and technology usability (Sanusi et al., 2022). Students who are satisfied with online learning are more committed, more motivated, and more likely to achieve stronger academic results (Hamid et al., 2022). Clear guidance, timely feedback, and user-friendly digital systems consistently improve satisfaction and support learning effectiveness (Leong et al., 2022; Martin & Bolliger, 2022). Within this study, satisfaction is viewed as a mediating construct that links teaching presence, engagement, and technology usability to overall online learning effectiveness.

H7: Student satisfaction has a significant and positive relationship with the effectiveness of online learning.

Based on the literature, the following hypotheses are proposed: teaching presence, student engagement, and technology usability each influence student satisfaction and the effectiveness of online learning, while student satisfaction contributes directly to learning effectiveness.

Conceptual Framework

Figure 1. Research Framework



The hypotheses presented in Figure 1 constitute the conceptual framework of this study. The model illustrates the proposed relationships between teaching presence, online student engagement, and technology usability with student satisfaction and the effectiveness of online learning. Student satisfaction is also proposed as an intervening variable influencing online learning effectiveness. These hypothesized relationships provide the analytical foundation for examining how instructional, behavioral, and technological factors shape students' perceptions of online learning effectiveness.

RESEARCH METHOD

Research Approach

This study uses a quantitative research design to examine the factors influencing online learning effectiveness among university students. A cross-sectional survey design was used to collect data at a single point in time. This design is appropriate for studies that aim to measure perceptions without the need for longitudinal tracking.

Sampling Method

The target population for this study consists of undergraduate and postgraduate students at USM who have experience with online learning. Since online learning continues to be used alongside traditional classroom methods at USM, it is important to assess how students perceive its effectiveness. The unit of analysis for this study is the individual student, as the objective is to understand personal perceptions of teaching presence, student engagement, technology usability, satisfaction, and the overall effectiveness of online learning. A non-probability convenience sampling method was employed. This technique was appropriate because USM students are easily reachable through university communication channels, and the study focuses on a specific institutional context rather than achieving full population representation. Convenience sampling is widely used in educational research when the aim is to capture insights from an accessible group of respondents. A total of 150 students were targeted, which meets the recommended sample size for multivariate analyses according to established sampling guidelines. Demographic information such as gender, age, race, education level, Cumulative Grade Point Average (CGPA), and frequency of online learning was collected. These variables help describe the sample and allow for contextual

interpretation of the findings by examining whether perceptions differ across different groups

Data Collection Method

An online questionnaire created through Google Forms was distributed to students via WhatsApp, Telegram, and other student groups to ensure accessibility and reach across various faculties. Participation was voluntary and anonymous, and no identifying information was collected. Data collection was carried out over approximately two weeks.

Data Analysis Procedure

Data were analyzed using SPSS software. Descriptive statistics were used to summarize demographic characteristics and mean scores for all constructs. Reliability analysis using Cronbach's Alpha assessed the internal consistency of the measurement scales. Correlation analysis was conducted to examine the relationships between teaching presence, engagement, technology usability, satisfaction, and learning effectiveness. Regression analysis was employed to identify significant predictors of online learning effectiveness and student satisfaction.

Measures

The questionnaire consisted of six sections: demographic information, teaching presence, student engagement, technology usability, student satisfaction, and effectiveness of online learning. All measurement items, except demographic variables, were adapted from validated instruments in previous studies to ensure reliability. Teaching presence was measured using five items adapted from the CoI Survey, focusing on clarity, facilitation, and feedback provided by instructors. Student engagement was assessed using five items adapted from Dixson (2015), which measured participation, attention, and motivation during online learning. Technology usability was measured using five items from Brooke's System Usability Scale (1995), assessing ease of use and accessibility of online learning platforms. Student satisfaction was measured using items adapted from Kuo et al. (2014) and Sun et al. (2008), capturing overall satisfaction and attitude toward online learning. Effectiveness of online learning was measured using five items adapted from Singh and Anthonysamy (2023), focusing on perceived improvement in academic performance and learning outcomes. All items (except demographics) used a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Likert scale is widely used for quantifying subjective perceptions and attitudes.

RESULTS

Table 1. Respondents' Profile Summary (N=150)

Response		Frequency	Percentage (%)
Gender	Male	87	58
	Female	63	42
Age	18–21 years old	42	28
	22–25 years old	80	53.3
	26–29 years old	25	16.7
	30 years old and above	3	2
Race	Chinese	85	56.7
	Indian	29	19.3
	Malay	36	24
Education Level	Postgraduate	42	28
	Undergraduate	108	72

According to the data in Table 1, a total of 150 respondents participated in this study. In terms of gender distribution, 87 respondents (58%) were male, and 63 respondents (42%) were female, indicating that the sample was slightly dominated by male participants.

With respect to age, the majority of the respondents were between 22 and 25 years old, accounting for 80 individuals (53.3%). This was followed by 42 respondents (28%) within the 18–21 age group, and 25 respondents (16.7%) aged 26–29 years. Only three respondents (2%) were 30 years old and above. This distribution shows that the sample largely represents young adults who are typically in their early stages of university study. This matters because younger students may have different learning motivations, technological familiarity, and academic responsibilities compared to older learners. As a result, the generalizability of the findings is stronger for younger university students than mature learners within the USM population.

In terms of ethnicity, Chinese respondents represented the largest proportion, with 85 individuals (56.7%). Malay respondents formed the second largest group with 36 individuals (24%), followed by Indian respondents with 29 individuals (19.3%). Although the sample includes multiple racial groups, the dominance of Chinese respondents suggests that the overall findings may reflect the experiences or preferences of this group more strongly.

Regarding educational levels, 108 respondents (72%) were undergraduate students, while 42 respondents (28%) were postgraduate students. This indicates that the majority of the sample consists of undergraduates. This is important because undergraduates and postgraduates often experience online learning differently. Undergraduates typically depend more on structured guidance, while postgraduates may demonstrate greater autonomy and self-directed learning skills. Therefore, the higher proportion of undergraduates means that the findings are more reflective of undergraduate learning experiences in USM.

Table 2. Summary of the Effectiveness of Online Learning Among University Students (N=150)

Response		Frequency	Percentage (%)
Average CGPA	Below 3.0	5	3.3
	3.0-3.49	45	30
	3.50-3.74	60	40
	3.75 and above	40	26.7
How often do you attend or use online learning platform?	Once a month	4	2.7
	Twice a month	26	17.3
	Once a week	46	30.7
	More than once a week	74	49.3

The result in Table 2 indicates that the majority of respondents achieved an average CGPA between 3.50 and 3.74, accounting for 60 students (40%). This is followed by 45 students (30%) who reported a CGPA between 3.0 and 3.49, and 40 students (26.7%) with a CGPA of 3.75 and above. Only a small proportion of respondents, specifically five individuals (3.3%), recorded a CGPA below 3.0. These findings show that most participants are academically strong, with a large proportion achieving above-average grades. This suggests that most respondents demonstrate relatively strong academic performance. As a result, their perceptions of online learning effectiveness may differ from students with modest academic performance, which should be considered when interpreting the overall results.

Regarding the frequency of online learning usage, 74 respondents (49.3%) reported using online learning platforms more than once a week, while 46 respondents (30.7%) indicated that they accessed these platforms once a week. Furthermore, 26 respondents (17.3%) utilized online learning tools twice a month, and only four respondents (2.7%) engaged in online learning once a month. This distribution suggests that most respondents use online learning platforms frequently and consistently, therefore their feedback is likely based on substantial and continuous experience rather than occasional engagement.

Table 3. Descriptive Analysis, Cronbach's Coefficients Alpha, and Zero-order Correlations of All Study Variables (N=150)

Variables		1	2	3	4	5
1	Teaching presence	0.714				
2	Student engagement	0.726**	0.716			
3	Technology usability	0.656**	0.742**	0.720		
4	Student satisfaction	0.584**	0.585**	0.654**	0.738	
5	Effectiveness of Online Learning	0.631**	0.630**	0.693**	0.701**	0.750
Number of items		5	5	5	5	5
Mean		4.28	4.31	4.35	4.32	4.38
Standard Deviation		0.522	0.501	0.493	0.511	0.479

Note: N=150; *p < 0.05, **p < 0.01; Diagonal entries in bold indicate Cronbach's coefficient alpha.

According to the results presented in Table 3, all study variables demonstrate acceptable internal reliability, as indicated by their Cronbach's alpha values, which range from 0.714 to 0.750. Specifically, teaching presence (α = 0.714), student engagement (α = 0.716), technology usability (α = 0.720), student satisfaction (α = 0.738), and effectiveness of online learning (α = 0.750) all exceed the commonly accepted threshold of 0.70. This indicates that the questionnaire items used to measure each construct are stable and consistently capture the same underlying idea. In other words, respondents interpreted the items in a similar way, and the scales functioned reliably throughout the study.

In terms of descriptive statistics, the mean values for the variables ranged between 4.2760 and 4.3800. These are relatively high values on a 5-point scale, suggesting that students generally held positive views towards teaching presence, engagement, technology usability, satisfaction, and the overall effectiveness of online learning. The standard deviations, ranging from 0.47867 to 0.52157, are fairly small. This indicates that the responses were not widely spread out; instead, most students tended to agree in a similar direction. This consistent pattern strengthens the interpretation that students, as a group, had favorable experiences with online learning.

The correlation analysis reveals strong and statistically significant positive relationships among all study variables. Teaching presence shows strong correlations with student engagement ($r = 0.726$, $p < 0.01$), technology usability ($r = 0.656$, $p < 0.01$), student satisfaction ($r = 0.584$, $p < 0.01$), and the effectiveness of online learning ($r = 0.631$, $p < 0.01$). Similarly, student engagement is strongly correlated with technology usability ($r = 0.742$, $p < 0.01$), student satisfaction ($r = 0.585$, $p < 0.01$), and effectiveness of online learning ($r = 0.630$, $p < 0.01$). Technology usability is also positively related to student satisfaction ($r = 0.654$, $p < 0.01$) and the effectiveness of online learning ($r = 0.693$, $p < 0.01$). Furthermore, student satisfaction is highly correlated with the effectiveness of online learning ($r = 0.701$, $p < 0.01$). From these data, it is clear that students who experience stronger teaching presence, higher engagement, and better technology usability are more likely to report higher satisfaction and view online learning as more effective.

Taken together, these results indicate that higher levels of teaching presence, student engagement, technology usability, and student satisfaction are associated with increased effectiveness of online learning. These correlations indicate that the study variables are positively associated with each other, providing preliminary support for the proposed relationships.

Table 4. Summary of Regression Analysis

Variables			Beta
Student Satisfaction	1	Teaching presence	0.119**
	2	Student engagement	0.050
	3	Technology usability	0.244**
	R^2		0.556
	F value		45.413
	Durbin-Watson Statistic		1.982
Effectiveness of Online Learning	1	Teaching presence	0.173
	2	Student engagement	0.082
	3	Technology usability	0.276**
	4	Student satisfaction	0.371**
	R^2		0.612
	F value		57.279
	Durbin-Watson Statistic		2.170

Note: N=150; *p < 0.05, **p < 0.01.

Based on the regression results in Table 4, H1 proposed that teaching presence is positively related to student satisfaction. The findings show that teaching presence has a significant positive effect on student satisfaction ($\beta = 0.119$, $p < 0.01$). Therefore, H1 is supported. H2 posited that online student engagement is positively related to student satisfaction. However, the regression results indicate that student engagement does not have a significant effect on student satisfaction ($\beta = 0.050$, $p > 0.05$). Thus, H2 is not supported. H3 suggested that technology usability is positively related to student satisfaction. The results demonstrate that technology usability has a significant and positive influence on student satisfaction ($\beta = 0.244$, $p < 0.01$). Accordingly, H3 is supported. Overall, the model explains 55.6% of the variance in student satisfaction ($R^2 = 0.556$), indicating that teaching presence and technology usability significantly predict student satisfaction. The regression model for student satisfaction was statistically significant ($F = 45.413$, $p < 0.01$), and the Durbin–Watson value of 1.982 indicates no serious autocorrelation issue.

With regard to the effectiveness of online learning, H4 proposed that teaching presence is positively related to the effectiveness of online learning. The regression results show that teaching presence does not have a statistically significant direct effect on online learning effectiveness ($\beta = 0.173$, $p > 0.05$). Therefore, H4 is not supported. H5 stated that online student engagement is positively related to the effectiveness of online learning. However, student engagement was not found to be a significant predictor ($\beta = 0.082$, $p > 0.05$). Hence, H5 is not supported. H6 predicted that technology usability is positively related to the effectiveness of online learning. The findings reveal a significant positive relationship between technology usability and online learning effectiveness ($\beta = 0.276$, $p < 0.01$). Thus, H6 is supported. Finally, H7 proposed that student satisfaction positively influences the effectiveness of online learning. The regression analysis confirms that student satisfaction is the strongest predictor of online learning effectiveness ($\beta = 0.371$, $p < 0.01$). Therefore, H7 is supported. The model explains 61.2% of the variance in online learning effectiveness ($R^2 = 0.612$), indicating strong explanatory power. The regression model predicting online learning effectiveness was

also statistically significant (F = 57.279, p < 0.01), with a Durbin–Watson statistic of 2.170, suggesting that the assumption of independent errors was met.

Overall, the regression results partially support the proposed hypotheses, highlighting the central role of technology usability and student satisfaction in determining the effectiveness of online learning, while teaching presence and student engagement show weaker or non-significant direct effects.

Figure 2. Hypothesized Model

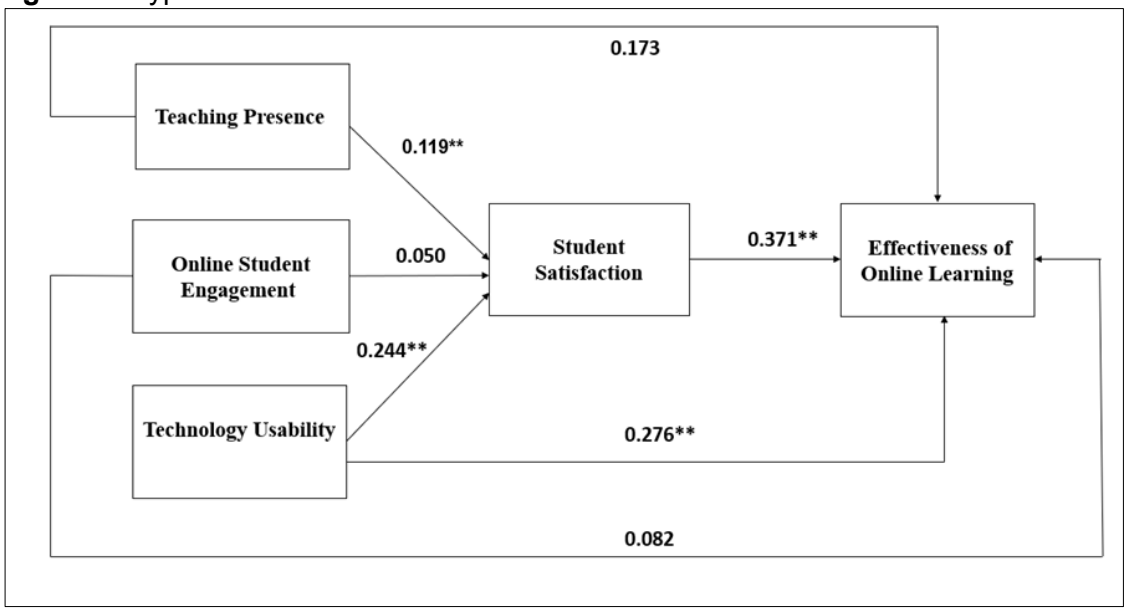


Figure 2 shows that student satisfaction functions as an important linking variable between the antecedent constructs and online learning effectiveness. Specifically, teaching presence (β = 0.119, p < 0.01) and technology usability (β = 0.244, p < 0.01) have significant positive effects on student satisfaction, whereas online student engagement (β = 0.050, p > 0.05) does not demonstrate a meaningful influence. In turn, student satisfaction strongly predicts the effectiveness of online learning (β = 0.371, p < 0.01), indicating that learners who are more satisfied with their online experience tend to perceive online learning as more effective.

In addition, technology usability also exerts a direct effect on the effectiveness of online learning (β = 0.276, p < 0.01), suggesting that the functionality and ease of use of digital learning tools contribute to positive learning outcomes beyond their indirect effects through student satisfaction. Conversely, teaching presence (β = 0.173) and online student engagement (β = 0.082) do not demonstrate significant direct effects on the effectiveness of online learning. Overall, the model highlights that student satisfaction and technology usability are the primary drivers of online learning effectiveness, while instructional and engagement factors show weaker or non-significant direct effects.

From a practical perspective, these findings suggest that universities should prioritize improving students' overall satisfaction and the usability of online learning platforms if they aim to enhance the effectiveness of online learning. Investments in user-friendly technology, stable learning systems, and responsive support services are likely to bring the greatest impact on students' learning outcomes.

DISCUSSION

Teaching Presence

The findings confirm that teaching presence positively influences student satisfaction (H1) and shows a positive but not statistically significant influence on the effectiveness of online learning (H4). This aligns with Fiock et al. (2021), who suggest that instructional presence has a positive correlation with learning and student satisfaction. When instructors provide clear and specific guidance, facilitate discussion, and offer timely feedback, students demonstrate higher cognitive engagement and academic achievement. Active instructor engagement explains 68% of the differences in students' perceived learning outcomes, highlighting its crucial role. This perspective is consistent with Hu and Kee (2022), who emphasized that effective teaching presence is essential for optimizing learning in the new normal, as it helps maintain meaningful academic interaction.

This finding is further supported by Anwar et al. (2024), who found that effective e-learning management enhances students' psychological motivation, which subsequently improves learning outcomes. Similarly, strong teaching presence in the present study may foster students' motivation, confidence, and sense of academic support, thereby increasing their satisfaction with online learning. In the context of USM students, teaching presence is particularly important because many learning activities rely on the USM eLearning platform. Proactive instructors tend to monitor student progress, anticipate potential challenges, and provide immediate support when needed. For the USM, lectures often use features such as the Announcements section to provide timely updates, the Forum to clarify weekly topics, and the Progress Report to monitor student participation. They also regularly review activity logs and quiz attempts in eLearning to identify students who may be struggling. They then reach out through eLearning message or Microsoft Teams to offer additional support. These actions help students feel supported, maintain motivation, and overcome learning barriers, thereby improving online learning satisfaction and learning outcomes.

In addition, active instructor guidance can support students in achieving better academic performance in online learning environments (Ng et al., 2023). Specifically, when instructors actively guide discussion in the eLearning forum, pose thought-provoking questions related to weekly topics, and encourage collaborations, they can guide student to develop higher-order thinking skills and engage more meaningfully with their peers. These actions enhance students' cognitive, social, and emotional engagement, which are critical for improving learning effectiveness and satisfaction in the online learning experience. Although the relationship between teaching presence and learning effectiveness was not statistically significant in this study, the consistently positive trend suggests that teaching presence remains an important enabling factor rather than a direct determinant of online learning effectiveness.

Online Student Engagement

The study also supports the hypothesis that online student engagement positively influences student satisfaction and the effectiveness of online learning (H2 and H5). However, these relationships were found to be positive but not statistically significant. According to Dixson (2010) and Fredricks et al. (2004), overall online learning outcomes are influenced by student engagement across behavioral, emotional, and cognitive aspects. Although engagement did not emerge as a strong predictor in the empirical results, its positive direction suggests that engagement remains a relevant contributing factor within the online learning context.

In online courses, behaviorally engaged students actively participate in discussions and complete assignments on time, which helps them stay connected with course content and peers. Among USM students, engagement plays a particularly crucial role because

many learning activities depend on the USM eLearning platform. For example, students who actively participate in eLearning discussion forums, complete weekly quizzes, and interact with lecture materials tend to demonstrate stronger behavioral engagement. Some USM lecturers design a weekly "guide discussion question" on eLearning to encourage students to share reflections and respond to peers.

Cognitive engagement among USM students is often supported through online quizzes and scaffolded modules uploaded to the eLearning platform. These encourage students to think critically, process content more deeply, and apply concepts effectively. Emotional engagement is also strengthened when lecturers use eLearning announcements, personalized feedback, and motivational messages. For example, students sometimes join quiz competitions via Google Forms or Webex sessions to actively participate and generate their My Continuous Student Development (MYCSD). Sabeh et al. (2021) noted that system quality and instructional support jointly shape learners' emotional responses, reinforcing satisfaction as a key mechanism linking engagement to learning outcomes.

Although engagement was not a statistically significant predictor, active engagement may still help students remain motivated, manage their time efficiently, and overcome common online learning challenges such as isolation and distractions. For instance, USM students often report that timely instructor feedback in eLearning and structured activities like Webex sessions increase their sense of connection and reduce feelings of isolation. Structured activities like discussions, collaborative projects, and timely instructor feedback further improve cognitive and emotional engagement, promoting deeper learning and a sense of belonging. By encouraging behavioral, cognitive, and emotional engagement, online courses can enhance student satisfaction and learning effectiveness, ensuring that USM students receive the full benefits of the virtual learning environment. This pattern is consistent with the synthesis by Sabeh et al. (2021), who concluded that engagement-related factors tend to influence perceived learning success indirectly through user satisfaction rather than as direct determinants of learning outcomes.

Technology Usability

The study reveals a strong positive relationship between technology usability and both student satisfaction and effectiveness in online learning (H3 and H6). Usability refers to the degree to which students can navigate and utilize online learning platforms with ease. Studies by Brooke (1995) and Zhang et al. (2023) note that high usability tends to reduce cognitive load, minimize frustration, and encourage engagement. In this context, the USM eLearning platform is used to deliver and manage online courses, allowing students to access course materials, submit assignments, participate in discussions, communicate with lecturers, and track their learning progress. This is consistent with Kee et al. (2023), who found that course quality, including technological and system-related aspects of course delivery, significantly influences students' perceptions of course effectiveness and satisfaction in the Malaysian higher education context.

When the online learning platform is easy to use, USM students spend less mental effort trying to understand the system and can instead concentrate on the learning tasks themselves. As a result, student less likely to feel overwhelmed or discouraged by technical difficulties, which creates a more positive learning experience. They interact more actively with content and complete tasks more effectively, which enhances both their satisfaction and learning outcomes. These behavioral patterns demonstrate that usability removes key barriers to learning and enables students to view the platform as supportive rather than obstructive. This aligns with Alqurashi (2019), who found that an intuitive LMS platform like USM eLearning increases engagement, timely task completion, and active participation in discussion forums. Systematic reviews highlight

that elements such as navigation clarity, system responsiveness, and mobile compatibility are among the most influential factors for successful online learning (Vlachogianni & Tselios, 2023). For USM students, navigation clarity is important to ensure students can easily locate course material from the internet, complete assignments, and build online discussion forums without confusion, reducing time spent searching and preventing frustration. System responsiveness allows students to complete tasks efficiently and maintain engagement without interruptions. Mobile compatibility allows students to access the eLearning on different devices like smartphones or tablets, providing flexibility and convenience, especially for those who may not have constant access to a desktop or laptop.

Together, these usability features create a seamless and supportive learning environment, enabling students to focus on learning tasks, actively participate, and complete coursework on time, which leads them to be more satisfied with the learning environment and engage in the effectiveness of online learning to the students. As noted by Kee et al. (2023), investments in improving course and system quality are essential not only for enhancing learning effectiveness but also for supporting meaningful educational outcomes in the long term.

The Role of Student Satisfaction as a Mediating Variable on the Effectiveness of Online Learning

Based on the results, student satisfaction significantly impacts the effectiveness of online learning (H7). The findings show that student satisfaction completely mediates the relationship between technology usability and the effectiveness of online learning, and partially mediates the relationship between teaching presence and online learning effectiveness. While student engagement shows no significant effect on it. This is contradicted by the claim that student engagement itself can guarantee online learning effectiveness. This finding also further indicates that student engagement must be complemented by technology usability and teaching presence to become relevant. This is consistent with Ullah et al. (2022), who found that students' satisfaction and acceptance of online learning technologies are critical in determining whether online classes are perceived as effective, even when students actively participate in online learning. This can be due to the fact that satisfaction in itself is an outcome of the involvement of the student and not the cause of involvement. Indeed, according to Yin et al. (2024), satisfaction leads to student engagement and motivations, which means that the causal relationship might be reversed.

According to Yin et al. (2024), student satisfaction is a significant indicator of learning effectiveness and course quality. That is, students who express high levels of satisfaction are more likely to be motivated, engaged, and do well. The findings reflect the pattern, where satisfied students reported higher perceived efficacy of online learning. This is consistent with wider learning models, such as the Delone-McLean Information System Success Model, which states that user satisfaction as an emotive reaction, mediates the effect of system quality on net benefits, which refer to learning outcomes.

All in all, this implies that student satisfaction strongly mediates the technology usability, partially mediates teaching presence, and weakly mediates student engagement with the perceived effectiveness of online learning. The results indicate that student satisfaction is very effective as a predictor of online learning, and satisfaction is often used as a measure of perceived learning success. The findings can be explained by other broad-based models of learning, in particular, the DeLone-McLean model of IS Success, according to which the impact of system quality on net learning benefits is mediated by user satisfaction as an emotional response. On the whole, this study highlights the significance of student satisfaction to enhance online learning effectiveness.

Research Implications

Theoretical Implications

From a theoretical standpoint, the findings offer several contributions to understanding the factors that affect the effectiveness of online learning. Firstly, the findings indicate that teaching presence is vital to the process of making the students satisfied, which subsequently leads to the perceived online learning efficiency. This was in line with CoI theory, which frames online education into the interaction of instructor-guided teaching presence, social presence, and cognitive presence. According to the systematic review conducted by Sabeh et al. (2021), system quality, information quality, and service quality are valid predictors of user satisfaction and perceived benefits in online learning systems, with user satisfaction as a decisive mediator between the system quality and net benefits in such systems. In fact, the satisfaction with learning is considered to be a critical product of CoI presence (Zhang et al., 2023). The research builds on CoI theory, which shows that, as the teaching presence is more intensive, it enhances pleasure, although indirectly, learning efficacy is enhanced.

Consequently, the findings are in line with the Technology Acceptance Model (TAM) by Davis (1989) and the Information Systems Model by Delone and McLean (2003), in which usability and platform quality determine user satisfaction, indicating that the better the technology to be used is in terms of usability, the higher the level of student satisfaction and perceived effectiveness. According to a supporting study by Hamidi and Amirfazli (2025), student satisfaction boosts perceived utility in online learning. All in all, the findings above indicate the necessity of a reliable, easy-to-use technology that will be able to please online students in higher education.

Student Engagement Theory indicates that the more engaged learners are, the more satisfaction and better learning outcomes they will have. However, the findings did not show a significant effect of engagement on student satisfaction or perceived effectiveness. There are recent research confirms the same finding. For instance, Alshammari and Alrehaili (2025) found that the presence of teachers did not translate into an instant student engagement boost. Adeel et al. (2023) also indicate that effective individual learning process demands more than cognitive absorption, including technological opportunity, and ability to absorb information, and state that even when students appear engaged, they might not get meaningful learning outcomes when the teaching presence and technology usability is insufficient. Although engagement theory takes as its focus active participation, the results show that student engagement itself exert mainly indirect or non-significant influences on online learning effectiveness.

Finally, the findings indicate that student satisfaction is the mediator in the relationship between online learning effectiveness, technology usability, and teaching presence. The more satisfied the students are with their education, the more they think that online learning is more effective and will attend classes more. In a study by Fitria et al. (2024), the quality and usability of the system increase user satisfaction and the willingness to use e-learning. Similarly, Hamidi and Amirfazli (2025) demonstrate that the perceived utility is more likely to enhance the effect of student satisfaction on acceptance and efficacy of online learning. The study has affirmation that technology usability is the significant factors that influence online learning effectiveness through student satisfaction, while teaching presence and student engagement exert mainly indirect influences.

Practical Implications

This study offers various practical and useful suggestions for USM and Malaysian higher education to improve the effectiveness of online learning. First and foremost, USM

should improve its teaching presence, which has a substantial impact on the effectiveness of online learning. For example, the lecturers must develop a clear course plan that outlines objectives, timelines, and resources, while maintaining their presence through timely announcements and feedback. Besides that, lecturers should include interactive components in their classes, such as discussion prompts and group projects, in order to encourage communication between the students and lecturers. Moreover, they should also conduct courses in the form of an effective forum and make sure that the class sizes and schedule are suitable and allow lecturers to maintain a consistent presence.

Furthermore, enhancing student engagement is also an important strategy for USM to improve the effectiveness of online learning among students. According to Alshammari and Alrehaili (2025), strategies such as encouraging peer cooperation and including thought-provoking information are important to increase social and cognitive presence, as well as boost student engagement in online learning. Thus, the lecturers are urged to use a variety of multimedia, real-life examples, and interactive tests. As a result, they can provide a wide range of online materials as well as interesting content (Salta et al., 2022). The university management should help the faculty to develop fascinating content and develop a complete online library (Spitzer et al., 2021). For example, various interactive exercises such as peer reviews and group projects can be used in the learning process and provide immediate support in the form of mentorship and useful advice. They can also use relevant material that is related to students' real-life issues to enhance the level of cognitive involvement, as well as boost student engagement in learning.

A lack of technology availability and usability was linked to a higher level of perceived online learning stress as well as a lower level of student satisfaction towards online learning (Hasan et al., 2021). Hence, USM should invest more in technology through the improvement of internet connectivity, the improvement of the online learning system (e-Learn USM), and adequate training to facilitate online learning. In addition, USM has to offer students tutorials and support materials for all needed technologies, including e-Learn USM. Apart from that, USM should have an IT helpdesk or peer support staff to promptly resolve technical problems. According to Hasan et al. (2021), if the university prioritizes technology usability, students will be able to focus on their studies, while clear instructions and reliable platforms can improve both student satisfaction and online learning effectiveness.

To sum up, USM, as well as Malaysian higher education, can achieve a higher level of online learning effectiveness by improving their teaching presence, fostering student engagement, minimizing the burden of technology use, and providing comprehensive support in regard to online learning. These evidence-based strategies allow the management of the university to improve student outcomes and satisfaction in online learning.

CONCLUSION

This study investigates the factors that influence the effectiveness of online learning in USM, focusing on teaching presence, student engagement, and technology usability. The findings highlighted that teaching presence and technology usability significantly influence the mediating variable, student satisfaction, which contributes to a greater level of online learning effectiveness. However, the findings of this study also show that although student engagement correlated with other variables, it does not predict student satisfaction and online learning effectiveness directly. Thus, it can be concluded that student engagement needs the involvement of teaching presence and technology usability in order to enhance the level of online learning effectiveness. The study in line with Adeel et al. (2023), indicates that student engagement will not be effective to enhance online learning without proper teaching presence and usability of technology, highlighting student satisfaction as a key mediating variable.

From a theoretical perspective, this study validates and expands on previous well-established frameworks, including CoI, TAM, and Delone-McLean IS Success Model. These frameworks highlight the importance of teaching presence and technology usability in improving student satisfaction and online learning effectiveness. Other than that, this study also proposes various practical recommendations for USM as well as Malaysian higher education in order to enhance the quality and effectiveness of digital education. This can be done by emphasizing effective and innovative teaching, engaging content and interactions between lecturer and student, and also user-friendly technology. These findings are extremely crucial for USM and Malaysian higher education as online learning and blended learning become more and more prevalent nowadays.

LIMITATION

Although the study offers numerous valuable insights and recommendations regarding the effectiveness of online learning at USM, several limitations should be considered. Firstly, this study used a convenience sample of 150 respondents, predominantly undergraduates, aged between 22 and 25, which may restrict generalizability. Besides that, the cross-sectional methodology used for data collection purposes, which is based on self-reported data from the respondents' own perspectives, can result in biased responses. Additionally, the focus on three key independent variables in this study, which are teaching presence, student engagement, and technology usability, did not include other crucial factors that can affect the effectiveness of online learning, such as digital literacy and learning motivation, which should be considered in future research for a more complete and comprehensive view of online learning effectiveness. Furthermore, the focus on only a single institution, Universiti Sains Malaysia, suggests the needs of doing comparison analyses across various Malaysian universities, which would enhance the external validity of this finding. Irrespective of these limitations, this study can contribute immensely to the literature on digital education, especially in the context of online learning effectiveness in Malaysia, and can be used as a foundation in future studies.

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