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Enhancing educational continuity: exploring factors affecting the success of learning management systems in Dubai higher education

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Introduction: In recent years, educational institutions worldwide have increasingly embraced technology as a means of enhancing the learning experience and adapting to the demands of the modern era. This trend toward digital transformation has become even more pronounced in the wake of the COVID-19 pandemic, which necessitated a rapid shift to remote learning modalities. Learning Management Systems (LMS) have emerged as crucial tools for educational continuity, enabling institutions to deliver course materials, facilitate communication, and manage student progress in virtual environments. However, the success of LMS implementation varied among educational institutions, with some achieving seamless transitions while others encountered challenges stemming from students' reluctance to fully embrace the technology. This paper contributes to the understanding of LMS adoption in higher education institutions in Dubai, UAE, by proposing a comprehensive model based on the Technology Acceptance Model (TAM) and enhanced with modern factors that fit the nature of virtual learning.

Methods: Employing a quantitative research approach, the study utilized the main structure of the Technology Acceptance Model (TAM) to propose an enhanced version of factors that might influence students' acceptance of online learning management systems. To collect the necessary data, a self-administered survey questionnaire was distributed to 500 students, ensuring a comprehensive dataset for analysis. The analysis was conducted using Partial Least Square Structural Equation Modeling (PLS-SEM), a robust statistical technique suitable for complex models with latent variables. This method allowed the researchers to empirically validate the proposed model, assessing the impact of various modern factors tailored to the nature of virtual learning environments.

Results: The study's empirical findings revealed several significant factors influencing students' intentions to use LMS, including personal innovation, perceived utility, system quality, service quality, and information quality. While system quality encompasses the technical aspects and functionalities of the LMS, information quality focuses on the relevance, accuracy, completeness, and timeliness of the system's content.

Discussion: These insights provide valuable guidance for educational institutions in Dubai and beyond, offering actionable recommendations for optimizing LMS implementation strategies to enhance student engagement and educational outcomes in the digital learning landscape.

KEYWORDS

LMS, technology acceptance, structure equation modeling, personal innovation, system quality, service quality, information quality, social influence

Introduction

Information technology (IT) has made significant progress in many areas and is easily accessible to many people. This progress has led to the creation of information systems (IS) that facilitate the management of learning activities that are not limited by time or space. The use of E-learning, a widely recognized term referring to information technology-based learning, has had a substantial influence on the overall efficacy of educational institutions in terms of learning outcomes. E-learning has flourished with the sudden advent of COVID-19 and the necessity for most schools to close their classes and open their E-learning platforms. Early on, educational technology experienced tremendous expansion and adoption, with worldwide Edtech investments increasing to US $18.66 billion in 2019 and the entire sector for online education predicted to reach $350 billion by 2025, even before COVID-19 (Li and Lalani, 2020). Much has changed since the COVID-19 incident. People are using more language-learning platforms, online tutors, and video-conferencing tools to learn new things now (Pokhrel and Chhetri, 2021).

Academic institutions are employing various approaches to enhance the quality of teaching, facilitated by information technology, in order to fulfill their educational goals. According to Hassnzadeh et al. (2012), the use of E-learning has significantly enhanced the core learning principles in higher education environments. The current focus at many universities is on prioritizing the incorporation of E-learning systems due to their substantial contribution to knowledge management endeavors (Lin and Hwang, 2014; Sharma et al., 2017). An increasingly prevalent information technology system, the LMS, specifically facilitates learning in a flexible manner, enabling individuals to engage in educational activities at their convenience and regardless of their physical location. LMS is a widely recognized acronym that encompasses a range of names used to denote similar concepts, including E-learning systems, LMSs, course management systems (CMS), educational computer programs, and virtual learning environments (VLE). In general, students have the ability to use these systems to access course information in several media, such as text, images, and audio. Additionally, they may engage in conversation with instructors and/or peers using message boards, forums, chats, video conferencing, and other similar technologies (Sánchez and Hueros, 2010). Moodle, Blackboard, and WebCT are often used as LMSs inside educational establishments (Waheed et al., 2016). Higher education institutions have made significant investments, especially after COVID-19, in the application of LMSs to improve teaching and learning (Fathema et al., 2015). The return on these investments heavily relies on instructors' and students' sustainable use of LMSs. Since LMS is the reality for most universities and requires such a significant investment, highlighting the key factors influencing learners' acceptance of LMSs is critical for the sustainable use of LMSs. Recent studies have highlighted the value of identifying key factors contributing to the better acceptance and integration of LMS by university students before the pandemic. (Fathema et al., 2015; Raza et al., 2020), during COVID-19 (Raza et al., 2020; Wang et al., 2022); and after the pandemic (Delone and McLean, 2003; Mastan et al., 2022; Ndebele and Mbodila, 2022).

Due to its convenience and success during the COVID-19 pandemic, some colleges in Dubai have integrated virtual learning into their regular curriculum, offering certain courses online as part of their routine. However, this shift has brought to light various usability issues inherent in online management systems. Students often face challenges navigating these platforms, accessing course materials, and engaging in interactive activities, which can significantly impact their learning experiences and overall motivation. Addressing these usability concerns is essential for ensuring that students can successfully utilize online systems and derive maximum benefit from their virtual learning environments.

Numerous scholarly investigations have delved into students' inclination to embrace these systems. However, it is crucial to recognize that institutional cultures and attributes vary, necessitating a comprehensive examination of each study's scope. This collective knowledge can contribute to a more comprehensive understanding of the factors influencing LMS acceptance, particularly in the context of the COVID-19 pandemic. Furthermore, given the increasing rates of LMS adoption in university education and the importance of assessing relevant factors before implementing such a system in higher education institutions in the UAE, there is a pressing need to conduct research on the determinants predicting students' inclination to adopt LMS. Several studies in the Middle East have investigated students' adoption of LMS, but these studies took place prior to COVID-19 and utilized older LMS versions. To the best of the author's knowledge, this is the first study to be conducted on a modern LMS after COVID-19 in the UAE context using empirical validations. Existing research on LMS acceptance during COVID-19 (Camilleri and Camilleri, 2021; Al-Nuaimi et al., 2022, 2023) has generally utilized the Technology Acceptance Model (TAM) with minor modifications. However, certain modern features particularly relevant to Generation Z students, such as the quality of the E-learning system, personal innovation, perceived connectedness, and social influence, were not included as key influencers on students' intentions to use LMS. The interaction among these factors has the potential to enhance the traditional TAM framework, potentially leading to an improved model that integrates social and system features for better performance.

To bridge this gap, this research endeavors to investigate the factors sharing students' intentions to utilize LMS in higher education institutions across the United Arab Emirates (UAE). Drawing upon the Technology Acceptance Model (Davis, 1989) and the IS Model by Delone and McLean (2003), the study incorporates contemporary factors reflecting the dynamic nature of current LMS platforms. Its principal objective is to explore the myriad elements influencing the efficacy and adoption of LMS in UAE higher education settings. This paper will propose a model that incorporates these factors and formulate hypotheses based on a thorough literature review. Utilizing the Structural Equation Modeling (SEM) approach, the research aims to empirically validate the proposed model, uncovering the interplay among latent variables such as personal innovation (PI), perceived usefulness (PU), system quality (SYS-Q), service quality (SQ), social influence (SI), and intention (INT) to employ LMS. School administrators, educational authorities, and pertinent stakeholders in the UAE can benefit from the findings as they implement robust LMS solutions to ensure instructional continuity during pandemics.

The subsequent portions of this work are structured as follows: Section two provides an overview of the relevant academic literature, with a specific focus on post-adoption investigations of Electronic Learning Management Systems (E-LMSs). Section three of this paper

presents the proposed study model and research hypotheses. This is followed by Section 4, which provides an overview of the technique used in this research. Section 5 provides an analysis of the outcomes derived from the structural model. Section six provides a comprehensive analysis of the constraints and draws appropriate conclusions.

Literature review

Technology acceptance model

The Technology Acceptance Model (TAM), first proposed by Davis (1989), has been extensively used by several academics to predict the acceptance and adoption of LMSs by users (Delone and McLean, 2003; Hsu et al., 2009; Mastan et al., 2022; Ndebele and Mbodila, 2022). TAM represents a significant theoretical contribution to our knowledge of information systems use and information technology adoption behaviors. Previous studies have employed the Technology Acceptance Model (TAM) to determine user acceptance of various information technologies. These technologies encompass blog participation (Hsu et al., 2009), multimedia applications (Ropaka et al., 2020), web surfing (Davis, 1989), and email acceptance (Adams and Mcintyre, 2020). Davis (1989) presented TAM as an adaptation of TRA for the realm of IS (Chaudhry et al., 2021). According to TAM, users' behavioral intention (BI) to use technology is influenced by their attitude (A) toward it, which is influenced by perceived usefulness (PU) and perceived ease of use (PEOU). Perceived ease of use is also seen to have a direct impact on perceived usefulness. The user's belief that adopting a given application system will improve his or her job performance within an organizational setting" is defined as the PU (Adams and Mcintyre, 2020). Both PU and PEOU, according to TAM are main factors that lead to a positive attitude toward utilizing a system, with an attitude defined as the user's desire to utilize the system. The individual's BI to use the system is influenced by PU.

Research on LMS acceptance

Investigating the impact of educational technology on students' learning has garnered significant attention among researchers, as evidenced by numerous studies exploring this topic (e.g., Tulinayo et al., 2018; Binyamin et al., 2019; Müller and Wulf, 2020). Concerning students' acceptance of educational technology, several scholars, including Attuquayefio and Addo (2014), Sharma et al. (2017), and Binyamin et al. (2019), have utilized the Technology Acceptance Model (TAM) and its constructs like Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) to assess the adoption of LMSs. For instance, Binyamin (Schoonenboom, 2014) conducted a study in Saudi Arabia, extending the TAM to identify the primary determinants of LMS utilization, emphasizing factors such as ease of use, usefulness, and learning support. Similarly, Attuquayefio and Addo (2014) explored students' responses to LMS in a blended learning scenario, uncovering the significant influence of social factors, price value, and anxiety on their intention to use LMS.

Moreover, in addressing the integration of educational technology into academic institutions, Ndebele and Mbodila's study in South Africa advocated for enhanced teacher training to equip educators with the necessary skills for better technology integration. They stressed the importance of institutional support mechanisms, such as uninterrupted access to devices and internet connection, to facilitate seamless technology integration. Additionally, they proposed the establishment of electronic learning communities to foster collaboration among learners and educators in technology for educational purposes. Similarly, Bansah and Darko Agyei (2022) investigated the impact of perceived convenience, usefulness, and efficacy on LMS adoption, highlighting the significance of variables like personal computer (PC) access, perceived usefulness, and ease of use in determining user acceptance.

Furthermore, recent studies, such as Ngampornchai and Adams (2016) and Raza et al. (2020), have continued to explore factors influencing LMS adoption. Raza et al. (2020) modified the Unified Theory of Acceptance and Use of Technology (UAUT) to assess students' acceptance of LMS, revealing the positive relationship between performance expectation, effort expectancy, and social influence with LMS behavioral intention. They also identified the moderating role of COVID-19 concerns in this relationship. On the other hand, Ngampornchai and Adams (2016) focused on the E-learning environment in Thailand, finding a significant positive relationship between performance expectation, effort expectancy, and technology adoption. These studies collectively contribute to understanding the complex dynamics of educational technology adoption and its implications for teaching and learning practices.

Structure equation modeling and technology acceptance

Research in the field of information systems (IS) often focuses on various aspects related to the adoption, acceptance, conditions, and success of technology. To examine these domains, scholars must establish, articulate, and comprehend conceptual entities such as beliefs, perceptions, motives, and attitudes. Due to the inherent challenge in quantifying abstract constructs, they are often assessed as latent variables (LVs), indirectly evaluated using a series of questions (indicators) designed to capture the underlying notions of the constructs in question. Structural Equation Modeling (SEM) is a frequently used methodology in IS research, aiming to represent the connections between latent variables, with the Partial Least Squares (PLS) algorithm often used to estimate associations between latent variables using a provided dataset (Chin et al., 2008). This section provides a comprehensive review of Structural Equation Modeling (SEM) and Partial Least Squares (PLS) and their integration into the proposed model of this dissertation.

Structural Equation Modeling (SEM) is widely recognized as a fundamental approach for examining route models that include intricate connections between latent variables and various indicators (Chine et al., 2001). In contrast to conventional statistical methods, SEM offers more versatility in integrating theoretical constructs with empirical data. Researchers can utilize SEM to address various aspects of their study, allowing consideration of multiple predictors, construction of latent constructs (representing unobservable phenomena like beliefs, feelings, and intentions), incorporation of measurement error from observed variables, and empirical testing of previous assumptions against collected data (Straub et al., 2004; Hair et al., 2011). The clear differentiation between observable and latent variables in SEM may provide valuable assistance to researchers in examining a diverse array of hypotheses. Conventional statistical

methods lack a straightforward approach to differentiate between observable and latent variables, focusing on identifying averages and associations among observable variables, potentially overlooking important latent variables (Hair et al., 2011).

One primary benefit of Structural Equation Modeling (SEM) is its ability to allow researchers to evaluate two key components of the model concurrently: (1) the measurement model, examining the association between constructs and their indicators; and (2) the path model, exploring relationships between constructs to test theoretical propositions (Chine et al., 2001). The integration of the measurement model and the structural model provides a more accurate evaluation of associations between internal and external interactions (Straub et al., 2004). Estimations generated using SEM are superior to those obtained by linear regression, as shown by Chine et al. (2001; Gefen et al., 2011). Moreover, SEM allows researchers to construct and estimate models including several dependent variables and their interrelationships concurrently, offering a more accurate perspective on outcomes pertaining to the interconnectedness of variables. Additionally, SEM serves as both an *a priori* and confirmatory approach, enabling researchers to formulate and evaluate models against evidence, adapting hypotheses to align with gathered evidence, and transitioning from the confirmatory stage to the exploratory stage (Hair et al., 2011).

Proposed theoretical model and hypotheses

Figure 1 illustrates the proposed model for the study, comprising six independent variables: Personal Innovation (PI), Perceived Usefulness (PU), System Quality (SYS-Q), Service Quality (SQ), Information Quality (IQ), and Social Influence (SI). Additionally, the model includes users' intention (INT) to use LMS as the dependent variable, which is positively influenced by these independent variables. In the subsequent section, each of these factors will be comprehensively explored, including their respective hypotheses and justifications.

Personal innovation

According to Rogers (Al-Busaidi, 2012), the diffusion of innovation may be described as the transmission of a new idea or technology via certain communication channels over a period of time among individuals within a given social group. The concept of personal innovativeness, as defined in this research, pertains to the degree to which an individual's inclination or mindset demonstrates a willingness to independently explore and experiment with LMS technologies, regardless of the experiences shared by others (derived from Sharma et al., 2017). Within the scope of this study, the principal investigator suggests that students should demonstrate a willingness to engage in experimentation with current LMS options. In their study, O'Connor et al. (2016) identified a correlation between individual propensity for innovation and the integration of technology. Sharma et al. (2017) conducted a study to investigate the factors influencing the adoption of E-LMSs. Their findings revealed a statistically significant relationship between the use of e-LMS by instructors and the variables examined in their research. According to O'Connor et al. (2016), individuals who fully integrate a technological solution tend to use all available and suitable applications for various objectives. Previous studies have shown that Perceived Ease of Use (PI) has a significant role in

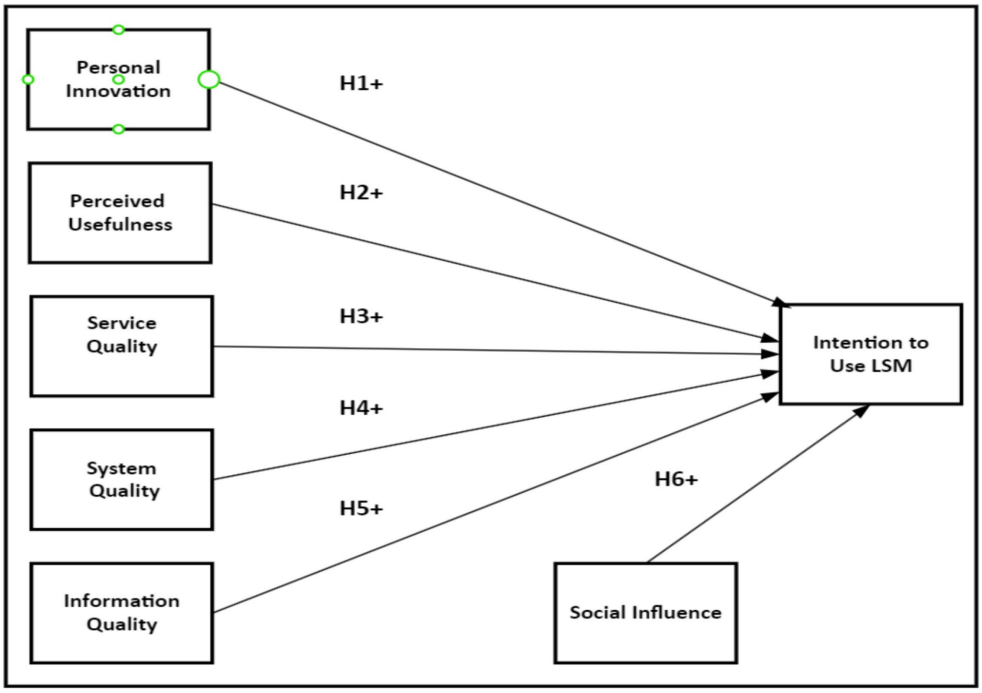

FIGURE 1
Proposed model.

influencing individuals' adoption of technology and their level of happiness with it (Venkatesh, 2000; Van Raaij and Schepers, 2008). Moreover, in comparison to users who do not engage with new technology, users who actively use innovative technology have a higher propensity for adapting to various systems and processes (Venkatesh and Bala, 2008). Thus, we put forward the following hypothesis:

> Hypothesis 1 (*H1*): Personal Innovation has a positive impact on students' intention to use LMS.

Perceived usefulness

Perceived usefulness, as defined by Davis (1989), refers to the extent to which individuals believe that the implementation of a particular technology will enhance their work performance. In this study, the construct of Perceived Usefulness (PU) is operationalized as the degree to which students believe that engaging with LMS and utilizing its features will improve their academic performance. The Technology Acceptance Model (TAM), TAM 3 (Venkatesh and Bala, 2008), and the factors of Perceived Ease of Use (PEOU) (Stodnick and Rogers, 2008) have introduced the constructs of Perceived Usefulness (PU) and Behavioral Intention (BI). Furthermore, the constructs of Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) have been suggested as precursors to Behavioral Intention (BI) in various technology models, including the Technology Acceptance Model (TAM), TAM2, PEOU determinants, and TAM3.

In the context of LMS, previous research has indicated a positive correlation between learners' adoption of LMS and the tangible benefits it offers. Ain et al. (2016) conducted a study examining the impact of learning value on the use of LMSs. The results of their study revealed a significant influence of learning value and performance anticipation on students' intention towards LMS. Consistent with the present study, we propose the following hypothesis:

> Hypothesis 2 (*H2*): Perceived Usefulness has a positive impact on student's intention to use LMS

System quality

The concept of System Quality (SYS-Q) encompasses several aspects of an information system, including its access speed, simplicity of use, navigation, and web interface design (Delone and McLean, 2003). Users of LMSs often exhibit reduced levels of system satisfaction when confronted with system faults and inconsistent interaction. Conversely, when users encounter a high degree of system satisfaction, they tend to have fewer issues related to bugs and inconsistent interaction. In their study, Hsu et al. (2009) discovered a significant and affirmative correlation between the perceived SYS-Q and the ongoing behavioral intention to use E-learning services. Cavus et al. (2021) conducted a study examining the many aspects that influence the success of LMS. Their research revealed a significant relationship between the quality of the system and the level of acceptance shown by students towards the LMS. In their study, Delone and McLean (2003) discovered a significant association between the quality of a system and the level of pleasure experienced by users within the context of information systems. The authors propose that an increase in system quality is anticipated to result in an increase in user satisfaction and use. This, in turn, is projected to have favorable effects on individual productivity, ultimately leading to increases in total productivity. Moreover, Syed et al. (2021) discovered a positive correlation between system quality and the intention to utilize LMS in higher education, while investigating the operational risks that hinder the adoption of eLearning. In this study, we put forth the following hypothesis:

> Hypothesis 3 (*H3*): System quality has a positive impact on student's intention to use LMS.

Service quality

Service quality encompasses several dimensions such as responsiveness, convenient working hours, dependability, and ease of contact with service providers (Sharma et al., 2017). Within the realm of higher education, service quality may be conceptualized as the discernible variance between the expectations and actual experiences of students in relation to the services provided (Stodnick and Rogers, 2008). Service quality may be conceptualized as the presence of responsiveness, dependability, and active communication functionalities inside the LMS. Prior research has shown a robust association between the quality of LMS services and the level of satisfaction experienced by students. In their study, Wang et al. (2007) constructed and verified a multi-factor framework derived from prior scholarly investigations on information systems success. This framework was used to evaluate the performance of an E-learning system implemented in Taiwan. The findings of the study revealed that the success of the E-learning system is determined by three criteria, namely system quality, information quality, and service quality. Uppal et al. (2017) conducted a study to examine the correlation between E-learning and LMS service quality. Their findings revealed that the quality of the E-learning system played a crucial role in determining the overall quality of E-learning services. Moreover, the study demonstrated a positive association between the overall quality of E-learning services and the satisfaction levels of E-learning students. Therefore, we propose the following hypothesis:

> Hypothesis 4 (*H4*): Service quality has a positive impact on students' intention to use LMS.

Social influence

Social influence (SI) refers to the extent to which a person sees the need to adopt a contemporary system, as described by Venkatesh et al. (2003). According to the findings of this study, social influence is operationally defined as the extent to which a student perceives that their peers believe that using an LMS is a beneficial method for educational purposes. Multiple research studies have shown that social influence (SI) has a substantial role in shaping individuals' behavioral intentions towards system adoption (Delone and Mclean, 1992; Nguyen et al., 2014; Allam et al., 2019, 2020). Moreover, it has been demonstrated that social influence plays a

significant and direct role in shaping behavioral intention within the Unified Theory of Acceptance and Use of Technology (UTAUT), as well as being included in other models as an external component that positively impacts users' attitudes. The following theory is proposed:

> Hypothesis 5 (*H5*): Social influence has a positive impact on students' intention to use LMS.

Information quality

The quality of information refers to the standard of information generated by systems for their consumers (Delone and Mclean, 1992). Within the realm of information systems literature, the assessment of information systems' performance often relies on the examination of two crucial factors: information quality and user satisfaction. According to Wang and Strong, accuracy, timeliness, precision, dependability, currency, completeness, and relevancy are some of the data quality (DQ) factors that are covered under information quality, along with user satisfaction. Accessibility and interpretability are two more factors. Wang and Strong (1996), along with Al-Samarraie et al. (2003), argue that the quality of information plays a crucial role in influencing user satisfaction among instructors and students alike. Moreover, previous studies have shown evidence that the quality of information significantly influences students' satisfaction with the use of LMS (Alkhateeb and Abdalla, 2021; Cavus et al., 2021). Hence, in order to examine the potential impact of information quality on students' satisfaction with their LMS, the following proposition is proposed:

> Hypothesis 6 (*H6*): Information quality has a positive impact on students' intention to use LMS.

Method

Data collection and instrumentation

Based on the review of relevant studies, such as Davis (1989), Sharma et al. (2017), Azizi et al. (2020), and Cavus et al. (2021), the authors designed a questionnaire consisting of 60 items measuring personal innovation, perceived usefulness, service quality, system quality, social factors, and intention to use LMS. Out of the 68 items initially selected, only 36 were sent to a group of graduate students to measure the items' content validity. Before actual data collection, the questionnaire was sent to 15 students from different departments at the college to ensure the survey ran smoothly without any difficulties. These 15 students indicated that all the questions in the survey were understandable and consistent. Students were issued a survey invitation along with a link to access the survey. Microsoft SharePoint survey tools were used due to their widespread usage across all college campuses. The survey was sent to a total of 14 distinct campuses to ensure a robust sample size. The Department of Computer and Information Science sent a communication to many department chairs, including those from health science, business, applied media, computer and information science, and engineering. The survey invitation letter included a concise overview of the study's aims and urged faculty members to promote student participation in the survey as a means of enhancing the quality of the university's E-learning services.

A total of 500 questionnaires were returned by students over a span of 10 days. Participants provided their responses to the survey questions using a Likert scale consisting of five points, where a rating of 1 indicated complete disagreement and a rating of 5 indicated complete agreement. Upon careful examination of the aforementioned responses, it was determined that a total of 62 responses had to be excluded from the analysis due to their fragmentary nature or the absence of essential data. In the present research, a total of 458 electronic questionnaires were used for the purpose of conducting further statistical analysis to evaluate the accuracy of the proposed model.

Demographics

The demographic analysis revealed the profiles of the respondents, as shown in Table 1. Analysis of the gender distribution among respondents revealed that the majority were female, accounting for 57 percent, while male respondents constituted 43 percent of the entire sample. Regarding the age distribution of the participants, the findings indicate that 19% fell within the age range of 18 to 19, 20% fell within the age range of 19–20, 30% fell within the age range of 20–21, and finally, 27% fell within the age range of 21–22.

Moreover, analyzing the students' academic specialization, it was found that students majoring in CIS constituted the majority, at 26 percent, followed by students from the Business Division at 20 percent. The distribution for other academic majors is as follows: engineering, 16 percent; health science, 13 percent; foundation studies, 13 percent; and applied media, 12 percent. Concerning students' experience in using information technology, 39 percent reported having 3 years of experience, 28 percent reported two or more years of experience, 19 percent reported having 4 years of experience, and only 13 percent reported having 1 year of experience.

Data analysis and results

Construct validity

In accordance with the validation criteria proposed by Straub et al. (2004) and Urbach and Ahlemann (2010), the decision was made to assess the reliability and validity of the measurement model. Construct validity refers to the degree to which a scale accurately measures the intended variable. Our research adheres to Chin's (Ngafeeson and Sun, 2015) methodology for establishing construct validity while evaluating survey instruments in the field of Management Information Systems (MIS). Available information indicates that there are appropriate measurement criteria for all of the latent variables examined in this research. The composite reliability, Cronbach's alpha, and average variance extracted (AVE) are shown in Table 1. The table displays values of Cronbach's alpha and composite reliabilities, all of which are above the required threshold of 0.707 as suggested by Nunnally (1994). Moreover, all of the values of AVE are above the threshold of 0.50 as proposed by Fornell and Larcker (1981), which suggests that the measurement model exhibits strong internal consistency and convergent validity. Put simply, each construct is assessing its

TABLE 1 Demographics distribution.

	Category	Frequency	Percentage (%)
Gender	Male	198	43%
	Female	260	57%
Age	18–19	68	15%
	19–20	129	28%
	20–21	136	30%
	21–22	125	27%
Student major	CIS	120	26%
	Business	90	20%
	Engineering	58	16%
	Health science	75	13%
	Foundation	55	13%
	Applied media	60	12%
Experience with LMS	One year	60	13%
	Two years	130	28%
	Three years	180	39%
	Four years	88	19%

designated notion without any overlap with the other constructs (Table 2).

Discriminate validity

Discriminant validity refers to the extent to which the measurements of a particular construct may be distinguished from measurements of other constructs (Fornell and Larcker, 1981). The technique used for assessing validity in this study adheres to the approach proposed by Chin et al. (2008). When considering many variables, it is expected that each variable has distinct characteristics. In such cases, it is anticipated that the measures of each variable would exhibit strong correlations among themselves, while displaying weak correlations with measurements of other latent variables. The discriminant validity of all the constructs is shown in Table 3. Initially, it is seen that the correlation between each variable and itself, as shown by the shaded diagonal elements, yields a greater value for the square root of AVE compared to its correlation with any other variable. Furthermore, it has been shown that the loadings of questions on their respective variables are greater in magnitude compared to the cross-loadings with other factors (Chin, 1998). According to Fornell and Larcker (1981), loadings ranging from 0.45 to 0.54 are deemed fair, loadings ranging from 0.55 to 0.62 are considered good, loadings ranging from 0.63 to 0.70 are regarded as very good, and loadings beyond 0.71 are classified as excellent. Table 3 presents the relationships between each construct and all the elements of the other constructs.

Structural model and the results

As mentioned earlier, the suggested model is assessed using Structural Equation Modeling (SEM) as the chosen approach for data analysis. Structural Equation Modeling (SEM) is a technique that offers many advantages in the context of this study, as its primary aim is to investigate the interrelationships among six distinct elements (Fornell and Larcker, 1981; Chin, 1998). The data analysis method used in this study was SmartPLS, which was employed to elucidate the measurement and structural models as outlined by Hair et al. (2011). Assessing structural models includes:

- Collinearity assessment;
- Path coefficients;
- R2 coefficient of determination
- F2 effect size;
- Predictive relevance through Q2 and RMSE.

Table 4 presents all the results of the structural models (Figure 2) and provides a comprehensive summary of the hypotheses that were examined, along with their corresponding statistical outcomes, indicating whether they were supported or not supported.

The Q2 values of StoneGeisser were derived via Partial Least Squares (PLS) analysis. The blindfolding technique was used in the SmartPLS software to obtain the Q2 values. According to a general guideline, all values above zero were observed, thereby validating the out-of-sample predictive significance of both models. In a study conducted by Shmueli et al. (2016), novel PLS prediction approaches were developed to assess the predictive capabilities of the model. In contrast, Table VII presents the Root Mean Square Error (RMSE). In a recent study conducted by Sharma et al. (2017), the researchers used the Root Mean Square Error (RMSE) as the benchmark for evaluating the predictive capabilities of the models under investigation. Consequently, despite the high R2 value obtained, the presence of a low RMSE suggests a model with potentially high accuracy. The findings of the structural model developed using SmartPLS are shown in Figure 2.

We employed the bootstrapping method to evaluate the significance of the t-values. Following the recommendation by Hair et al., we utilized 5,000 samples, consistent with our observation of 458

TABLE 2 Convergent validity and composite reliability.

Variable	Item	Loadings	CR	AVE
	PI1	0.866		
Personal innovativeness (PI)	PI2	0.890	0.892	0.710
Perceived usefulness (PU)	PU1	0.833		
	PU2	0.866	0.781	
	PU3	0.881	0.823	
	PU4	0.855		
System quality (SYS-Q)	SYS-Q1	0.766		
	SYS-Q2	0.848		
	SYS-Q3	0.866	0.912	0.832
	SYS-Q4	0.887		
	SYS-Q5	0.871		
Service quality (SQ)	SQ1	0.781		
	SQ2	0.866	0.722	
	SQ3	0.832	0.854	
	SQ4	0.868		
Information quality (IQ)	IQ1	0.921		
	IQ2	0.791	0.931	0.0735
	IQ3	0.832		
	SI1	0.896		
Social influence (SI)	SI2	0.888	0.879	0.756
	SI3	0.851		
	BI1	0.921		
Behavioral intention	BI2	0.890	0.861	0.738
	BI3	0.913		

TABLE 3 Constructs' correlation.

	(PI)	(PU)	(SQ)	(S YS-Q)	(IQ)	(SI)	(INT)
Personal innovation (PI)	0.84						
Perceived usefulness (PU)	0.76	0.87					
Service quality (SQ)	0.68	0.58	0.86				
System quality (SQ)	0.68	0.26	0.3	0.89			
Information quality (IQ)	0.71	0.38	0.62	0.54	0.88		
Social influence (SI)	0.83	0.31	0.27	0.41	0.38	0.85	
Intention to use LSM (INT)	0.73	0.68	0.62	0.73	0.62	0.5	0.86

cases. For a two-tailed test, our critical t-values were 1.65 (for $p \leq 0.10$), 1.96 (for $p \leq 0.05$), and 2.58 (for $p \leq 0.01$). Figure 2 and Table 4 depict the overall effect between the independent and dependent variables, including the path coefficient, sample mean, standard deviation, T statistics, p values, significance of the relationship, and supported hypotheses. According to Hair et al. (2011), an R2 value of 0.75, 0.5, or 0.25 for the affected constructs in the structural model is described as substantial, moderate, or weak, respectively. In our tested model, intention to use LSM achieved an R2 of 0.74, indicating a positive relationship. As illustrated in Figure 2 and Table 4, the path coefficients for this inner model are presented alongside their respective t-values in parentheses. Five out of six hypotheses are supported with strong statistical significance. As hypothesized, personal innovation strongly influences users' intention to use LSM, with a path coefficient of 0.21 and a t-value of 2.4 at the 0.05 level of significance. Additionally, perceived usefulness exhibits a positive path coefficient of 0.42 with a t-value of 2.4 on intention to use, significant at the 0.001 level. Furthermore, service quality has a strong influence on users' intention with a path coefficient of 0.19 and a t-value of 1.8. Further, system quality and information quality impacted users' intention to use LMS with path coefficients of 0.35 and 0.38 and t-values of 3.1 and 3.4, respectively. However, social influence did not have a significant impact on users' intention to use LSM, which means that hypothesis 6 failed to hold its claim.

TABLE 4 Results of structural model.

Hypotheses	Path	Path coefficient	*t*-value	Results	Effect size $_f2$	R^2	R^2 adjusted	Q2	RMSE
H1	PI---> BI	0.21**	2.9	Sup	0.01	0.76	0.74	0.45	0.489`
H2	PU---> BI	0.42***	6.2	Sup	0.042				
H3	SQ---> BI	0.31***	3.9	Sup	0.07				
H4	SYS-Q→BI	0.35***	4.2	Sup	0.068				
H5	IQ→BI	0.38***	4.9	Sup	0.064				
H6	SI→BI	0.11**	1.2	Not Sup	0.043				

Sup., supported; Not Sup., not supported; ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

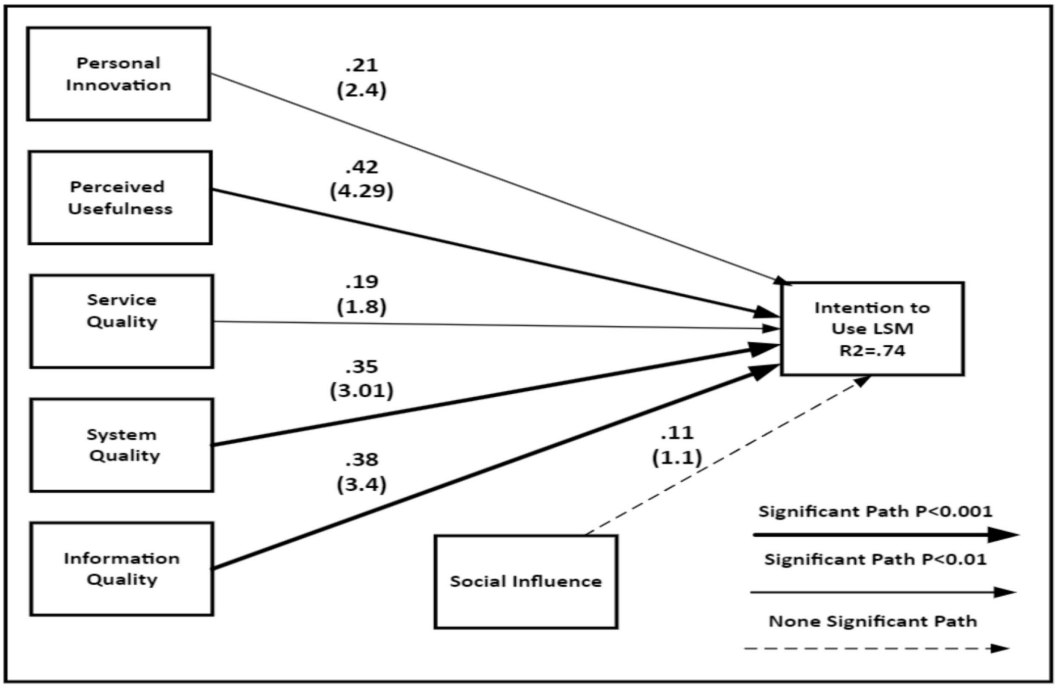

FIGURE 2
PLS results of the research model.

Discussion and conclusion

Discussion

The study aims to investigate and attempt to predict students' use of LMS through a suggested model composed of several factors: personal innovation, perceived usefulness, service quality, system quality, information quality, and social influence. The proposed model was correct for all variables except social influence, which, according to the result, does not affect students' intention to use LMS. In other words, students perceive that an LMS will be used if it allows them to feed their personal innovation and if it is useful for their academic progress. Notably, personal innovativeness had a considerable impact on behavioral intention, with a path coefficient of 0.25, indicating that it is an important contributor to students' intention to use LMS. This finding is in line with earlier research (Ngafeeson and Sun, 2015; Zwain, 2019). In this regard, the authors argue that students who are more technologically innovative will use the LMS system more. We can conclude that students of innovative technology can easily adapt to any system or procedure compared to non-innovative students. This will boost not just the academic performance of students but also the institution's technological image.

The research further discovered that factors such as system quality and service quality of the LMS are significant variables in determining students' intention to consistently use an E-LMS. This conclusion aligns with previous research undertaken by Sharma et al. (2017), Alkhateeb and Abdalla (2021), and Cavus et al. (2021), on student satisfaction with e-LMSs. According to their assertions, for educational institutions to better use the LMS, it is vital to ascertain that the system has robust functionality and offers services of exceptional quality. The present investigation revealed that system quality exerted the second most significant influence on students' inclination to use LMS. The aforementioned observation aligns with the research outcomes of Alkhateeb and Abdalla (2021) as well as Lwoga (2014). Both investigations conducted in this research have shown that system quality emerged as a very relevant factor in determining student happiness. Conversely, the impact of service quality on student satisfaction was found to be statistically insignificant. This emphasizes

the significance of factors such as interactivity, navigation speed, and layout in achieving student satisfaction, highlighting the relevance of quality considerations in this regard. Student satisfaction is positively correlated with their perception of the LMS being interactive, including a suitable layout that facilitates easy access to information, and promptly addressing any issues that may arise. Alkateeb and Abdallah (Alkhateeb and Abdallah, 2021), it is essential that the system's availability and the accompanying people address students' concerns and provide them with the necessary help, hence enhancing their overall happiness.

According to this study, the influence of perceived usefulness is the most significant on students' intentions to use LMS. The findings were consistent with recent studies conducted by Alkhateeb and Abdalla (Alkhateeb and Abdallah, 2021) and Bansah and Darko Agyei (2022) who found a strong connection between students' perception of how useful and informative the LMS is and their intention to use it. Furthermore, the findings are consistent with previous research by Elameer and Idrus, (Elameer and Idrus, 2010) and Alkhateeb & Abdalla (Alkhateeb and Abdalla, 2021), and Jafari et al. (Jafari et al., 2015) found that perceived usefulness was the second-highest factor that positively impacted students' future use of MOODLE, which is an open-source LMS. Such findings suggest that when students perceive that the system provides them with useful information, they are more likely to continue using it for their academic purposes. In other words, students prefer to use an LMS because it helps them achieve their academic tasks and activities. This corresponds with the benefits of using an LMS, namely, for the students to upload their assignments, follow course progress, connect with other students' posts, and contact their group regarding their projects. This observation aligns with the majority of research conducted on information systems, which indicates that individuals are more likely to use an information system if it assists them in completing their routine activities. The correlation between system quality and intention is of considerable significance. If LMSs were of superior quality, providing users with seamless navigation and uninterrupted interaction, students would be more inclined to actively participate in their usage. This discovery builds upon prior research on Technology Acceptance Model (TAM), which has consistently shown that the ease of use of technologies is the primary factor influencing consumers' attitudes towards technology adoption.

The proposed model showed a strong impact of the construct of information quality on students' future use of LMS. Furthermore, the findings are consistent with previous research by Elameer and Idrus, (Elameer and Idrus, 2010) and Alkhateeb & Abdalla (Alkhateeb and Abdalla, 2021), and Jafari et al. (Jafari et al., 2015), who found that information quality is a key determinant of student satisfaction. This seems reasonable, given that the goal of any LMS is to offer students current, accurate, and relevant information about their academic materials. In other words, students are more satisfied with the system if the LMS meets their demands and makes information available whenever and wherever they need it. It also indicates that students are aware of the relevance of the material provided.

Implications for educators

The onset of the COVID-19 pandemic and the consequent implementation of preventive measures necessitated higher education institutions and other educational bodies to adopt online LMS to sustain their educational endeavors. Even subsequent to the pandemic, numerous universities have opted to integrate E-learning as a viable option to cater to students' demands for flexible learning opportunities. However, this transition poses a challenge in enhancing LMS platforms to effectively engage students and facilitate the achievement of educational objectives.

This study proposes that educators should actively monitor student engagement during virtual sessions and endeavor to enhance the features of LMS platforms accordingly. The findings of this research indicate that students' intention to continue using LMS is positively influenced by their perception of the usefulness, system quality, and information quality provided by the platform. Moreover, the study reveals that personal innovation and the service quality offered by LMS are significant factors influencing students' future utilization of such systems.

Educators play a pivotal role in leveraging the factors identified in this study to enhance student engagement within LMS. Firstly, educators should focus on emphasizing the perceived usefulness of the LMS among students. By clearly articulating how the LMS facilitates learning objectives, educators can instill a sense of value and relevance in students, thereby encouraging their active participation. Additionally, educators need to prioritize the enhancement of system quality within the LMS platform. This involves ensuring that the technical functionalities and user interface of the system are user-friendly, reliable, and conducive to effective learning experiences. Regular assessments and updates to address any technical issues or limitations are crucial in maintaining high system quality.

Secondly, educators should place emphasis on service quality within the LMS environment. This entails providing prompt and effective support to students regarding any queries or technical challenges they encounter while using the platform. By offering responsive and personalized assistance, educators can foster a supportive learning environment that encourages students to actively engage with the LMS. Furthermore, educators need to pay attention to information quality within the LMS content. This involves curating and delivering high-quality, accurate, and relevant educational materials that cater to diverse learning styles and preferences. By ensuring the availability of comprehensive and well-organized learning resources, educators can enhance students' learning experiences and promote deeper engagement with the LMS. Lastly, educators should encourage and foster a culture of personal innovation among students within the LMS environment. By empowering students to explore creative and innovative ways of utilizing the platform to achieve their learning goals, educators can inspire intrinsic motivation and autonomy, leading to heightened engagement and academic success.

Conclusion

The aim of this study was to investigate the influence of personal innovation, perceived usefulness, system quality, service quality, and social presence on students' intention to use LMS in the context of the UAE college and university environment. The results indicate that students' future use of LMS is determined by the benefits of the LMS to students, the quality of the LMS, the quality of the services provided by LMS, and the personal innovation that the system stimulates in students, respectively. Overall, the factors identified in this study are closely related to those extracted in previous studies. Specifically, system quality and service quality emerge as the main E-learning factors in the studies of Sharma et al. (2017), Ameen et al. (Ameen et

al., 2019), and Cavus et al. (Cavus et al., 2021). This suggests that universities should shift their perspective on the LMS as a platform that serves their customers, not just as a means to transfer knowledge to students (Al-Nuaimi and Al-Emran, 2021). It can be argued that such a direction is imperative for universities given that most IT applications already conform to such a trend because the current user is highly demanding and will seek another platform if their needs are not met.

This study contributes significantly to the existing literature by emphasizing the crucial role of service and system quality features in shaping the overall experience of students using LMS in the United Arab Emirates (UAE). The identified elements influencing students' inclination to utilize the LMS are system quality, service quality, and personal innovativeness. This research establishes a connection between these factors and previously examined variables, such as perceived ease of use and perceived pleasure, proposing a potential integration to enhance the design of LMS and improve student satisfaction. It suggests that the notion of system quality has a comparable nature. This research has the potential to enhance the understanding of users' usage patterns in online learning systems, thereby enabling the promotion of active engagement with these systems as a complementary alternative to traditional face-to-face classrooms. Additionally, the research outcomes are expected to provide insights into the formulation of approaches aimed at understanding and enhancing the utilization of LMS by students, promising a sustainable learning experience among students engaged in online education.

Another contribution of this article lies in the introduction and evaluation of a new research model that introduces new variables such as achieving academic tasks (manifested in the construct of perceived usefulness). Although the study's model used TAM's famous concept of perceived usefulness, the questions asked reflected the contextual benefits of the LMS (BlackBoard in this case). For instance, students were asked questions related to their online learning environment and the benefits of the Blackboard platform for them. Examples of the questions include: using LMS enables me to accomplish my assignment tasks more quickly; using LMS makes it easier to perform my course-related tasks, and using LMS enhances the effectiveness of my course-related tasks. Initially, generic forms of the perceived usefulness construct based on TAM were used during the survey design, but the sample of students found this construct too general, leading to its contextualization to fit the benefits of the LMS environment.

This study aims to evaluate the behavioral intention to use LMS by consolidating several factors revealed in previous research into a comprehensive framework. While these elements have been individually explored, they have not been collectively examined to evaluate students' adoption of LMS. Specifically, this research integrated the constructs of system quality, service quality, and information quality as proposed by Delone and McLean (2003) with the perceived usefulness construct from the Technology Acceptance Model (TAM). The objective was to examine the impact of these factors on students' behavioral intention to use LMS. Additionally, the research enhanced the suggested model by including a social impact element derived from the Unified Theory of Acceptance and Use of Technology (UTAUT) (Nguyen et al., 2014). These characteristics were shown to have predictive power in determining that around 75% of students had intentions to use a LMS during the epidemic.

Actionable strategies for educational institutions

Based on the findings and contributions of the study, here are some actionable requirements for online LMS in the context of UAE colleges and universities:

1. Enhanced System Quality: LMS platforms should prioritize reliability, responsiveness, ease of navigation, and feature availability to ensure a positive user experience.
2. Improved Service Quality: Institutions need to focus on providing high-quality services through the LMS, including prompt technical support, clear communication channels, and user-friendly interfaces to enhance student satisfaction.
3. Integration of Personal Innovativeness: LMS should incorporate features that stimulate personal innovativeness among students, encouraging them to explore new ways of learning and engaging with course materials.
4. Contextualized Perceived Usefulness: The perceived usefulness of the LMS should be tailored to match students' academic needs and tasks, ensuring that the platform supports their coursework and assignments.
5. Comprehensive Evaluation Framework: Develop a comprehensive framework for assessing LMS performance, incorporating factors such as system quality, service quality, information quality, perceived usefulness, and social impact, to provide insights into student adoption and usage patterns.
6. Continuous Improvement Cycle: Implement a continuous improvement cycle for LMS platforms based on feedback from students and faculty, ensuring that the system evolves to meet changing educational needs and technological advancements.
7. Training and Support: Provide comprehensive training and support resources for both students and faculty to ensure a good utilization of the LMS, addressing usability issues and promoting user proficiency.
8. Accessibility and Inclusivity: Ensure that the LMS is accessible to all students, including those with disabilities, by adhering to accessibility standards and providing alternative formats for content delivery.
9. Data Security and Privacy: Prioritize data security and privacy measures within the LMS to protect sensitive student information and ensure compliance with relevant regulations and standards.

Limitations and future research

Although the sample data were sufficiently large, the study's scope was limited to some colleges in the UAE. The next phase should encompass universities from diverse regions worldwide to develop a more generalized model and yield broader results. For instance, conducting similar research in countries with varying cultural, educational, and technological contexts could unveil unique insights into LMS adoption patterns and drivers. Moreover, the study relied on five variables extracted from research rich in TAM. An intuitive progression would involve incorporating additional factors such as perceived enjoyment, students' attitudes toward LMS, and facilitating conditions. These variables have the potential to influence the interactions among all factors, potentially altering the outcomes. For example, perceived enjoyment may indicate students' satisfaction

with the user interface or the engaging nature of online learning materials, while students' attitudes toward LMS could encompass their perceptions of its relevance to their academic goals.

While SEM is a well-established method for uncovering relationships among latent constructs, leveraging other contemporary tools could enhance the structural model. Modern data mining tools like Artificial Intelligence (AI) models, Support Vector Machine (SVM), and Artificial Neural Network (ANN) could serve as supportive tools for confirming or disproving relationships among the study variables. For instance, AI models could analyze extensive datasets to reveal hidden patterns or predict students' behavior toward LMS adoption based on various input variables.

Furthermore, it is imperative for future studies to adopt a holistic perspective that considers the multifaceted nature of LMS adoption. This entails recognizing the roles played by instructors, information technology infrastructure, institutional support mechanisms, and other contextual factors in shaping students' experiences with LMS. For instance, understanding how instructors' teaching styles or institutional policies influence students' perceptions of LMS usability and performance can offer valuable insights for enhancing LMS implementation strategies.

We acknowledge that one of the limitations of this study is the length of the survey, which consisted of 60 items. However, given that the survey was conducted at a time when students were accustomed to working online, we believe this did not pose a significant issue. An intuitive next step is to reduce the number of questions to improve the questionnaire's usability and prevent respondent fatigue.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

HA: Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, JD: Investigation, Methodology, Formal analysis, Validation, Writing – original draft, Writing – review & editing. FK: Project administration, Resources, Software, Supervision, Writing – original draft, Writing – review & editing. DH: Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

Adams, R, and Mcintyre, N (2020). Available at: https://www.theguardian.com/education/2020/aug/13/england-a-level-downgrades-hit-pupils-from-disadvantaged-areas-hardest

Ain, N., Kaur, K., and Waheed, M. (2016). The influence of learning value on learning management system use: an extension of UTAUT2. *Inf. Dev.* 32, 1306–1321. doi: 10.1177/0266666915597546

Al-Busaidi, K. (2012). Learners' perspective on critical factors to LMS success in blended learning: an empirical investigation. *Commun. Assoc. Inf. Syst.* 30:2. doi: 10.17705/1CAIS.03002

Alkhateeb, M. A., and Abdalla, R. A. (2021). Social media adoption and its impact on SMEs performance: a case study of Palestine. *Stud. Appl. Econ.* 39. doi: 10.25115/eea.v39i7.4872

Allam, H., Bliemel, M., Ali-Hassan, H., Blustein, J., and Spiteri, L. (2020). If you build it, they Won't come: what motivates employees to create and share tagged content: a theoretical model and empirical validation. *Int. J. Inf. Manag.* 54, –102148. doi: 10.1016/j.ijinfomgt.2020.102148

Allam, H., Bliemel, M., Spiteri, L., Blustein, J., and Ali-Hassan, H. (2019). Applying a multi-dimensional hedonic concept of intrinsic motivation on social tagging tools: a theoretical model and empirical validation. *Int. J. Inf. Manag.* 45, 211–222. doi: 10.1016/j.ijinfomgt.2018.11.005

Al-Nuaimi, M. N., al Sawafi, O. S., Malik, S. I., al-Emran, M., and Selim, Y. F. (2022). Evaluating the actual use of learning management systems during the covid-19 pandemic: an integrated theoretical model. *Interact. Learn. Environ.* 31, 6905–6930. doi: 10.1080/10494820.2022.2055577

AL-Nuaimi, M. N., Al Sawafi, O. S., Malik, S. I., Al-Emran, M., and Selim, Y. F. (2023). Evaluating the actual use of learning management systems during the covid-19 pandemic: an integrated theoretical model. *Interact. Learn. Environ.* 31, 6905–6930.

Al-Nuaimi, M. N., and Al-Emran, M. (2021). Learning management systems and technology acceptance models: a systematic review. *Educ. Inf. Technol.* 26, 5499–5533. doi: 10.1007/s10639-021-10513-3

Al-Samarraie, H., Teng, B. K., Alzahrani, A. I., and Alalwan, N. (2003). E-learning continuance satisfaction in higher education: a unified perspective from instructors and students. *Stud. High. Educ.* 43, 2003–2019. doi: 10.1080/03075079.2017.1298088

Ameen, N., Willis, R., Abdullah, M. N., and Shah, M. (2019). Towards the successful integration of e-learning systems in higher education in Iraq: a student perspective. *Br. J. Educ. Technol.* 50, 1434–1446. doi: 10.1111/bjet.12651

Attuquayefio, S., and Addo, H. (2014). Using the UTAUT model to analyze students' ICT adoption. *Int. J. Educ. Develop. ICT* 10.

Azizi, S. M., Roozbahani, N., and Khatony, A. (2020). Factors affecting the acceptance of blended learning in medical education: application of UTAUT2 model. *BMC Med. Educ.* 20:367. doi: 10.1186/s12909-020-02302-2

Bansah, A. K., and Darko Agyei, D. (2022). Perceived convenience, usefulness, effectiveness and user acceptance of information technology: evaluating students' experiences of a learning management system. *Technol. Pedagog. Educ.* 31, 431–449. doi: 10.1080/1475939X.2022.2027267

Binyamin, S., Rutter, M. J., and Smith, S., "The moderating effect of education and experience on students' use of learning Management Systems in Saudi Higher Education (2019). Available at: https://napier-repository.worktribe.com/output/1617313

Camilleri, M. A., and Camilleri, A. C. (2021). The acceptance of learning management systems and video conferencing technologies: lessons learned from COVID-19. *Technol. Knowl. Learn.* 27, 1311–1333. doi: 10.1007/s10758-021-09561-y

Cavus, N., Mohammed, Y. B., and Yakubu, M. N. (2021). Determinants of learning management systems during COVID-19 pandemic for sustainable education. *Sustainability* 13:5189. doi: 10.3390/su13095189

Chaudhry, I. S., Paquibut, R., Islam, A., and Chabchoub, H. (2021). Testing the success of real-time online delivery channel adopted by higher education institutions in the United Arab Emirates during the COVID-19 pandemic. *Int. J. Educ. Technol. High. Educ.* 18:48. doi: 10.1186/s41239-021-00283-w

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern Methods for Business Research* 295, 295–336.

Chin, W. W., Peterson, R. A., and Brown, S. P. (2008). Structural equation modeling in marketing: some practical reminders. *J. Mark. Theory Pract.* 16, 287–298. doi: 10.2753/mtp1069-6679160402

Chine, WW, Chin, W. W., Soft Modeling Inc.Chin, W., and Frye, T. (2001). "PLS-Graph User's Guide,". Available at: https://spss-pasw.ir/upload/images/ei8gx66re11tenmq0sm.pdf

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* 13, 319–340. doi: 10.2307/249008

Delone, W. H., and Mclean, E. R. (1992). Information systems success: the quest for the dependent variable. *Inf. Syst. Res.* 3, 60–95. doi: 10.1287/isre.3.1.60

Delone, W., and McLean, E. (2003). The DeLone and McLean model of information systems success: a ten-year update. *J. Manag. Inf. Syst.* 19, 9–30. doi: 10.1080/07421222.2003.11045748

Elameer, S., and Idrus, R. M. (2010). The readiness for an e-learning system in the University of Mustansiriyah (UoMust) Baghdad-Iraq. *Malay. J. Educ. Technol.* 10, 31–41.

Fathema, N., Shannon, D., and Ross, M. (2015). Expanding the technology acceptance model (TAM) to examine faculty use of learning management systems (LMSs) in higher education institutions. *J. Online Learn. Teach.* 11, 210–232.

Fornell, C., and Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: algebra and statistics. *J. Mark. Res.* 18, 382–388. doi: 10.1177/002224378101800313

Gefen, D., Rigdon, E. E., and Straub, D. (2011). Editor's comments: an update and extension to SEM guidelines for administrative and social science research. *MIS Q.* 35, iii–xiv. doi: 10.2307/23044042

Hair, J. F., Ringle, C. M., and Sarstedt, M. (2011). PLS-SEM: indeed a silver bullet. *J. Mark. Theory Pract.* 19, 139–152. doi: 10.2753/MTP1069-6679190202

Hassnzadeh, A., Kanaani, F., and Al Alahi, S. (2012). A model for measuring E-learning systems success in universities - ScienceDirect. *Expert Syst. Appl.* 39, 10959–10966. doi: 10.1016/j.eswa.2012.03.028

Hsu, M. K., Wang, S. W., and Chiu, K. K. (2009). Computer attitude, statistics anxiety and self-efficacy on statistical software adoption behavior: an empirical study of online MBA learners. *Comput. Hum. Behav* 25, 412–420. doi: 10.1016/j.chb.2008.10.003

Jafari, S M, Salem, S F, Moaddab, M S, and Salem, S O. (2015). Learning Management System (LMS) success: An investigation among the university students. In Proceeding of 2015 IEEE Conference on e-Learning, e-Management and e-Services (IC3e), 64–69

Li, C., and Lalani, F., (2020). "The COVID-19 Pandemic Has Changed Education Forever," World Economic Forum. Available at: https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/

Lin, H., and Hwang, Y. (2014). Do feelings matter? The effects of intrinsic benefits on individuals' commitment toward knowledge systems. *Comput. Hum. Behav.* 30, 191–198. doi: 10.1016/j.chb.2013.07.056

Lwoga, E. (2014). Critical success factors for adoption of web-based learning management systems in Tanzania. *Int. J. Educ. Develop. ICT* 10.

Mastan, A., Sensuse, D. I., Suryono, R. R., and Kautsarina, K. (2022). Evaluation of distance learning system (e-learning): a systematic literature review. *Jurnal Teknoinfo* 16:132. doi: 10.33365/jti.v16i1.1736

Müller, F. A., and Wulf, T. (2020). Technology-supported management education: a systematic review of antecedents of learning effectiveness. *Int. J. Educ. Technol. High. Educ.* 17:47. doi: 10.1186/s41239-020-00226-x

Ndebele, C., and Mbodila, M. (2022). Examining technology acceptance in learning and teaching at a historically disadvantaged University in South Africa through the technology acceptance model. *Educ. Sci.* 12:54. doi: 10.3390/educsci12010054

Ngafeeson, M., and Sun, J. (2015). The effects of technology innovativeness and system exposure on student acceptance of E-textbooks. *J. Inform. Technol. Educ.* 14, 055–071. doi: 10.28945/2101

Ngampornchai, A., and Adams, J. (2016). Students' acceptance and readiness for E-learning in northeastern Thailand. *Int. J. Educ. Technol.* 13, 1–13. doi: 10.1186/s41239-016-0034-x

Nguyen, T. D., Nguyen, D. T., and Cao, T. H. (2014). "Acceptance and use of information system: E-learning based on cloud computing in Vietnam," in *Information and Communication Technology: Second IFIP TC5/8 International Conference, ICT-EurAsia 2014, Bali, Indonesia, April 14-17, 2014. Proceedings 2.* Berlin Heidelberg: Springer, 139–149. Available at: https://link.springer.com/chapter/10.1007/978-3-642-55032-4_14

Nunnally, J, (1994). Available at: https://cir.nii.ac.jp/crid/1370002219408110722

O'Connor, Y., O'Connor, S., Heavin, C., Gallagher, J., and O'Donoghue, J. (2016). "Sociocultural and technological barriers across all phases of implementation for mobile health in developing countries," in *Applied Computing in Medicine and Health* (Morgan Kaufmann), 212–230. Available at: https://www.sciencedirect.com/science/article/abs/pii/B9780128034682000102

Pokhrel, S., and Chhetri, R. (2021). A literature review on impact of COVID-19 pandemic on teaching and learning. *Higher Educ. Future* 8, 133–141. doi: 10.1177/2347631120983481

Raza, S. A., Qazi, W., Khan, K. A., and Salam, J. (2020). Social isolation and acceptance of the learning management system (LMS) in the time of COVID-19 pandemic: an expansion of the UTAUT model. *J. Educ. Comput. Res.* 59, 183–208. doi: 10.1177/0735633120960421

Ropaka, M., Nikolaou, D., and Yannis, G. (2020). Investigation of traffic and safety behavior of pedestrians while texting or web-surfing. *Traffic Inj. Prev.* 21, 389–394. doi: 10.1080/15389588.2020.1770741

Sánchez, R. A., and Hueros, A. D. (2010). Motivational factors that influence the acceptance of Moodle using TAM. *Comput. Hum. Behav.* 26, 1632–1640. doi: 10.1016/j.chb.2010.06.011

Schoonenboom, J. (2014). Using an adapted, task-level technology acceptance model to explain why instructors in higher education intend to use some learning management system tools more than others. *Comput. Educ.* 71, 247–256. doi: 10.1016/j.compedu.2013.09.016

Sharma, S. K., Gaur, A., Saddikuti, V., and Rastogi, A. (2017). Structural equation model (SEM)-neural network (NN) model for predicting quality determinants of E-learning management systems. *Behav. Inform. Technol.* 36, 1053–1066. doi: 10.1080/0144929X.2017.1340973

Shmueli, G., Ray, S., Estrada, J. M. V., and Chatla, S. B. (2016). The elephant in the room: predictive performance of PLS models. *J. Bus. Res.* 69, 4552–4564. doi: 10.1016/j.jbusres.2016.03.049

Stodnick, M., and Rogers, P. (2008). Using SERVQUAL to measure the quality of the classroom experience. *Decision Sci. J. Innov. Educ.* 6, 115–133. doi: 10.1111/j.1540-4609.2007.00162.x

Straub, D., Boudreau, M. C., and Gefen, D. (2004). Validation guidelines for IS positivist research. *Commun. Assoc. Inf. Syst.* 13:24. doi: 10.17705/1CAIS.01324

Syed, A. M., Ahmad, S., Alaraifi, A., and Rafi, W. (2021). Identification of operational risks impeding the implementation of eLearning in higher education system. *Educ. Inf. Technol.* 26, 655–671. doi: 10.1007/s10639-020-10281-6

Tulinayo, F. P., Ssentume, P., and Najjuma, R. (2018). Digital technologies in resource constrained higher institutions of learning: a study on students' acceptance and usability. *Int. J. Educ. Technol. High. Educ.* 15:36. doi: 10.1186/s41239-018-0117-y

Uppal, M. A., Ali, S., and Gulliver, S. R. (2017). Factors determining e-learning service quality. *Br. J. Educ. Technol.* 49, 412–426. doi: 10.1111/bjet.12552

Urbach, N., and Ahlemann, F. (2010). Structural equation modeling in information systems research using partial least squares. *J. Inform. Technol. Theory Appl.* 11:2.

Van Raaij, E. M., and Schepers, J. J. L. (2008). The acceptance and use of a virtual learning environment in China. *Comput. Educ.* 50, 838–852. doi: 10.1016/j.compedu.2006.09.001

Venkatesh, V. (2000). Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Inf. Syst. Res.* 11, 342–365. doi: 10.1287/isre.11.4.342.11872

Venkatesh, V., and Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decis. Sci.* 39, 273–315. doi: 10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. (2003). User acceptance of information technology: toward a unified view. *MIS Q.* 27, 425–478. doi: 10.2307/30036540

Waheed, M., Kaur, K., Ain, N., and Hussain, N. (2016). Perceived learning outcomes from Moodle: an empirical study of intrinsic and extrinsic motivating factors. *Inf. Dev.* 32, 1001–1013. doi: 10.1177/0266666915581719

Wang, R. Y., and Strong, D. M. (1996). Beyond accuracy: what data quality means to data consumers. *J. Manag. Inf. Syst.* 12, 5–33. doi: 10.1080/07421222.1996.11518099

Wang, Y.-S., Wang, H.-Y., and Shee, D. Y. (2007). Measuring e-learning systems success in an organizational context: scale development and validation. *Comput. Hum. Behav.* 23, 1792–1808. doi: 10.1016/j.chb.2005.10.006

Wang, Y., Yu, L., and Yu, Z. (2022). An extended CCtalk technology acceptance model in EFL education. *Educ. Inf. Technol.* 27, 6621–6640. doi: 10.1007/s10639-022-10909-9

Zwain, A. A. A. (2019). Technological innovativeness and information quality as neoteric predictors of users' acceptance of learning management system: an expansion of UTAUT2. *Interact. Technol. Smart Educ.* 16, 239–254. doi: 10.1108/ITSE-09-2018-0065