Journal of Information Technology Education: Research

An Official Publication of the Informing Science Institute
InformingScience.org

JITEResearch.org

Volume 21, 2022

TOWARDS A SUSTAINABLE ADOPTION OF E-LEARNING SYSTEMS: THE ROLE OF SELF-DIRECTED LEARNING

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ABSTRACT

Aim/Purpose	This study seeks to investigate the factors that influence online students' continued usage intention toward e-learning systems by presenting an extended model that is based on the Delone and McLean (2003) IS success model (D&M ISS model).
Background	The use of e-learning systems in this era has become a vital element of delivering higher education. Learning via e-learning systems has significant benefits that support conventional learning. Thus, it is crucial to measure the success of e-learning systems' implementation.
Methodology	This study was conducted with 590 undergraduate and postgraduate students from three private universities in Jordan, and data was gathered via an online self-report questionnaire.

Accepting Editor Peter Blakey | Received: February 13, 2022 | Revised: March 28, April 13, May 1, May 20, 2022 | Accepted: May 21, 2022.

Cite as: Al-Adwan, A. S., Nofal, M., Akram, H., Albelbisi, N. A., & Al-Okaily, M. (2022). Towards a sustainable adoption of e-learning systems: The role of self-directed learning. *Journal of Information Technology Education: Research, 21,* 245-267. https://doi.org/10.28945/4980

Contribution	Theoretically, this study advances the literature and empirically examines a modified version of the D&M ISS model by including context-specific factors that are drivers of successful implementations of e-learning systems.
Findings	The path analysis with structural equation modelling confirms that students' satisfaction and their continued usage intention regarding the e-learning system are positively related to service quality, system quality, and information quality. Self-directed learning, however, has a negative effect on satisfaction and continued usage intention. Furthermore, the findings reveal that both satisfaction and continued usage intention positively influence students' perceptions of perceived academic performance.
Recommendations for Practitioners	The quality of learning content format and design are recognized as fundamental factors for e-learning success. Thus, both instructors and e-learning developers should provide reliable, accurate, and up-to-date learning materials. This directs e-learning developers toward designing systems with simple and useful functionalities that embrace the essential features that enable students to perform the required tasks effectively and to access and share learning materials flexibly. Furthermore, the current study reveals that self-directed learning (SDL) is a key barrier to successful e-learning system employment. It has a negative impact on satisfaction (SAT) and continued usage intention (CUI). Thus, developing students' skills related to SDL is deemed a necessity. This could be attained by designing contemporary pedagogical curricula that are based on student-centered learning. This approach to learning encourages students to acquire self-regulatory skills and be accountable for their learning. This environment has to be supported by pedagogical tools (e.g., synchronous/asynchronous communication channels and multimedia tools) to enable effective interaction between instructors and students.
Recommendations for Researchers	The current study does not investigate the role of potential moderators that might influence the research model's relationships. Future studies might tackle such limitation by examining the moderating effect of computer self-efficacy and culture.
Impact on Society	This study reveals that the success of e-learning systems depends not only on the quality of the information, system, and service but also on student self-directed learning.
Future Research	The sample employed for this study was selected from three private universities in Jordan; consequently, the results cannot be generalized to the entire student population of Jordan. Further research, therefore, should focus on targeting a larger scope by including public universities, which in turn would enhance the generalizability of the findings. In addition, this cross-sectional study was conducted using a quantitative method based on the use of self-reported online survey to gather data. Thus, future research should consider longitudinal study that employs a mixed methods approach to reveal additional constructs and insights regarding e-learning system adoption by students.
Keywords	success factors, e-learning, Moodle, information quality, continuous usage, self-direct learning, IS success model

INTRODUCTION

E-learning refers to the use of information technology to convey information and knowledge for the purpose of training and education; it has emerged as a modern education paradigm (Cidral et al., 2018). It encompasses the utilization of the web to access knowledge and information, disregarding time and space. The adoption of e-learning by higher education institutions (HEIs) – both public and private – has led to the implementation of a variety of web-based platforms (i.e., e-learning systems) that are available to students (Eze et al., 2020). Such adoption is encouraged due to several benefits, including geographical scope, simple access, learning control (enhanced convenience and flexibility), high-quality learning content, and lower learning costs. As a result, the use of e-learning systems is one of the most important current developments in higher education, with a rapid growth rate (Almajali & Masadeh, 2021; Safsouf et al., 2020). E-learning systems are considered as web-based systems that are utilized to provide e-learning. They make managing, organizing, and following online courses easier.

The COVID-19 epidemic has contributed significantly in increasing the adoption of e-learning by HEIs. Universities have been forced to close face-to-face teaching and send students home due to the COVID-19 epidemic (Al-Bashayreh et al., 2022; Al-Okaily et al., 2020a; Shahzad et al., 2021; Yaseen et al., 2021; Wang et al., 2021). As a result, institutions are being forced to provide courses through e-learning portals. Since the COVID-19 outbreak, e-learning in universities worldwide has increased exponentially (Akram et al., 2021; Almajali et al., 2021; Al-Okaily et al., 2020b; Dhawan, 2020). However, implementing a successful e-learning system in HEIs is recognized as a lengthy process that necessitates allocating a substantial amount of effort and time to organize and plan the learning management system (San-Martín et al., 2020). Institutional support, which is reflected by a significant financial commitment and institutional acknowledgment of the dedication, is also required for e-learning implementation success. Furthermore, the system quality and the instructors' and students' self-perceptions and long-term dedication are all key factors as long-term usage of the system is vital to e-learning systems' success. It has been argued by Almaiah et al. (2020) that the continued usage of e-learning systems by students determines their success and that poor usage of such systems hinders students from realizing system advantages, resulting in failed e-learning systems and, as a result, low return on investment.

Hence, a considerable number of studies have investigated the main success elements of e-learning to assist e-learning stakeholders in successfully implementing these systems (Al-Adwan et al., 2021; Al Mulhem, 2020; Seta et al., 2018; Yakubu & Dasuki, 2018; Zhang et al., 2020). Despite the fact that these studies have sought to determine the key critical success factors for e-learning systems, they have not uncovered all of them. Additionally, these studies have focused on system usage instead of continued usage intention (CUI). CUI is deemed the main indicator of e-learning system success as it refers to the long-term usage of such systems (Lwoga & Komba, 2015). Moreover, Al-Fraihat et al. (2020) and Al-Adwan et al. (2021) identify that further research is needed to offer a contextualized model that considers context-specific factors to assess the success of e-learning systems. Because the relative importance of e-learning success factors varies depending on the context, numerous solutions for dealing with these issues have been developed. For instance, in developing countries, hurdles are found regarding infrastructure, access, and resources. On the other hand, aspects such as improving lifelong education, information quality, system usefulness, and ethical considerations are more pronounced in developed countries (Al-Fraihat et al., 2020). Accordingly, this study aims to fill these gaps by investigating the factors that influence the success of e-learning and by proposing a model that incorporates the determinants for e-learning success that are of recent concern and interest to e-learning users, and sharing practical experiences of e-learning success measurements in developing countries such as, Jordan. In particular, this study seeks to investigate the key success factors that influence online students' CUI toward e-learning systems by presenting a modified model that is based on the Delone and McLean (2003) IS success model (D&M ISS model). It empirically exam-

ines the impact of students' self-directed learning beliefs, service quality, information quality, and system quality on students' satisfaction, CUI, and perceived academic performance. The proposed model is expected to guide the efforts of HEIs in Jordan to successfully and sustainably adopt e-learning systems. The following section presents the theoretical foundation. Following this, the development of the research hypotheses is introduced. Thereafter, the research methodology is discussed, followed by the results and the discussion. Finally, the theoretical and practical implications are highlighted.

THE THEORETICAL FOUNDATION

It is proposed that continued usage during the stage of post-implementation is more important to determine the IS' success than initial usage during the pre-implementation stage (Bhattacherjee, 2001). Thus, continuous usage is treated by this study as the focal point. The updated D&M ISS model is used to fulfil the goal of this study. The D&M ISS model was first introduced in 1992 and was later updated in 2003 to tackle the criticisms of the original version (DeLone & McLean, 1992, 2003). The updated model proposes that service quality, information quality, and system quality directly influence user satisfaction, intention to use, and actual use (Al-Okaily, 2021). Furthermore, the "net benefit" construct is influenced by user satisfaction, intention to use, and actual use. The literature notes that the updated D&M ISS model is adequate to measure the success of a particular IS as it meets all the essential criteria for IS success assessment (Al-Okaily & Al-Okaily, 2022; Mohammadi, 2015). Particularly, the D&M ISS model is deemed appropriate for this study since it captures both system and information qualities, as opposed to other acceptance models that solely address a subset of these qualities (Yakubu & Dasuki, 2018). However, while the updated D&M ISS model has been applied in several contexts, it is suggested that the model should be constantly modified and tested within these various contexts to prove its reliability and validity (Delone & McLean, 2003). Correspondingly, this study presents the construct of self-directed learning (SDL) as context-specific and related to the context of e-learning settings. The newly added construct is operationalized as a key determinant of student satisfaction and CUI (see Figure 1). SDL is an essential success factor for e-learning (Al-Adwan, 2020; Al-Adwan et al., 2021). The nature of Jordan's educational culture, in which students regard instructors as the primary source of knowledge, means that well-structured and formal learning spaces, such as classrooms, are still appealing to Jordanian students (Al-Adwan et al., 2022; Al-Adwan, Al-Adwan, & Berger, 2018, Al-Adwan, Al-Madadha, & Zvirzdinaite, 2018). In e-learning, there is usually just a little direct interaction between the instructor and the students, putting the responsibility on the students to control their own learning. As a result, learners must self-regulate their learning by observing and altering their behaviors and actions in relation to their specific learning environment. According to Hood et al. (2015), learners with greater self-regulated learning skills employ more effective learning approaches in online learning. Examining the impact of SDL is important because it underlies the degree of abilities necessary for self-directed and independent learning.

Furthermore, this study proposes student perceived academic performance as the main outcome variable of the research model. According to DeLone and McLean (1992), the ISSM proposes that a well-functioning and effective IS has a beneficial impact on individual performance. Empirically research found it has been confirmed that there is a significant relationship between student satisfaction and the outcomes of e-learning (Al-Adwan et al., 2020; Al-Adwan et al., 2021; Islam, 2013;). It is reasonable to propose that by establishing effective connections with students in a learning environment and cooperating on a specific topic, students' learning is prominently improved in that topic. Many scholars suggest collaborative social learning groups as a critical element in both traditional and online settings for attaining improved learning outcomes (Islam, 2013; Šumak et al., 2011). By providing a timely learning content and enabling active online discussions, students through using e-learning may improve their learning compared with other learning modes. Consequently, improved learning is anticipated to contributing in enhanced academic performance.

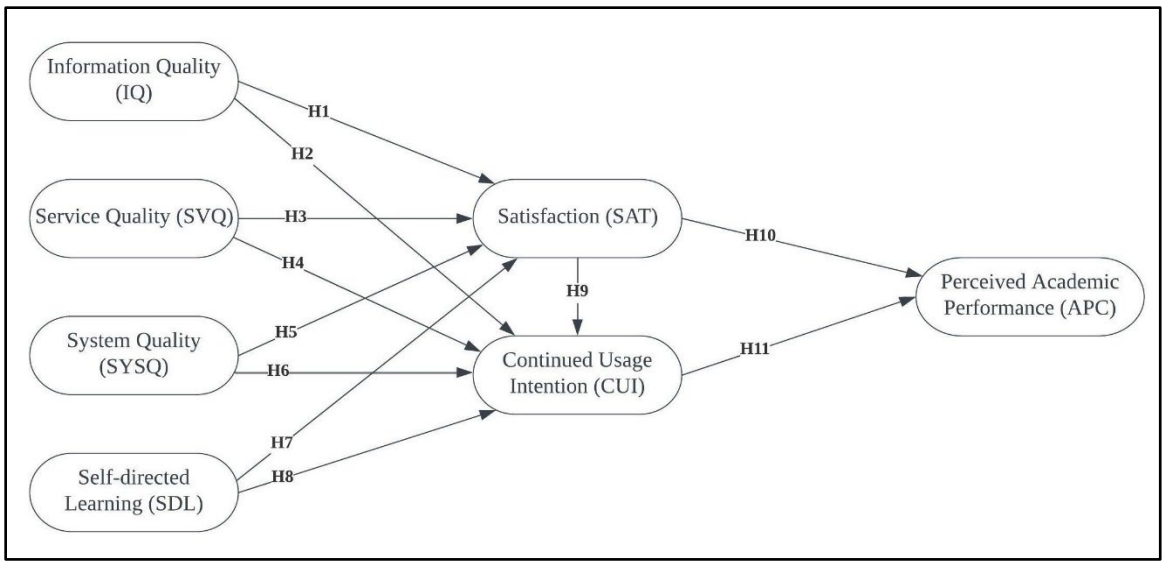

Figure 1. The research Model

HYPOTHESES DEVELOPMENT

Information quality (IQ)

IQ is defined by Zhang et al. (2020, p. 4) as the "quality of the information provided by the system." The literature confirms that IQ is recognized as a critical factor in determining the success of e-learning systems (Al-Fraihat et al., 2020; Cidral et al., 2018). While high IQ facilitates the achievement of learning goals, poor IQ is seen a source of serious issues that negatively affect the learning process (Cidral et al., 2020). IQ is considerably related to the content of the e-learning systems (Kurt, 2019). It is fundamental to providing students with necessary information and learning materials that support them to achieve learning goals. Thus, the content offered by the e-learning systems should be sufficient, complete, valid, up to date, reliable, easy to understand, secure, accurate, relevant, timely available, and consistent (Al-Fraihat et al., 2020; Cidral et al., 2018; Kurt, 2019; Ramadiani et al., 2017). E-learning systems that are fundamentally developed and designed to fulfil student needs are more likely to be used and positively impact students' satisfaction and learning outcomes. Many scholars endorse the positive impact of IQ on students' behavioral intention to use e-learning systems (Zhang et al., 2020), their usage of e-learning systems (Aldholay et al., 2018; Al-Fraihat et al., 2020; Cidral et al., 2018; Yakubu & Dasuki, 2018), and their continued usage of e-learning systems (Cidral et al., 2020). In addition, the positive influence of IQ on student satisfaction is evident in the literature (Aldholay et al., 2018; Shahzad et al., 2021). Similarly, this study suggests that enhanced IQ of an e-learning system leads to an increase in student satisfaction and favorable intention to continue using the system.

H1: "Information quality positively influences student satisfaction."

H2: "Information quality positively influences student continued usage intention regarding the e-learning system."

Service quality (SVQ)

It is suggested that a student-centered approach is a promising strategy for enhancing educational service quality in universities (Pham et al., 2019). The main aim behind this strategy is to treat students as customers, and HEIs (e.g., universities) are required to do their utmost to offer students excellent educational services. This is expected to encourage students to be more loyal to and satisfied

with their university. Such a notion is amplified with the increased employment of educational technologies (such as e-learning systems) in higher education. Students are now treated as customers, and HEIs must provide the highest quality e-learning services possible (Martinez-Arguelles & Batalla-Busquets, 2016). Shahzad et al. (2021, p. 810) define SVQ as "how efficiently the technical department responds to the queries of users." It reflects the support quality that students receive from the IT personnel (e.g., hotline, helpdesk, and training) (Mkinga & Mandari, 2020). Thus, the delivery of reliable and timely services that address user-specific requirements might result in an enhanced services delivery of e-learning systems to students. The main SVQ attributes related to e-learning systems can be measured in terms of empathy, confidence, responsiveness, follow-up, security, and trust of the supporting staff (Alzahrani et al., 2019; Cidral et al., 2020). Prior literature highlights SVQ as a fundamental element for successful e-learning systems adoption (Al-Adwan et al., 2021; Turugare & Rudhumbu, 2020) and reveals that providing adequate and sufficient IT services in universities regarding e-learning systems is anticipated to positively impact perceived usefulness, student satisfaction, and system usage (Al-Adwan et al., 2021; Al-Fraihat et al., 2020; Shahzad et al., 2021). Furthermore, many previous studies have concluded that SVQ is an essential factor that encourages students to continue using e-learning systems (Chopra et al., 2019; Sharma et al., 2017). Based on these studies, the current study suggests that an increased level of SVQ leads to higher student satisfaction and CUI.

H3: "Service quality positively influences student satisfaction."

H4: "Service quality positively influences student continued usage of e-learning system."

System quality (SYSQ)

Cidral et al. (2018, p. 6) state that SYSQ "corresponds to the technological characteristics, performance, and usability of the system itself." The SYSQ of an e-learning system is assessed according to various characteristics, including functionality, ease of use, usability, integration, adaptability, reliability, compatibility, and flexibility (Lee et al., 2018; Seta et al., 2018; Shahzad et al., 2021). Furthermore, SYSQ can be evaluated based on various user interface features such as screen design, terminology, and navigation (Alzahrani et al., 2019). Cidral et al. (2018) imply that the SYSQ of an e-learning system is vital for a pleasant and favorable user experience. The more that students perceive the e-learning system as easy to use, easily accessible, user friendly, compatible, and flexible, the more they will be encouraged to use the system and enhance their overall experience. Accordingly, many scholars have confirmed the positive impact of the SYSQ of e-learning systems on students' usage intention (Yakubu & Dasuki, 2018; Zhang et al., 2020) and continued system usage (San-Martín et al., 2020; Sharma et al., 2017), in addition to its positive influence on student user satisfaction (Aparicio et al., 2017; Cidral et al., 2020; Seta et al., 2018). Therefore, this study suggests that having a high-quality e-learning system leads to an increase in student satisfaction and favorable intention to continue using the system.

H5: "System quality positively influences student satisfaction."

H6: "System quality positively influences student continued usage of e-learning systems."

Self-directed learning (SDL)

Geng et al. (2019, p. 5) define SDL as "the psychological processes of learners that purposively direct themselves to gain knowledge and understand how to solve problems." Loeng (2020) finds that SDL entails that learners take responsibility and initiative for their own learning. As observed in the literature (Loyens et al., 2008; Robinson & Persky, 2020), self-directed learners are always responsible for defining learning tasks to determine what must be learned. Self-directed learners are generally recognized to be more active in learning-related tasks than directed learners (Geng et al., 2019). For example, self-directed learners actively read online learning materials, complete classroom tasks and homework, and plan and evaluate the different milestones of learning. However, Garrison (1992) argues

that SDL is not entirely autonomous learning, rather it can be viewed as a collaborative process between the learner and the instructor. In the environment of e-learning, instructors serve as facilitators of learning, not transmitters. An e-learning system acts as a central hub where instructors can post course content, assignments, examinations, learning resources, and announcements and interact and communicate with students (Rhode et al., 2017). Students are expected to take initiative with or without assistance from others (i.e., instructors) to identify learning needs, pinpoint learning goals, select and apply suitable learning strategies, and evaluate learning outcomes (Durnali, 2020). Accordingly, SDL, as a major element of e-learning readiness (Yilmaz, 2017), has been deemed a determinant of both students' intention to use e-learning systems (Balkaya & Akkucuk, 2021) and their satisfaction and academic achievement in e-learning environments (Kırmızı, 2015; Kumar, 2021).

H7: "Student self-directed learning positively influences student satisfaction."

H8: "Student self-directed learning positively influences student continued usage of e-learning systems."

Satisfaction

User satisfaction has been regarded as a key determinant of the effectiveness, acceptance, usage, and success of information systems (Al-Fraihat et al., 2020). This assumption holds true in the context of e-learning because satisfaction has been widely considered in assessing e-learning systems' success and continued use (Mohammadi et al., 2015; Soria-Barreto et al., 2021). Satisfaction is defined by Oliver (1980) as "the summary psychological state resulting when the emotion surrounding disconfirmed expectations is coupled with the consumer's prior feelings about the consumption experience." Hence, satisfaction is recognized as a "cognitive appraisal" of the expectation–performance divergence (confirmation) (Tiyar & Khoshsima, 2015). It can be suggested that less expectation and/or greater performance leads to greater confirmation. However, when this condition is reversed, disconfirmation occurs, leading to dissatisfaction and discontinuance intention. In this study, satisfaction is measured as the confirmation of students' expectations regarding the e-learning system by comparing the system's performance with their expectations. According to DeLone and McLean (2003), satisfaction is generated after the system is used because system use acts as an antecedent for satisfaction and success.

Furthermore, it is proposed that satisfaction can lead to continuous usage. Students may feel satisfied if they utilize the e-learning system to complete their academic-related activities. As a result of satisfaction, students may also be inclined to continue using the e-learning system. Y. M. Cheng (2020) confirms that user satisfaction with the e-learning system might lead to user intention to utilize the system in the future. It has been found that when satisfaction with the e-learning system is increased, the users will further use the system and the benefits of using it will be attained (Cidral et al., 2018; Shahzad et al., 2021). Previous empirical research (i.e., M. Cheng & Yuen, 2018, Safsouf et al., 2020, and Wang et al., 2021) confirms the positive influence of satisfaction on intention to continue using e-learning systems. Additionally, Tam and Oliveira (2016) state that an increase in user satisfaction leads to greater individual impact. Moreover, research on e-learning success has reported that student satisfaction has a positive impact on individual performance (Aparicio et al., 2017; Cidral et al., 2018). This study suggests that satisfaction is centered on students' positive experiences regarding the usage of the e-learning system. As Piccoli et al. (2001) note, positive experience may lead to positive influence on the perception of individual outcomes with respect to fulfilling the students' needs and matching their self-efficacy. Thus, the current study suggests that satisfaction can impact students' continuance intention to use the e-learning system and that it influences their perception of academic performance.

H9: "Student satisfaction positively influences student continued usage of e-learning systems."

H10: "Student satisfaction positively influences student academic performance perception"

Continued usage intention (CUI)

The use of information systems has a positive influence on individual performance (Tam & Oliveira, 2016). It has been confirmed that adoption and continuous usage denotes system success (DeLone & McLean, 1992) and that e-learning systems can facilitate simple access to learning content and enable effective communication with instructors and peers. Such activities can be seen as individual benefits that contribute significantly to enhancing students' academic performance. As Cidral et al. (2018) state, if the usage of e-learning systems is perceived by students to be compatible with their needs, they can complete their tasks more effectively. According to Aparicio et al. (2017), the more frequently e-learning systems are used, the more students perceive positive individual impacts.

H11: "Student continued usage intention of e-learning systems positively influences student academic performance perception"

METHODOLOGY

SAMPLE AND TARGET SYSTEM

Data was collected via an online questionnaire survey. The online survey (see Appendix A) was sent to 800 students (both undergraduates and graduates) of three private universities in Amman, Jordan, that use the Moodle e-learning system. Moodle has been the primary platform for making online course at these universities. Educators create a hybrid course where traditional "face-to-face" teaching and online activities using Moodle are mixed. Teachers use traditional class examinations to assess students' achievement at the end of the course. The direct link to the survey was posted on several courses' pages, which were selected randomly. The survey was in English and was available online for over two months to be completed by the students. During this period, students were frequently reminded to participate in the survey. The total number of students who responded was 603, providing a response rate of 75%. Nevertheless, 13 of the returned questionnaires were deemed incomplete, and, consequently, these questionnaires were excluded. As a result, 590 questionnaires were deemed valid and qualified for the data analysis stage. Table 1 displays the participants' demographics.

Table 1. Respondents' profile

Variable		Frequency	%
Gender	Male	363	62
	Female	227	38
Age (year)	<20	252	43
	20-30	284	48
	>30	54	9
Enrolled course	Bachelor's	552	94
	Master's	38	6
Experience using the e-learning system	< 1 year	120	20
	1-2 years	377	64
	>2 years	93	16

SURVEY DEVELOPMENT

The research model consisted of seven constructs. These constructs were measured by 28 items borrowed from well-established and relevant literature (Al Mulhem, 2020; Al-Adwan, Al- Adwan, & Berger et al., 2018; Al-Fraihat et al., 2020; Bhandari et al., 2020; Islam, 2013; Seta et al., 2018; Shahzad et al., 2021; Yakubu & Dasuki, 2018) (see Appendix). All items were rated on a 5-point Likert scale, ranging from 1 = strongly agree to 5 = strongly disagree. Although the items employed to measure the research model's constructs were previously tested and validated in prior literature, several proce-

dures were followed to ensure the current reliability and validity of these constructs. The questionnaire survey items were assessed by a panel of experts (n = 4), including academics and PhD candidates who have considerable expertise in the educational technology field. The panel was asked to assess the items in terms of clarity, wordiness, relevance, and relationship to the problem. The assessment process revealed that the level of agreement among the panel members was 90%. Furthermore, a pilot test was performed on 60 students to evaluate the internal consistency of each construct. The results demonstrated that the Cronbach's alpha value for all constructs was >0.7, suggesting adequate internal consistency (Hair et al., 2019).

Common Method Bias (CMB)

CMB is associated with cross-sectional studies, survey research where all data (e.g., dependent, mediating, independent variables) are collected using one method such as this study (Jordan & Troth, 2020). The presence of CMB can threaten the reliability and validity of all measurement items (Podsakoff et al., 2012), and it may inflate or deflate of relationships among dependent and independent variables (Antonakis et al., 2010). Accordingly, to avoid CMB in this study, many procedures were followed during the questionnaire design by avoiding vague questions and using a clear and direct language, and by separating the measurement items of dependent and independent constructs (Podsakoff et al., 2003). Then, the test of Harman's one factor was conducted to evaluate the existence of CMB (Hair et al., 2019). Therefore, an exploratory factor analysis (EFA) was performed and all measurement items were factorized into a one single factor. The result indicates that seven factors emerged, and none of these factors accounted for more than 50% of the explained variance (the largest factor accounted for 45.23% of the explained variance). This result demonstrates that CMB is not a threat to the reliability and validity of this study.

Data Analysis Procedures

The collected data was analyzed using partial least squares structural equation modelling (PLS-SEM) to examine the proposed hypotheses in the research model. PLS-SEM is considered an effective approach to estimate complex models that include many relationships, latent constructs, and/or indicators (Akter et al., 2017; Hair et al., 2019). Accordingly, PLS-SEM analysis was performed using SmartPLS 3.0 software (Ringle et al., 2015). This study adopts the two-phase data analysis methodology of Anderson and Gerbing (1988). The first phase was performed to assess the measurement model by testing the internal consistency reliability, convergent validity, and discriminant validity, and the second phase was established to examine the structural model and the proposed hypotheses.

Data Analysis

Measurement Model

This stage began with testing the internal consistency reliability of the research constructs. Two assessments were conducted to examine the internal consistency, namely Cronbach's alpha (α) and composite reliability (CR). The value of both α and CR ranges from 0 to 1. The closer the value of Cronbach's alpha and CR to 1, the more the construct is internally consistent and reliable. A minimum value of 0.7 is recommended for both α and CR (Hair et al., 2019). Table B1 (see Appendix B) reveals that all constructs in the research model possess a considerable internal constancy reliability as the value of α (ranging from 0.893 to 0.946) and the value of CR (ranging from 0.927 to 0.965) are higher than 0.7. For convergent validity, two metrics were evaluated, namely reflective indicator (item) loadings and average variance explained (AVE). It is suggested that the minimum indicator loading on its theoretical construct should be 0.707, and there should be an AVE value of 0.5 for each construct (Hair et al., 2019). Table B1 demonstrates that all indicators have a loading higher than 0.707, except two: SYS4 (0.651) and SAT4 (0.535). Accordingly, these two indicators were eliminated. The

analysis reveals that the AVE values (ranging from 0.757 to 0.903) for all constructs surpass the endorsed value of 0.5.

Discriminant validity is employed to prove that the constructs are significantly different from each other. To evaluate this assumption, it has been recommended by Fornell and Larcker (1981) that the $\sqrt{AVE}$ for each construct should exceed the correlation with other constructs. As Table B2 (see Appendix B) denotes, this aforementioned condition is fulfilled, confirming the discriminant validity.

Furthermore, the heterotrait-monotrait ratio of correlations test (HTMT) was performed as another evaluation of discriminant validity (Dijkstra & Henseler, 2015). It is recommended that a HTMT value higher than 0.85 indicates a lack of discriminant validity. Table B3 (see Appendix B) illustrates that all HTMT values are less than 0.85, implying that discriminant validity is present.

Structural Model

After validating the measurement model, the structural model was employed. The aim of this stage was to assess the significance of path coefficients (the proposed hypotheses). However, it is essential to investigate the existence of collinearity before testing the path coefficients. The variance inflation factor (VIF) was used to assess collinearity. It is suggested that the estimates of VIF for the dependent variables should be less than 3 (Hair et al., 2019). Table B4 (see Appendix B) indicates that this condition is satisfied for all the independent variables, demonstrating the absence of any collinearity issues. Furthermore, the model fit indices were evaluated at this stage. As Table 2 illustrates, based on Hair et al. (2019), all indices are within the advocated values, suggesting that the data set adequately fits the proposed model.

Table 2. Model fit indexes

Fit index	Value
SRMR	0.047
d_ULS	0.782
d_G	0.445
Chi-Square	1555.770
NFI	0.901

The procedure of bootstrapping (5000 resamples) was used to examine the path coefficients. As illustrated in Table 3, IQ, SYSQ, and SYSQ were key enablers of SAT and CUI. These results support H1 to H6. However, SDL was found to be a major inhibitor for SAT and CUI. This result does not support H7 or H8. Furthermore, SAT ($\beta = 0.223$, p value <0.001) was found to have a positive influence on CUI, which supports H9. The analysis reveals that H10 and H11 are supported because SAT ($\beta = 0.348$, p value <0.001) and CUI ($\beta = 0.460$, p value <0.001) were the main facilitators for ACP as they had a positive influence on it. Additionally, IQ, SVQ, SYSQ, and SDL explain 71.7% ($R^2 = 0.717$) of the variance in SAT. In addition, IQ, SVQ, SYSQ, SDL, and SAT explained 71.5% ($R^2 = 0.715$). These explanatory powers are considered substantial (Chin, 1998). Both SAT and CUI explain 57.9% ($R^2 = 0.579$) of the variance in ACP, indicating a moderate explanatory power (Chin, 1998). Table 3 summarizes the findings of testing the proposed hypotheses. The results suggest that all hypotheses were supported, except H7 and H8. Particularly, SDL was found to have a negative effect on SAT ($\beta = -0.217$, p value <0.001) and CUI ($\beta = -0.161$, p value <0.001).

Table 3. Hypotheses testing summary

H	Path	β	t value	p values	Supported
H1	IQ -> SAT	0.320	6.179	0.000	Yes
H2	IQ -> CUI	0.153	3.324	0.001	Yes
H3	SVQ -> SAT	0.189	3.895	0.000	Yes
H4	SVQ -> CUI	0.234	4.253	0.000	Yes
H5	SYSQ -> SAT	0.233	4.450	0.000	Yes
H7	SYSQ -> CUI	0.187	3.504	0.000	Yes
H6	SDL -> SAT	-0.217	4.987	0.000	No
H8	SDL -> CUI	-0.161	3.674	0.000	No
H9	SAT -> CUI	0.223	4.067	0.000	Yes

Finally, the total indirect effects were examined. As Table 4 demonstrates, the total indirect effects of the independent variables on the dependent variables are significant. This suggests that the effects generated by the independent variables are carried through the mediator variables to influence the dependent variables. For example, SAT (β = 0.102, *p* value <0.001) has a significant total indirect effect on APC via CUI. Such a finding indicates that the increase in SAT would lead to enhanced APC by strengthening CUI

Table 2. Total indirect effect

Path	β	T Statistics	P Values
IQ -> APC	0.214	6.525	0.000
IQ -> CUI	0.071	3.204	0.001
SAT -> APC	0.102	3.668	0.000
SDL -> APC	-0.172	5.874	0.000
SDL -> CUI	-0.048	3.010	0.003
SVQ -> APC	0.193	5.354	0.000
SVQ -> CUI	0.042	2.947	0.003
SYSQ -> APC	0.191	5.354	0.000
SYSQ -> CUI	0.052	2.997	0.003

DISCUSSION

All the of the proposed hypotheses are supported, except H7 and H8. ACP is explained by CUI and SAT. CUI is explained by SAT, SYSQ, SVQ, IQ, and SDL. SAT is explained by SYSQ, SVQ, IQ, and SDL. Importantly, SDL is recognized as a key inhibitor for SAT and CUI as it has a negative influence on both (Table 3).

The findings reveal that IQ is statistically significant in predicting SAT and CUI. IQ has a positive effect on SAT and CUI, thereby validating hypotheses H1 and H2. This implies that the higher the quality of the course content and resources, the more students feel satisfied, which leads to continued usage of the e-learning system. When students perceive the course content and resources uploaded to the e-learning system as accurate, complete, useful, valid, available, up to date, relevant, and easy to comprehend, they are more satisfied and continue using the system. The findings of previous research in terms of H1 and H2 are varied. For example, the findings of Kurt (2019) confirm H1 and H2, while many scholars (Cidral et al., 2020; Mafazi, 2021; Shahzad et al., 2021) have found that although IQ is significant and positively impacts system use, the influence of IQ on SAT is insignificant. Contrarily, Yakubu & Dasuki (2018) demonstrate that IQ has a significant and positive impact on SAT and an insignificant influence on behavioral intention. Furthermore, the findings of Safsouf et al. (2020) suggest that course content and information quality negatively influence SAT. Moreover,

H3 and H4 are supported by the statistical analysis. Specifically, the SVQ of the e-learning system has a significant positive influence on the SAT and CUI, and hence it is recognized as a key enabler for both. While these findings contradict earlier research (Cidral et al., 2020; Cidral et al., 2018), they are in line with other studies (Mohammadi, 2015; Shahzad et al., 2021). Such findings signify the critical role of e-learning systems' support staff in terms of responsiveness, empathy, and competency in boosting students' satisfaction and supporting them to continue to use the system. When students are provided with timely support from knowledgeable IT staff to address any potential technical difficulties, they are more satisfied and encouraged to continue using the e-learning system.

The results indicate that H6 and H7 are not supported. In fact, SDL is recognized as a barrier for SAT and CUI as it has a significant negative effect on both. Such results indicate that the students who participated in this study are unable to self-pace their learning, which in turn hinders them in continuing to use the e-learning system and makes them unsatisfied. The more students lack SDL skills, the more likely they are to discontinue the use of the e-learning system and become dissatisfied. While many scholars have proved the positive impact of SDL on satisfaction and motivation toward e-learning systems (e.g., Yilmaz, 2017), other studies have found that the influence of SDL on satisfaction and e-learning system use is insignificant (Eom, 2012). Furthermore, several studies in Jordan, particularly the m-learning context (Al-Adwan, Al-Adwan, & Berger, 2018; Al-Adwan, Al-Madadha, & Zvirzdinaite, 2018) and the MOOCs context (Al-Adwan, 2020; Al-Adwan & Khdour, 2020), have revealed that self-management and self-regulated learning have a negative influence on system use. This refers to the learning tradition of the Jordanian higher education learning environment wherein instructors are viewed by students as the only source of learning, and a well-structured learning environment (i.e., classroom) is still preferred. Such circumstances hinder and discourage students from developing the SDL competences required for e-learning.

The findings indicate that SYSQ is a significant factor in explaining SAT and CUI. SYSQ has a positive influence on SAT and CUI, thus supporting H5 and H6. This means that the more that students perceive the e-learning system as high quality, the more they feel satisfied and continue using the system. More specifically, if students perceive the e-learning system as high quality in terms of accessibility, ease of use, structure, navigability, and effective interface, they become more satisfied, and thus the system will be used more frequently. Such findings are similar to previous empirical research (Cidral et al., 2018; Kurt, 2019). However, some scholars have reported insignificant influence of SYSQ on the usage of e-learning systems (Cidral et al., 2020; Shahzad et al., 2021) and on satisfaction (Yakubu & Dasuki, 2018).

The results reveal that SAT exerts a positive influence on continued usage (H9). While this result is aligned with previous research (Cidral et al., 2020; Wang et al., 2021), it is inconsistent with other studies (i.e., Ashrafi et al., 2020; Yakubu & Dasuki, 2018). This implies that when students are satisfied with the e-learning system, they intend to continue using the system. Furthermore, the results reveal that CUI and SAT have a positive influence on student APC, thus confirming H10 and H11. Such findings are similar to the findings of prior research, which found that SAT and the usage of e-learning systems are key determinants of individual impact (Al-Fraihat et al., 2020; Cidral et al., 2020; Cidral et al., 2018). These findings reveal that an increase in students' satisfaction and their continued usage of the e-learning system leads to a higher perception of academic performance enhancement. Students will perform better in class if they are satisfied with the system. Furthermore, when students continue with e-learning system use, they perceive an enhanced self-efficacy.

IMPLICATIONS

Theoretically, this study advances the literature and empirically examines a modified version of the D&M ISS model by including a context-specific factor that is a driver of successful implementations of e-learning systems. The D&M ISS model has been criticized due to several limitations. For instance, Eom et al. (2012, p. 158) note that "the DeLone and McLean model has limited explanatory power for explaining the role of e-learning systems on the outcomes of e-learning." Therefore, to

increase the explanatory power of the model, it has been suggested that additional research is needed to explore further quality factors that impact students' adoption of e-learning systems (Al-Fraihat et al., 2020). In addition, while the D&M ISS model has been applied in several fields of information systems, its application has been criticized, especially in e-learning-related contexts. Many scholars (Martins et al., 2019; Salam & Farooq, 2020) have identified that the influential factors of the outcome construct (net benefits) are not sufficiently recognized. Such a notion holds true, particularly because the net-benefits variable is context-specific and thus diverges based on each user group's requirements and is significantly influenced by the type of information system. Accordingly, further research is deemed important to recognize other determining factors of net benefits, mainly in the context of e-learning. This study responded by contextualizing and extending the D&M ISS model to fit the e-learning settings and increase its explanatory power. This study proposes that SDL is an additional determinant that indirectly influences the variable of net benefits via perceived satisfaction and CUI. The empirical results recognize SDL as a key inhibitor of students' satisfaction and CUI. In addition, the research model demonstrates a substantial predictive power among SAT, CUI, and perceived academic performance (ACP). The research model moderately to substantially explains 71.5%, 71.7%, and 57.9% of the variance in CUI, SAT, and ACP, respectively. This predictive power is noticeably higher than in many prior studies (e.g., Seta et al., 2018, and Yakubu & Dasuki, 2018).

The empirical findings of this study demonstrate that IQ positively impacts SAT and CUI. As previously mentioned, IQ in e-learning represents the quality of learning content. The quality of learning content format and design are recognized as fundamental factors for e-learning success. Thus, both instructors and e-learning developers should provide reliable, accurate, and up-to-date learning materials. By doing so, students are supported to achieve the desired learning goals, and such materials are perceived useful by students. Furthermore, the learning content should be designed to meet students' needs and preferences regarding various types and formats, with ease of accessing and sharing. For example, providing basic educational content (e.g., text and charts), collaborative educational content (e.g., sharable learning files), and multimedia educational content (e.g., video and animation) leads to increased student perceptions of the e-learning system as useful and simple.

This study confirms the positive impact of SYSQ on SAT and CUI. This directs e-learning developers toward designing systems with simple and useful functionalities that embrace the essential features to enable students to perform the required tasks effectively and to access and share learning materials flexibly. This can include, for instance, not only being able to access the e-learning system via ordinary websites but also being able to access them via various mobile platforms (e.g., smartphones and tablets). This would improve their SAT. Moreover, e-learning systems that embrace interactive and collaborative learning activities among students and instructors are viewed as more useful. Accordingly, introducing features that facilitate social networks among students and instructors is an important consideration.

The results demonstrate that the SVQ available to students is positively influencing students' SAT and CUI. Such support is fundamental to tackling any potential learning-related or technical problems that students may encounter during their use of the e-learning system. Here, both instructors and IT personnel staff have an important role as they are required to offer timely and sufficient support to students. Accordingly, institutional e-learning policies should include student support as a crucial component. Furthermore, technical support can be provided to students via training, providing them with manuals on how to use the e-learning system effectively.

The current study reveals that SDL is a key barrier to successful e-learning system employment. It has a negative impact on SAT and CUI. Thus, developing students' skills related to SDL is deemed a necessity. This could be attained by designing contemporary pedagogical curricula that are based on student-centered learning. This approach to learning encourages students to acquire self-regulatory skills and be accountable for their learning. This environment has to be supported by pedagogical tools (e.g., synchronous/asynchronous communication channels and multimedia tools) to enable effective interaction between instructors and students. Moreover, instructors have a critical role in

boosting students' SDL by seeking innovative activities to normalize students' SDL skills during their learning. Additionally, e-learning system developers should seek features and functions to support goal settings, task/time management, and personalized planning. Finally, both USE and SAT are found to be key determinants of ACP. Hence, increasing students' awareness regarding the benefits of e-learning systems in improving their perception of academic performance is deemed important, and polices and regulations of HEIs should be centered on promoting technology-enabled learning.

CONCLUSION

This study has been conducted to develop an integrated model of e-learning system success. The proposed model for this study was based on the IS success model of DeLone and McLean (2003). This study reveals that the success of e-learning systems depends not only on the quality of the information, system, and service but also on student self-directed learning. The results demonstrate that the quality factors (information, system, and service) have a significant positive influence on system CUI and student satisfaction. Furthermore, satisfaction positively influences CUI. Both CUI and student satisfaction have a significant and positive influence on student academic performance perception, and self-directed learning is recognized as a key inhibitor to student satisfaction and CUI. Recommendations for high-level management of HEIs and educational technology developers are offered to develop a holistic understanding of the various implications of information quality, system quality, service quality, self-directed learning, student satisfaction, and system use regarding e-learning system success (represented by student academic performance perception). The sample employed for this study was selected from three private universities in Jordan; consequently, the results cannot be generalized to the entire student population of Jordan. Further research, therefore, should focus on targeting a larger scope by including public universities, which in turn would enhance the generalizability of the findings. In addition, the current study does not investigate the role of potential moderators that might influence the research model's relationships. Future studies might tackle such limitation by examining the moderating effect of computer self-efficacy and culture. This cross-sectional study was conducted using a quantitative method based on the use of self-reported online survey to gather data. Thus, future research should consider longitudinal study that employs a mixed methods approach to reveal additional constructs and insights regarding e-learning system adoption by students.

REFERENCES

Akram, H., Yingxiu, Y., Al-Adwan, A. S., & Alkhalifah, A. (2021). Technology integration in higher education during COVID-19: An assessment of online teaching competencies through technological pedagogical content knowledge model. *Frontiers in Psychology*, *12*. https://doi.org/10.3389%2Ffpsyg.2021.736522

Akter, S., Fosso Wamba, S., & Dewan, S. (2017). Why PLS-SEM is suitable for complex modelling? An empirical illustration in big data analytics quality. *Production Planning & Control, 28*(11-12), 1011-1021. https://doi.org/10.1080/09537287.2016.1267411

Al Mulhem, A. (2020). Investigating the effects of quality factors and organizational factors on university students' satisfaction of e-learning system quality. *Cogent Education*, *7*(1), 1787004. https://doi.org/10.1080/2331186X.2020.1787004

Al-Adwan, A. S. (2020). Investigating the drivers and barriers to MOOCs adoption: The perspective of TAM. *Education and Information Technologies*, *25*(6), 5771-5795. https://doi.org/10.1007/s10639-020-10250-z

Al-Adwan, A. S., Albelbisi, N. A., Aladwan, S. H., Horani, O., Al-Madadha, A., & Al Khasawneh, M. H. (2020). Investigating the impact of social media use on student's perception of academic performance in higher education: evidence from Jordan. *Journal of Information Technology Education: Research*, *19*, 953-975. https://doi.org/10.28945/4661

Al-Adwan, A. S., & Khdour, N. (2020). Exploring student readiness to MOOCs in Jordan: A structural equation modelling approach. *Journal of Information Technology Education: Research*, *19*, 223-242. https://doi.org/10.28945/4542

Al-Adwan, A. S., Al-Adwan, A., & Berger, H. (2018). Solving the mystery of mobile learning adoption in higher education. *International Journal of Mobile Communications*, *16*(1), 24-49. https://doi.org/10.1504/IJMC.2018.088271

Al-Adwan, A. S., Albelbisi, N. A., Hujran, O., Al-Rahmi, W. M., & Alkhalifah, A. (2021). Developing a holistic success model for sustainable e-learning: a structural equation modeling approach. *Sustainability*, *13*(16), 9453. https://doi.org/10.3390/su13169453

Al-Adwan, A. S., Al-Madadha, A., & Zvirzdinaite, Z. (2018). Modeling students' readiness to adopt mobile learning in higher education: An empirical study. *International Review of Research in Open and Distributed Learning*, *19*(1), 221-241. https://doi.org/10.19173/irrodl.v19i1.3256

Al-Adwan, A.S., Yaseen, H., Alsoud, A., Abousweilem, F., & Al-Rahmi, W. M. (2022). Novel extension of the UTAUT model to understand continued usage intention of learning management systems: The role of learning tradition. *Education and Information Technologies*, *27*, 3567–3593 https://doi.org/10.1007/s10639-021-10758-y

Al-Bashayreh, M., Almajali, D., Altamimi, A., Masa'deh, R. E., & Al-Okaily, M. (2022). An empirical investigation of reasons influencing student acceptance and rejection of mobile learning apps usage. *Sustainability*, *14*(7), 4325. https://doi.org/10.3390/su14074325

Aldholay, A., Isaac, O., Abdullah, Z., Abdulsalam, R., & Al-Shibami, A.H. (2018). An extension of Delone and McLean IS success model with self-efficacy: Online learning usage in Yemen. *International Journal of Information and Learning Technology*, *35*(4), 285-304. https://doi.org/10.1108/IJILT-11-2017-0116

Al-Fraihat, D., Joy, M., & Sinclair, J. (2020). Evaluating E-learning systems success: An empirical study. *Computers in Human Behavior*, *102*, 67-86. http://dx.doi.org/10.1016/j.chb.2019.08.004

Almaiah, M. A., Al-Khasawneh, A., & Althunibat, A. (2020). Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic. *Education and Information Technologies*, *25*, 5261-5280. https://doi.org/10.1007/s10639-020-10219-y

Almajali, D., Hammouri, S., & Barakat, S. (2021). E-learning through COVID-19 crisis in developing countries. *International Journal of Pharmaceutical Research*, *13*(1), 5543-5553. https://doi.org/10.31838/ijpr/2021.13.01.732

Almajali, D., & Masadeh, R. (2021). Antecedents of students' perceptions of online learning through COVID-19 pandemic in Jordan. *International Journal of Data and Network Science*, *5*(4), 587-592.

Al-Okaily, M. (2021). Assessing the effectiveness of accounting information systems in the era of COVID-19 pandemic. *VINE Journal of Information and Knowledge Management Systems*. https://doi.org/10.1108/VJIKMS-08-2021-0148

Al-Okaily, M., & Al-Okaily, A. (2022). An empirical assessment of enterprise information systems success in a developing country: The Jordanian experience. *The TQM Journal*. https://doi.org/10.1108/TQM-09-2021-0267

Al-Okaily, M., Alqudah, H., Matar, A., Lutfi, A., & Taamneh, A. (2020a). Impact of Covid-19 pandemic on acceptance of elearning system in Jordan: A case of transforming the traditional education systems. *Humanities and social Sciences Review*, *6*(4), 840-851. https://doi.org/10.18510/hssr.2020.8483

Al-Okaily, M., Alqudah, H., Matar, A., Lutfi, A., & Taamneh, A. (2020b). Dataset on the Acceptance of e-learning system among universities students' under the COVID-19 pandemic conditions. *Data in Brief*, *32*, 106176. https://doi.org/10.1016/j.dib.2020.106176

Alzahrani, A. I., Mahmud, I., Ramayah, T., Alfarraj, O., & Alalwan, N. (2019). Modelling digital library success using the DeLone and McLean information system success model. *Journal of Librarianship and Information Science*, *51*(2), 291-306. https://doi.org/10.1177%2F0961000617726123

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103*(3), 411–423. https://doi.org/10.1037/0033-2909.103.3.411

Antonakis, J., Bendahan, S., Jacquart, P., & Lalive, R. (2010). On making causal claims: A review and recommendations. *The Leadership Quarterly*, *21*(6), 1086-1120. https://doi.org/10.1016/j.leaqua.2010.10.010

Aparicio, M., Bacao, F., & Oliveira, T. (2017). Grit in the path to e-learning success. *Computers in Human Behavior, 66*, 388–399. https://doi.org/10.1016/j.chb.2016.10.009

Ashrafi, A., Zareravasan, A., Rabiee Savoji, S., & Amani, M. (2020). Exploring factors influencing students' continuance intention to use the learning management system (LMS): A multi-perspective framework. *Interactive Learning Environments*, 1-23. https://doi.org/10.1080/10494820.2020.1734028

Balkaya, S., & Akkucuk, U. (2021). Adoption and use of learning management systems in education: The role of playfulness and self-management. *Sustainability*, *13*(3), 1127. https://doi.org/10.3390/su13031127

Bhandari, B., Chopra, D., & Singh, K. (2020). Self-directed learning: Assessment of students' abilities and their perspective. *Advances in Physiology Education*, *44*(3), 383-386. https://doi.org/10.1152/advan.00010.2020

Bhattacherjee, A. (2001). Understanding information systems continuance: An expectation-confirmation model. *MIS Quarterly, 25*(3), 351-370. https://doi.org/10.2307/3250921

Cheng, M., & Yuen, A. H. K. (2018). Student continuance of learning management system use: A longitudinal exploration. *Computers & Education*, *120*, 241-253. https://doi.org/10.1016/j.compedu.2018.02.004

Cheng, Y. M. (2020). Students' satisfaction and continuance intention of the cloud-based e-learning system: Roles of interactivity and course quality factors. *Education+ Training*, *62*(9), 1037-1059. https://doi.org/10.1108/ET-10-2019-0245

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern Methods for Business Research*, *295*(2), 295-336.

Chopra, G., Madan, P., Jaisingh, P., & Bhaskar, P. (2019). Effectiveness of e-learning portal from students' perspective: A structural equation model (SEM) approach. *Interactive Technology and Smart Education*, *16*(2), 94-116. https://doi.org/10.1108/ITSE-05-2018-0027

Cidral, W. A., Aparicio, M., & Oliveira, T. (2020). Students' long-term orientation role in e-learning success: A Brazilian study. *Heliyon*, *6*(12), e05735. https://doi.org/10.1016/j.heliyon.2020.e05735

Cidral, W. A., Oliveira, T., Di Felice, M. & Aparicio, M. (2018). E-learning success determinants: Brazilian empirical study. *Computers and Education, 122*, 273-290. https://doi.org/10.1016/j.compedu.2017.12.001

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60–95. https://doi.org/10.1287/isre.3.1.60

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, *19*(4), 9-30. https://doi.org/10.1080/07421222.2003.11045748

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems*, *49*(1), 5-22. https://doi.org/10.1177%2F0047239520934018

Dijkstra, T. K., & Henseler, J. (2015). Consistent partial least squares path modeling. *MIS Quarterly*, *39*(2), 297-316. https://www.jstor.org/stable/26628355

Durnali, M. (2020). The effect of self-directed learning on the relationship between self-leadership and online learning among university students in Turkey. *Tuning Journal for Higher Education*, *8*(1), 129-165. https://doi.org/10.18543/tjhe-8(1)-2020pp129-165

Eom, S. (2012). Effects of LMS, self-efficacy, and self-regulated learning on LMS effectiveness in business education. *Journal of International Education in Business, 5*(2), 129-144. https://doi.org/10.1108/18363261211281744

Eom, S., Ashill, N. J., Arbaugh, J. B., & Stapleton, J. L. (2012). The role of information technology in e-learning systems success. *Human Systems Management, 31*(3-4), 147-163. https://doi.org/10.3233/HSM-2012-0767

Eze, S. C., Chinedu-Eze, V. C., Okike, C. K., & Bello, A. O. (2020). Factors influencing the use of e-learning facilities by students in a private higher education institution (HEI) in a developing economy. *Humanities and Social Sciences Communications*, *7*. https://doi.org/10.1057/s41599-020-00624-6

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39-50. https://doi.org/10.1177%2F002224378101800104

Garrison, D. R. (1992). Critical thinking and self-directed learning in adult education: An analysis of responsibility and control issues. *Adult Education Quarterly*, *42*(3), 136-148.

Geng, S., Law, K. M., & Niu, B. (2019). Investigating self-directed learning and technology readiness in blending learning environment. *International Journal of Educational Technology in Higher Education*, *16*(1), 1-22. https://doi.org/10.1186/s41239-019-0147-0

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review, 31*(1), 2-24. https://doi.org/10.1108/EBR-11-2018-0203

Hood, N., Littlejohn, A., & Milligan, C. (2015). Context counts: How learners' contexts influence learning in a MOOC. *Computers & Education, 91*(1), 83–91. https://doi.org/10.1016/j.compedu.2015.10.019

Islam, A. N. (2013). Investigating e-learning system usage outcomes in the university context. *Computers & Education*, *69*, 387-399. https://doi.org/10.1016/j.compedu.2013.07.037

Jordan, P. J., & Troth, A. C. (2020). Common method bias in applied settings: The dilemma of researching in organizations. *Australian Journal of Management*, *45*(1), 3-14. https://doi.org/10.1177%2F0312896219871976

Kırmızı, Ö. (2015). The influence of learner readiness on student satisfaction and academic achievement in an online program at higher education. *Turkish Online Journal of Educational Technology-TOJET*, *14*(1), 133-142.

Kumar, S. P. (2021). Impact of online learning readiness on students satisfaction in higher educational institutions. *Journal of Engineering Education Transformations*, *34*, 64-70. https://doi.org/10.16920/jeet/2021/v34i0/157107

Kurt, Ö. E. (2019). Examining an e-learning system through the lens of the information systems success model: Empirical evidence from Italy. *Education and Information Technologies*, *24*(2), 1173-1184. https://doi.org/10.1007/s10639-018-9821-4

Lee, S. J., Lee, H., & Kim, T. T. (2018). A study on the instructor role in dealing with mixed contents: How it affects learner satisfaction and retention in e-learning. *Sustainability*, *10*(3), 850. https://doi.org/10.3390/su10030850

Loeng, S. (2020). Self-directed learning: A core concept in adult education. *Education Research International*, *2020,* Article 3816132. https://doi.org/10.1155/2020/3816132

Loyens, S. M., Magda, J., & Rikers, R. M. (2008). Self-directed learning in problem-based learning and its relationships with self-regulated learning. *Educational Psychology Review*, *20*(4), 411-427. https://doi.org/10.1007/s10648-008-9082-7

Lwoga, E. T., & Komba, M. (2015). Antecedents of continued usage intentions of web-based learning management system in Tanzania. *Education+ Training*, *57*(7), 738-756. https://doi.org/10.1108/ET-02-2014-0014

Mafazi, B. (2021). The analysis of e-learning success by using Delone and Mclean success model (Case study: Pertamina University). *Journal of Information Technology and Its Utilization*, *4*(1), 29-34. https://doi.org/10.30818/jitu.4.1.3694

Martinez-Arguelles, M., & Batalla-Busquets, J. (2016). Perceived service quality and student loyalty in an online university. *International Review of Research in Open and Distributed Learning*, *17*(4), 264–279. https://doi.org/10.19173/irrodl.v17i4.2518

Martins, J., Branco, F., Gonçalves, R., Au-Yong-Oliveira, M., Oliveira, T., Naranjo-Zolotov, M., & Cruz-Jesus, F. (2019). Assessing the success behind the use of education management information systems in higher education. *Telematics and Informatics, 38*, 182–193. https://doi.org/10.1016/j.tele.2018.10.001

Mkinga, M., & Mandari, H. (2020). Evaluating students information system success using DeLone and McLean's model: Student's perspective. *Journal of International Technology and Information Management*, *29*(2), 24-42. https://scholarworks.lib.csusb.edu/jitim/vol29/iss2/2

Mohammadi, H. (2015). Investigating users' perspectives on e-learning: An integration of TAM and IS success model. *Computers in Human Behavior*, 45, 359-374. https://doi.org/10.1016/j.chb.2014.07.044

Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research*, *17*(4), 460-469. https://doi.org/10.1177%2F002224378001 700405

Pham, L., Limbu, Y. B., Bui, T. K., Nguyen, H. T., & Pham, H. T. (2019). Does e-learning service quality influence e-learning student satisfaction and loyalty? Evidence from Vietnam. *International Journal of Educational Technology in Higher Education*, *16*(1), 1-26. https://doi.org/10.1186/s41239-019-0136-3

Piccoli, G., Ahmad, R., & Ives, B. (2001). Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skills training. *MIS Quarterly*, *25*(4), 401–426. https://doi.org/10.2307/3250989

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879-903. https://doi.org/10.1037/0021-9010.88.5.879

Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, *63*, 539-569. https://doi.org/10.1146/annurev-psych-120710-100452

Ramadiani, Azainil, Haryaka, U., Agus, F., & Kridalaksana, A. H. (2017). User satisfaction model for e-learning using smartphone. *Procedia Computer Science*, *116*, 373–380. https://doi.org/10.1016/j.procs.2017.10.070

Rhode, J., Richter, S., Gowen, P., Miller, T., & Wills, C. (2017). Understanding faculty use of the learning management system. *Online Learning*, *21*(3), 68-86. https://doi.org/10.24059/olj.v21i3.1217

Ringle, C. M., Wende, S., & Becker, J-M. (2015). *SmartPLS 3*. https://www.researchgate.net/publication/270883448_SmartPLS_3

Robinson, J. D., & Persky, A. M. (2020). Developing self-directed learners. *American Journal of Pharmaceutical Education*, *84*(3). https://dx.doi.org/10.5688%2Fajpe847512

Safsouf, Y., Mansouri, K., & Poirier, F. (2020). An analysis to understand the online learners' success in public higher education in Morocco. *Journal of Information Technology Education: Research*, *19*, 87-112. https://doi.org/10.28945/4518

Salam, M., & Farooq, M. S. (2020). Does sociability quality of web-based collaborative learning information system influence students' satisfaction and system usage? *International Journal of Educational Technology in Higher Education, 17*(1), Article 26. https://doi.org/10.1186/s41239-020-00189-z

San-Martín, S., Jiménez, N., Rodríguez-Torrico, P., & Piñeiro-Ibarra, I. (2020). The determinants of teachers' continuance commitment to e-learning in higher education. *Education and Information Technologies*, *25*(4), 3205-3225. https://doi.org/10.1007/s10639-020-10117-3

Seta, H. B., Wati, T., Muliawati, A., & Hidayanto, A. N. (2018). E-learning success model: An extention of DeLone & McLean IS' success model. *Indonesian Journal of Electrical Engineering and Informatics (IJEEI)*, *6*(3), 281-291. https://doi.org/10.52549/ijeei.v6i3.505

Shahzad, A., Hassan, R., Aremu, A. Y., Hussain, A., & Lodhi, R. N. (2021). Effects of COVID-19 in e-learning on higher education institution students: The group comparison between male and female. *Quality & Quantity*, *55*(3), 805-826. https://doi.org/10.1007/s11135-020-01028-z

Sharma, S. K., Gaur, A., Saddikuti, V., & Rastogi, A. (2017). Structural equation model (SEM)-neural network (NN) model for predicting quality determinants of e-learning management systems. *Behaviour & Information Technology*, *36*(10), 1053-1066. https://doi.org/10.1080/0144929X.2017.1340973

Soria-Barreto, K., Ruiz-Campo, S., Al-Adwan, A. S., & Zuniga-Jara, S. (2021). University students intention to continue using online learning tools and technologies: An international comparison. *Sustainability*, *13*(24), 13813. https://doi.org/10.3390/su132413813

Šumak, B., Heričko, M., & Pušnik, M. (2011). A meta-analysis of e-learning technology acceptance: The role of user types and e-learning technology types. *Computers in Human Behavior*, *27*(6), 2067-2077. https://doi.org/10.1016/j.chb.2011.08.005

Tam, C., & Oliveira, T. (2016). Understanding the impact of m-banking on individual performance: DeLone & McLean and TTF perspective. *Computers in Human Behavior*, *61*, 233-244. https://doi.org/10.1016/j.chb.2016.03.016

Tiyar, F. R., & Khoshsima, H. (2015). Understanding students' satisfaction and continuance intention of e-learning: Application of expectation-confirmation model. *World Journal on Educational Technology: Current Issues*, *7*(3), 157-166. https://www.researchgate.net/publication/288888657_Understanding_students%27_satisfaction_and_continuance_intention_of_e-learning_Application_of_expectation-confirmation_model

Turugare, M., & Rudhumbu, N. (2020). Integrating technology in teaching and learning in universities in Lesotho: Opportunities and challenges. *Education and Information Technologies*, *25*(5), 3593-3612. https://doi.org/10.1007/s10639-019-10093-3

Wang, T., Lin, C. L., & Su, Y. S. (2021). Continuance intention of university students and online learning during the COVID-19 pandemic: A modified expectation confirmation model perspective. *Sustainability*, *13*(8), 4586. https://doi.org/10.3390/su13084586

Yakubu, M. N., & Dasuki, S. (2018). Assessing eLearning systems success in Nigeria: An application of the DeLone and McLean information systems success model. *Journal of Information Technology Education: Research*, *17*, 183-203. https://doi.org/10.28945/4077

Yaseen, H., Alsoud, A. R., Nofal, M., Abdeljaber, O., & Al-Adwan, A. S. (2021). The effects of online learning on students' performance: A comparison between UK and Jordanian universities. *International Journal of Emerging Technologies in Learning*, *16*(20), 4-18. https://doi.org/10.3991/ijet.v16i20.24131

Yilmaz, R. (2017). Exploring the role of e-learning readiness on student satisfaction and motivation in flipped classroom. *Computers in Human Behavior*, *70*, 251-260. http://dx.doi.org/10.1016/j.chb.2016.12.085

Zhang, Z., Cao, T., Shu, J., & Liu, H. (2020). Identifying key factors affecting college students' adoption of the e-learning system in mandatory blended learning environments. *Interactive Learning Environments*, 1-14. https://doi.org/10.1080/10494820.2020.1723113

APPENDIX A

Questionnaire Form

Construct	*Item*
Self-directed learning (SDL)	SDL1: "When it comes to learning and studying, I am a self-directed person."
	SDL2: "In my studies, I am self-disciplined and find it easy to set aside reading and homework time."
	SDL3: "In my studies, I set goals and have a high degree of initiative."
	SDL4: "I am able to manage my study time effectively and easily complete assignments on time."
Satisfaction (SAT)	SAT1: "I am satisfied with the performance of Moodle."
	SAT2: "I enjoy using Moodle in my study."
	SAT3: "Moodle satisfies my educational needs."
	SAT4: "Overall, I am pleased with the experience of using Moodle."
Perceived Academic Performance (APC)	APC1: "Moodle has helped me to achieve the learning goals of the module."
	APC2: "I had good grades in such courses where Moodle is used heavily."
	APC3: "Moodle makes communication easier with the instructor and other classmates."
	APC4: "Moodle is a very effective educational tool and has helped me to improve my learning process."
Continued usage intention (CUI)	CUI1: "I intend to continue using Moodle for knowledge gathering".
	CUI2: I intend to continue using Moodle for knowledge sharing and construction".

Construct	*Item*
	CUI3: "I intend to continue using Moodle for my course work in this semester".
	CUI4: "Overall, I intend to continue using Moodle".
Information quality (IQ)	IQ1: "The content and information available in Moodle is timely."
	IQ2: "The content and information available in Moodle is useful and easy to understand."
	IQ3:"The content and information available in Moodle can be relied upon."
	IQ4: "The content and information available in Moodle is accurate."
System quality (SYSQ)	SYSQ1: "Moodle provides high availability".
	SYSQ2: "The response time of Moodle is reasonable".
	SYSQ3: "Moodle has attractive features to appeal to the users".
	SYSQ4: "Moodle provides interactive communication between teacher and students".
Service quality (SVQ)	SVQ1: "The IT services staff understands the specific needs of students."
	SVQ2: "I receive a satisfactory and timely response from the IT services staff."
	SVQ3: "The IT services staff is available and cooperative when facing an error at Moodle."
	SVQ4: "Moodle provides proper online assistance and help."

APPENDIX B - TABLES

Table B1. Reliability and convergent validity tests

Constructs	**Items**	**Load-ing**	**α**	**CR**	**AVE**
Perceived Academic Performance (APC)	APC1	0.935	0.941	0.958	0.850
	APC2	0.918			
	APC3	0.913			
	APC4	0.921			
Continued usage intention (CUI)	CUI1	0.895	0.915	0.940	0.797
	CUI2	0.879			
	CUI3	0.899			
	CUI4	0.898			
Information Quality (IQ)	IQ1	0.895	0.893	0.926	0.757
	IQ2	0.847			
	IQ3	0.869			
	IQ4	0.868			
Satisfaction (SAT)	SAT1	0.956	0.946	0.965	0.903
	SAT2	0.952			
	SAT3	0.942			
Self-directed Learning (SDL)	SDL1	0.853	0.895	0.927	0.761
	SDL2	0.901			
	SDL3	0.858			
	SDL4	0.877			

Constructs	Items	Load-ing	α	CR	AVE
Service Quality (SVQ)	SVQ1	0.905	0.915	0.940	0.798
	SVQ2	0.894			
	SVQ3	0.887			
	SVQ4	0.886			
System Quality (SYSQ)	SYSQ1	0.958	0.935	0.958	0.884
	SYSQ2	0.933			
	SYSQ3	0.930			

Table B2. Discriminant validity test

	APC	IQ	SAT	SDL	SVQ	SYSQ	CIT
Perceived Academic Performance (APC)	***0.922**						
Information Quality (IQ)	**0.685	**0.870**					
"Satisfaction" (SAT)	0.702	0.766	**0.950**				
"Self-regulated Learning" (SLR)	-0.652	-0.661	-0.720	**0.872**			
"Service Quality" (SVQ)	0.711	0.697	0.738	-0.710	**0.893**		
"System Quality" (SYSQ)	0.711	0.732	0.752	-0.673	0.732	**0.940**	
"Continued usage intention" (CUI)	0.728	0.730	0.769	-0.715	0.756	0.746	**0.893**

*AVE square root, **correlation

Table B3. HTMT test

	APC	IQ	SAT	SDL	SVQ	SYSQ	CUI
Perceived Academic Performance (APC)	-						
Information Quality (IQ)	0.745	-					
Satisfaction (SAT)"	0.743	0.833	-				
Self-directed Learning (SDL)	0.708	0.738	0.782	-			
Service Quality (SVQ)	0.765	0.770	0.792	0.784	-		
System Quality (SYSQ)	0.756	0.798	0.799	0.735	0.790	-	
Continued usage intention (CUI)	0.783	0.807	0.826	0.789	0.826	0.806	-

Table B4. Collinearity test

		Dependent variables		
		APC	CUI	SAT
Independent variables	APC	-	-	-
	CUI	2.45	-	-
	IQ	-	2.93	2.57
	SAT	2.44	2.94	-
	SDL	-	2.520	2.36
	SVQ	-	2.890	2.81
	SYSQ	-	2.910	2.82

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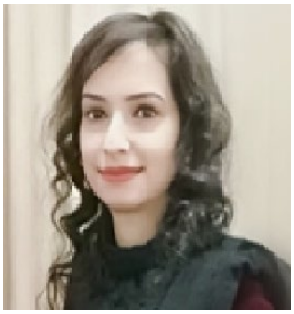

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