

Article

Examining E-Learning System Success in Jordanian Higher Education: Extending the Information Systems Success Model with Monitoring Quality

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Abstract

Higher education is increasingly digitalized, resulting in increased reliance on e-learning systems, and thus, e-learning system success should be sufficiently evaluated. However, students worldwide have shown unproductive e-learning use. Hence, the e-learning systems success model after the outbreak needs revision. To validate the e-learning systems success, the role of monitoring quality was examined in this study using current e-learning and information systems success models. Data from 600 students were analyzed with structural equation modelling (SEM) run by SMARTPLS 4. Results showed that user satisfaction was positively impacted by information quality, system quality and service quality but not by monitoring quality. Results further showed positive impact of user system use on student satisfaction, subsequently impacting student loyalty. Also, results showed user satisfaction significantly impacting learning effectiveness. This study enhances the information systems literature through the inclusion of monitoring quality into the DeLone and McLean information systems success model and through examining its impact on user satisfaction, loyalty intention, and learning effectiveness in e-learning environments.

Keywords: e-learning systems success; information systems success model; students' satisfaction; learning effectiveness; COVID-19 pandemic



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1. Introduction

The increasingly digitalized higher education has resulted in increased reliance on e-learning systems as a platform to deliver knowledge, communicate, and manage learning. As educational institutions continue investing in digital learning infrastructures, evaluating the success of e-learning systems becomes a vital research issue. Understanding the factors that contribute to user satisfaction, system utilization, and learning outcomes is essential for improving the effectiveness and sustainability of digital learning environments. At the global level, the pandemic has resulted in a dramatic shift toward digital

learning, and e-learning systems have secured a new and permanent role within higher education institutions [1–3], but this shift has an undesirable impact on societies, businesses, and economy [4,5]. The education sector was equally affected [6]. As reported by Núñez-Canal et al. [7], government restrictions owing to the pandemic have resulted in the incorporation of online learning or e-learning in schools worldwide. E-learning systems are essentially information systems (ISs) employing hardware, as well as software. Among the platforms used in delivering this form of learning are Coursera, Zoom, Google Classroom, and Microsoft Teams, especially in schools with internally developed e-learning systems [8]. Abumalloh et al. [2] saw the continued utilization of online education even after the pandemic ended.

In their studies Clark and Mayer [9] and Al-Fraihat et al. [10] highlighted the advantages of e-learning to learners. They mentioned that e-learning, aside from being uninhibited by the restriction of space and time, also offers various learning resources for learners in many forms like images, audio, and video. Not only that, learners can learn at their own pace with this type of learning (self-paced learning). Milićević et al. [11] added that e-learning offers flexibility and efficiency in addition to allowing learners to acquire the greatest amount of knowledge desired. In fact, e-learning was already a popular learning trend before the pandemic [12].

Despite its popularity and advantages, Singh et al. [13] found that e-learning does not always give positive outcomes, especially if it is employed as the only mode of learning, like during the pandemic. In other words, e-learning seems effective as a complementary method of learning [14]. In their studies, Szopiński and Bachnik [12] and Rasheed et al. [15] found that e-learning can be impaired by a learner's lack of trust or confidence, non-verbal communication, and the learner's personality traits. Monitoring quality has thus become a major concern among those responsible for developing and providing the services of e-learning [10,16].

In the traditional style of learning, also known as face-to-face learning, the one determining the learning goals, monitoring the learning plan, making available the information and resources, and evaluating the learning process and the effectiveness of the said learning process is the teacher or the instructor. In this type of learning, the teacher or instructor needs to be aware of the learner's learning needs and concerns in order that positive learning outcomes can be attained [14]. Contrariwise, in e-learning, instructor and learner are separated physically. Hence, it is impossible for the instructor to comprehensively monitor the learning process of the learner in this type of learning. Also, the instructor cannot promptly determine the correct responses and actions. Furthermore, as online learning lacks interactive communications, online discussions may not bring fruitful outcomes. For this reason, online learning or e-learning may not be suitable for unmotivated or dependent learners [12].

In higher education today, e-learning systems are key components of instructional delivery, and considering the increasing reliance of higher education institutions on digital learning environments, the quality, functionality, and the overall effectiveness of their e-learning systems need to be evaluated. Online learning was previously assessed based on two aspects, namely the test scores and the grades attained by learners in various course formats, attitudes of learners towards learning, and technology utilization to facilitate learning, as well as the suitability of e-learning for different types of learners [12,17]. On the other hand, the characteristics of e-learning systems, which could also affect learner perceptions and satisfaction and, consequently, learning effectiveness, have not been adequately examined.

E-learning systems are increasingly employed as support for face-to-face learning. It is thus important to assure that the e-learning used delivers quality education to learners [10].

Somehow, the effect of monitoring quality on students' attitudes and repeated usage of the system is not fully understood, and with the COVID-19 outbreak that resulted in a drastic rise in e-learning use, Milićević et al. [11] indicated the pressing need to investigate this aspect. Notably, e-learning system success has been examined in many studies based on popular frameworks, including the technology acceptance model (TAM) and the DeLone and McLean information systems success model. However, most of these studies focused on conventional systems' quality dimensions (e.g., information quality, service quality, and system quality), whereas other equally influential factors, such as monitoring quality and managerial satisfaction in e-learning environments, were not been adequately explored. Furthermore, most studies examined technology adoption and system success models discretely, while too few studies combined both perspectives in examining technology adoption and system success models. Apart from that, studies that empirically examined digital learning technologies utilizing both perspectives combined in higher education institutions in developing countries like Jordan were too few. As such, this study combined the DeLone and McLean information systems success model and technology acceptance model in examining learning system success and user satisfaction in higher education to gain deeper understanding of the factors influencing e-environments and to close the gap.

As e-learning systems are primarily information systems (ISs), the present study utilized the IS success model proposed by DeLone and McLean [18–20] to be its base. Furthermore, this study examined the effect of monitoring quality to gain understanding of the connections among features of ISs, loyalty intention, and the effectiveness of learning by way of communication quality and user satisfaction.

In addition, this study examined the quality attributes of IS success. Notably, the attributes were from the viewpoint of learner or student after the pandemic. The attributes which impact on students' loyalty intention and learning effectiveness were as follows: information quality, system quality and service quality, monitoring quality and information system (IS) use. Monitoring quality and IS use were the two new attributes. The role of quality attributes on learning outcomes was investigated, while the e-learning systems success model was attuned to the circumstances of the pandemic. The outcomes may benefit the e-learning providers and developers particularly during the designing stage. This study is indeed an enrichment to both e-learning and IS success knowledge.

The information systems success model has been extensively applied in evaluating information systems and e-learning platforms. However, research investigating the role of monitoring quality as an additional determinant of user satisfaction and learning outcomes is limited. Furthermore, many existing studies focus primarily on system quality, information quality, and service quality while overlooking the importance of monitoring mechanisms in supporting effective digital learning environments. The information systems success model was hence expanded in this study through the incorporation of monitoring quality. Using this expanded model, this study examined the impact of monitoring quality on user satisfaction, loyalty intention, and learning effectiveness.

Notably, despite the expansive use of the DeLone and McLean information systems success model in evaluating the success of information systems, it should be noted that the model mainly focuses on the dimensions of system quality and the post-adoption system success outcomes (e.g., system use and user satisfaction), and the model does not adequately explain the behavioral acceptance processes of users or the psychological factors that impact the decision of users to adopt a given technology. On the other hand, TAM provides stronger theoretical explanation of the perceptions of users toward technology acceptance, through the constructs of perceived usefulness and behavioral intention, which shape the technology adoption behavior of users.

2. Literature Review and Research Framework

2.1. E-Learning Systems Success

Originally, e-learning was simply an IS-fortified technology-based learning that involved electronical dissemination of learning materials to remote learners via a computer network [21]. In contrast, owing to advancements of technologies, the present-day e-learning offers learners content, tools, and systems that are richer and much more intricate [22]. Appositely, Huang and Chueh [9] and Al-Fraihat et al. [10] described e-learning as an IS or platform combining diverse instructional materials, including images, audio, and video text, and these materials are conveyed via live chats, online discussions, forums, quizzes and assignments, through Bluetooth, Wi-Fi, 5G cellular networks, and satellite. E-learning became a primary mode of learning and training during the outbreak of the pandemic [9,23,24].

E-learning has been studied by many, but thus far, findings on satisfaction towards learning process, quality attributes, and performance of e-learning have been inconclusive [25]. Considering these findings, McGill and Klobas [21] proposed the inclusion of e-learning into e-learning success studies. Equally, the impact of social, cultural, and political factors on perceived usefulness and perceived ease of use, and the continued intention to use and actual use, have been examined [9,10,26]. Furthermore, e-learning success could be measured using some models and theories [10]. For instance, the technology acceptance model (TAM) [27,28] could be employed in examining the factors that impact on the decisions of users towards adopting and utilizing e-learning systems, especially in terms of how and when.

TAM is often used by those who study e-learning acceptance [29]. Equally, TAM frequently receives criticisms, particularly concerning its theoretical ideas and real-world effectiveness. There are those who see that TAM lacks human and social change processes, in addition to lacking predictive and explanatory power [30,31]. Notably, TAM2 [32], TAM3 [33], UTAUT—which is an acronym for unified theory of acceptance and use of technology—created by Venkatesh et al. [34], and UTAUT2 created by Venkatesh et al. [35] are all expansions of TAM. As technologies progress, it is necessary to understand their antecedents and consequences. This will facilitate the comprehension of new technology adoption.

User satisfaction entails the discrepancy between user expectation towards an IS and the perceived performance of users of the said IS. Several approaches have been used in measuring user satisfaction. For instance, the micro perspective approach can be used in measuring user satisfaction. Specifically, it evaluates the satisfaction level of an IS [36]. Meanwhile, the macro perspective approach, as described by Wixom and Todd [37], can be used in evaluating all the implemented computer systems and technologies. Equally, within the context of an IS, user satisfaction can be evaluated as a sole factor [38]. Moreover, user satisfaction can also be combined with other constructs in a general evaluation of a model [20,39].

It appears that those who examined the success of e-learning system either used user satisfaction as a sole inclusive factor or included the factor into an evaluation model [40–43]. The level of user satisfaction denotes the success of an e-learning system [10], and in e-learning, perceived satisfaction becomes the outcomes of learner interaction with the instrument and environment of learning [12,44]. Hence, in learning effectiveness studies, student satisfaction is often a main indicator [45]. The IS success model from DeLone and McLean [18–20] therefore became the present study's theoretical foundation.

Additionally, the monitoring functions in the e-learning environments may facilitate students in their observation and assessment of their own learning progress during system usage. In this regard, having the perception that the e-learning system helps the attainment

of effective self-monitoring and progress evaluation may impart positive impact on the student's overall satisfaction toward the learning system. Hence, based on the findings of prior studies, a positive impact of monitoring quality on user satisfaction can be expected, especially within the environments of e-learning, among higher education students.

2.2. Information Systems (ISs) Success Model

In 1992, DeLone and McLean [20] created an IS success model. It includes six interrelated factors affecting IS success. These factors are as follows: system quality, system use, information quality, individual impact, organizational, and impact user satisfaction. The causality within the factors is displayed in the model organization and framework [46]. Previous studies have explored, augmented, and redefined the factors associated with the IS success model [47,48]. The first IS success model was updated by its authors (i.e., DeLone and McLean). Specifically, service quality factor was added as an aspect of IS success, while net benefits factor was added to replace of the factors of individual impact and organizational impact.

In examining e-commerce, DeLone and McLean [18] utilized the revised IS success model, resulting in the identification of success metrics of e-commerce systems. Apart from that, the authors mentioned the applicability of the validated success measures, including the quality attributes. Nonetheless, the attainment of net benefits requires the use of new success dimensions. The updated model has also been applied in numerous works, particularly in success measure verification involving the inclusion or amendment of numerous antecedent factors in predicting positive and negative impacts [10,22,45]. In this study, the model was used in investigating the impact of e-learning quality characteristics. A validated communication measure was also used, particularly on the net benefit outcomes of the continued use of e-learning tools and learning effectiveness.

In a study on e-commerce, DeLone and McLean [18] used an IS success model comprising the dimensions of usability, reliability, availability, adaptability, and response time. The model proposes direct connection between system quality and system performance. According to the model, information is the output performance of an e-commerce system. Additionally, measurement was made of the output performance based on content quality and the conventional aspects of information quality (applicable, easy to comprehend, and comprehensive). Meanwhile, service quality is the full e-commerce service support furnished by the internal department, or it can be outsourced through other service companies.

E-learning systems success is measurable through learner use. Meanwhile, learner use is potentially impacted by factors such as system quality, information quality, and e-system service quality, which also can affect learners' perceived satisfaction [18,19]. Therefore, the following three hypotheses were proposed:

H1. *Information quality imparts positive impact on user satisfaction.*

H2. *System quality imparts positive impact on user satisfaction.*

H3. *Service quality imparts positive impact on user satisfaction.*

2.3. Monitoring Quality

As elaborated by Järvelä and Hadwin [49], direct collaborative learning environments involved common views and standards through the monitoring of learning progress. As indicated by Järvelä and Hadwin [49], monitoring of learning progress is a major element within socially shared learning regulation. Further, Ucan and Webb [50], in describing collaborative learning, mentioned that it is a form of learning that involves the sharing of thoughts and feelings of learners towards the progress of the group. The performance

success of this type of learning is greatly affected by monitoring [51,52]. In previous studies, including those by Malmberg et al. [53] and Molenaar and Chiu [54], learning regulation monitoring was found to affect academic achievement positively.

The traditional classroom is physically monitored by instructors involving face-to-face or direct guidance, and this form of monitoring, according to Chen et al. [3], has desirable learning outcomes. In this type of learning, Chen et al. [3] indicated that both instructor and learner are physically present in the traditional classroom, and this arrangement is desirable for a learner who lacks autonomy, independence, and self-control. Meanwhile, in the e-learning system, the instructor is not physically present. Hence, physical monitoring cannot be performed in this learning type. In this study, monitoring quality is construed as the perceived ability of students in monitoring, evaluating, and tracking their own learning progress during interaction with the e-learning system. Notably, this study conceptualizes this construct from the viewpoint of the learner, specifically focusing on the self-assessment of the learner, the awareness of the learner of their own learning progress, and the capability of the learner to evaluate their own academic performance during their use of the e-learning system [16]. Contrariwise, the traditional construal of monitoring quality often focuses on the system-based or instructor-based monitoring mechanisms.

Monitoring quality can equally be understood as the degree to which the e-learning environment facilitates students in autonomously observing, assessing, and monitoring their own learning progress while utilizing the system. Hence, monitoring quality in this context focuses on the self-awareness of students during learning, identification of strengths and weaknesses, and autonomous progress assessment, as well as self-assessment of learning outcomes. Hence, the focus of this construct is on self-monitoring functionality not on external monitoring mechanisms executed by instructors or by automated learning systems [23]. Based on these patterns, the instructor could construct the right curricular support to facilitate learning so that learning becomes more effective and comprehensive [23]. This feature promotes nonstop learning and feedback, while also facilitating the attainment of learning goals [16]. Hence, this study proposed the hypothesis below:

H4. *Monitoring quality imparts positive impact on user satisfaction.*

Monitoring in e-learning environments has been examined in various studies, especially from the viewpoint of the system or the instructor. Contrariwise, monitoring quality was adopted in this study to be in alignment with the employed measurement instrument which focuses on the viewpoint of students on their capability to autonomously monitor and assess their own learning progress in their interaction with the e-learning system. Utilizing this approach harmonizes the construct operationalization and the measurement model.

2.4. System Use

Studies have been carried out on IS success and on the impact of IS usage on user satisfaction [55]. For instance, examining IS success, Masa'deh et al. [56] found that among a number of factors, user satisfaction seems to affect net benefits the most. However, the usage impact on user satisfaction has not been sufficiently investigated. Therefore:

H5. *Information system use imparts positive impact on user satisfaction.*

2.5. Loyalty Intention and Learning Effectiveness

Customer satisfaction can be viewed as the overall pleasing feeling felt by customers following the receipt of outcomes beyond expectation, resulting in positive user behaviors like the intent to recommend to others [57]. In a study by Wang et al. [58], it was documented that loyal customers are often the satisfied customers and that these customers are likely to

continue their usage—in this context, of e-commerce—if they felt satisfied in their previous use. Both these studies concluded that quality is linked to satisfaction and consequently to loyalty. Additionally, Shang and Wu [59], Hsu et al. [60], and Wang [61] found that customer satisfaction is a key determinant of customer loyalty, demonstrating that positive use experiences of a given system (e.g., e-learning systems) will increase the intention of users to reuse the systems. In other words, positive use experience will lead to loyalty. As such, we propose the following:

H6. *User satisfaction imparts positive impact on loyalty intention.*

Learning effectiveness can be understood as an inclusive array of learning outcomes [10]. Learning effectiveness has been measured by Alavi and Leidner [62]. In the measurement, the authors employed a number of constructs. These constructs included learning achievement and a satisfied feeling towards the learning process and outcomes, in addition to the emotional ambience of the learning environment. In a related study, Liaw [63] reported significant connection between the behavioral intention of learners and e-learning effectiveness. In their study, Wang et al. [58] reported positive effects of an intention to reuse on learning effectiveness through consistent learning-by-doing processes. Therefore, we propose the following:

H7. *Loyalty intention imparts positive impact on learning effectiveness.*

In examining intention towards usage continuance of the system (loyalty) and e-learning's learning effectiveness amid the pandemic, the present study brought forth an inclusive, multidimensional research model comprising constructs such as service quality, information quality, system quality, system use, monitoring quality, user satisfaction, loyalty intention, and learning effectiveness. Figure 1 accordingly illustrates the proposed research framework.

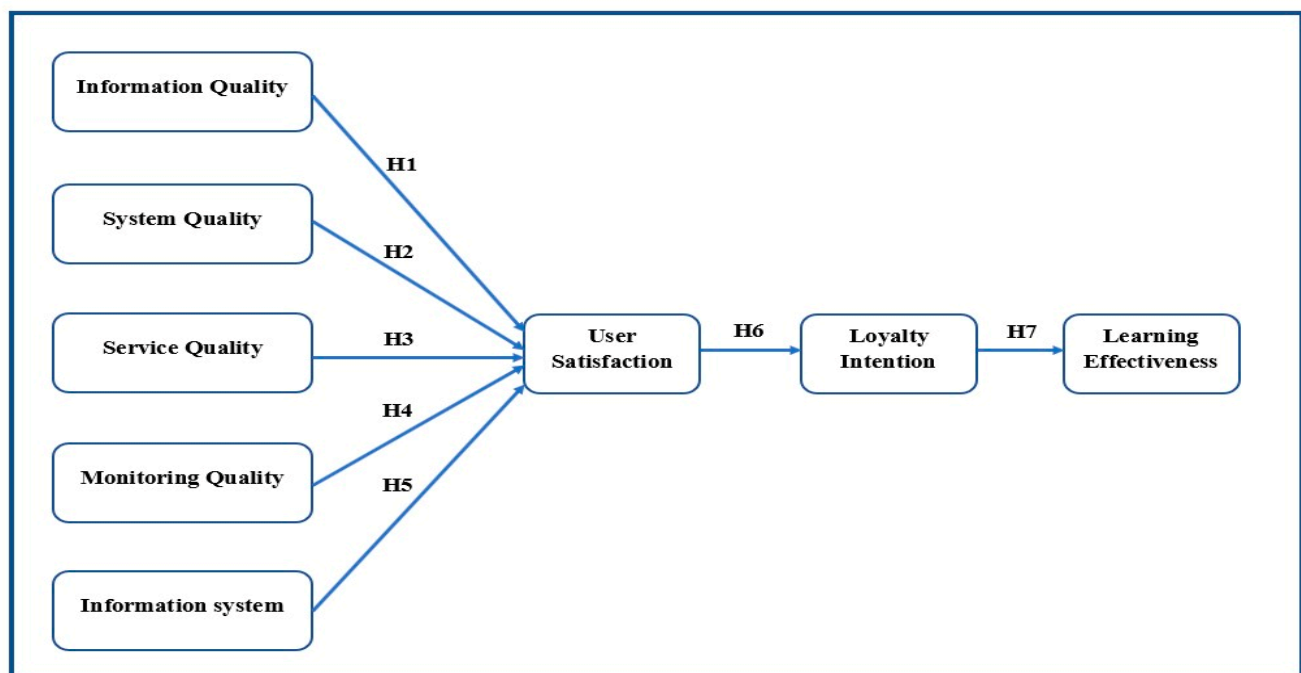


Figure 1. Research model.

3. Research Methodology

A questionnaire was the tool employed in data gathering. The questionnaire comprised items representing 8 constructs. All items, as displayed in Table 1, were adopted from previous studies. The construct Monitoring Quality was executed from a learner's viewpoint. Here, the items of measurement were based on the perceptions of students on their competences in monitoring and assessing their own learning progress in their interaction with the e-learning system.

Table 1. Measurements of factors.

Factor	Code	Measurement Dimensions of Factors
Information Quality (IQ) [61]	IQ1	I receive the correct information that I need when I use e-learning.
	IQ2	The information that I receive from e-learning is exactly the one that I need.
	IQ3	In my opinion, e-learning provides reliable outcomes.
System Quality (SQ) [64]	SQ1	I never faced disruptions or technical issues in my e-learning system use at my university.
	SQ2	The e-learning system in my university allows fast downloads of educational materials.
	SQ3	The e-learning system promotes effective communication among subject instructors of teachers.
	SQ4	Using e-learning system allows learners and instructors to communicate effectively, between them, and among them.
	SQ5	The e-learning system in my university appears to be well-organized and is of high quality.
Service Quality (SerQ) [18,19]	SerQ1	The e-learning system implemented in my university provides timely service.
	SerQ2	The information presented by my university's e-learning system is accurate.
	SerQ3	The training that I received from my university's e-learning system enhances my work especially in terms of quality.
	SerQ4	I can resolve issues with my university's e-learning system.
	SerQ5	My university has reliable e-learning system because it provides what it is intended to.
Monitoring Quality (MQ) [65]	MQ1	The new knowledge I attained from the e-learning at my university matches my own experiences.
	MQ2	I recognize my strengths and weakness in my learning.
	MQ3	I am capable of monitoring my own learning progress.
	MQ4	I am capable of assessing my learning outcomes on my own.
System Use (SU) [61]	SU1	In my university, subject instructors would present educational material with the e-learning system.
	SU2	Subject instructors in my university would use the e-learning system in their interactions with students and in providing answers to my questions.
	SU3	Subject instructors in my university would utilize the e-learning system in delivering tests and exams.
	SU4	Outbreak of COVID-19 has initiated the expansive and intensive use of e-learning system in my university.
	SU5	Use of e-learning system is nothing new to me.

Table 1. *Cont.*

Factor	Code	Measurement Dimensions of Factors
User Satisfaction (US) [18,19,66]	US1	In my university, e-learning system use is generally an effortless task for me.
	US2	My university's e-learning system is of good quality overall.
	US3	Overall, I have sufficient interaction with the subject instructors via the e-learning system.
	US4	Overall, I find my university's e-learning system satisfying.
	US5	I am generally satisfied with what I have academically achieved through e-learning system use in my university.
Loyalty Intention (LI) [66]	LI1	I am going to promote e-learning system use to my mates in the following semesters.
	LI2	I am almost certain to choose using the currently used e-learning system if I had to choose among other similar systems for my learning.
	LI3	I prefer using the e-learning system as opposed to YouTube, Facebook, TikTok, Instagram, etc.
Learning Effectiveness (LE) [63]	LE1	My learning performance can be improved with e-learning.
	LE2	I can learn more effectively with e-learning.
	LE3	I am more motivated to learn with e-learning.

All construct items were measured using five-point Likert scale, and the measurement ranged from “1” to denote “Strongly Disagree” to 5 to denote “Strongly Agree.” Also, the questionnaire distributed to the respondents was the translated Arabic version. Prior to data collection, the questionnaire was translated from the original English language to Arabic language. This was to facilitate the respondents in answering the items, considering that the respondents were mostly Arab native speakers. The method used in translating the questionnaire was the back- or reverse-translation method, where, first, the original English questionnaire was translated into Arabic. Then, the translated Arabic version was translated back into English. Then, both the original English version and the translated English version were compared. This method assures translation accuracy and conceptual equivalence. However, before the actual survey, the questionnaire was pretested on 15 students that have used e-learning systems at their respective school. The students also provided feedback on the questionnaire, and the questionnaire was accordingly refined using the feedback.

Sample and Data Collection

The participants of this study were recruited using non-probability convenience sampling method, and these participants were higher education students in Jordan. All participants took part in this study voluntarily and were assured in terms of anonymity and confidentiality. Also, they were informed on the study purposes prior to data collection. The study questionnaire was distributed to the participants via a link in the commonly used Facebook online educational communities and university student groups among Jordanian higher education students. Data were collected from May 2025 to July 2025. A total of 600 responses were usable for analysis. The following table, Table 2, provides the demographic information on the study respondents, particularly on their gender, age, level of education, and work experience.

Table 2. Demographic information.

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	252	42
	Female	348	58
Age	≤25 years	276	46
	26–30 years	204	34
	31–40 years	90	15
	>40 years	30	5
Educational Level	Diploma	108	18
	Bachelor's degree	432	72
	Postgraduate	60	10
Work Experience	<1 year	168	28
	1–5 years	180	30
	6–10 years	144	24
	>10 years	108	18

4. Data Analysis

Based on the recommendations of Hair et al. [67], this study employed structural equation modeling (SEM) run with SMARTPLS 4 to examine multiple concurrent relationships among latent constructs. The theoretical model was tested. As described by Hair et al. [68], SEM includes two models, namely the outer model that classifies the relationships between the latent variables and the observed indicators with them and the inner model that classifies the relationships between the independent and dependent latent variables.

4.1. Evaluation of the Outer Measurement Model

This study employed statistical tests in examining the model's validity and reliability based on Hair et al. [67]. Composite reliability (CR), the internal consistency reliability (Cronbach's alpha), the convergent validity, and the discriminant validity of the items were accordingly determined. Table 3 shows that Cronbach's alpha (α) values were in the range between 0.733 and 0.895. In regard to the attained composite reliability (CR) values, they were between 0.740 and 0.899, demonstrating a satisfactory level of internal reliability [69]. To determine the convergent validity of the items, AVE was computed and the resulting values fulfilled the cut-off value of 0.5 [68].

Table 3. Outer-loading and convergent validity.

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Information Quality	0.733	0.740	0.651
Learning Effectiveness	0.861	0.859	0.786
Loyalty Intention	0.775	0.776	0.690
Monitoring Quality	0.857	0.899	0.695
Service Quality	0.878	0.880	0.671
System Quality	0.834	0.838	0.604
System Use	0.875	0.879	0.667
User Satisfaction	0.895	0.898	0.706

To check for discriminant validity, the heterotrait–monotrait method (HTMT) was employed based on the recommendation of Henseler [70], and results in Table 4 shows HTMT values significantly lower than 0.90 as recommended by Leguina [71]. Hence, all constructs showed discriminant validity. For multicollinearity evaluation, variance inflation factor (VIF) values were used, and the table shows that all values of VIF were lower than 5.0, which is the recommended cutoff value. Hence, this study had no multicollinearity issue.

Table 4. Discriminant validity heterotrait–monotrait ratio (HTMT) matrix.

Construct	IQ	LE	LI	MQ	SERQ	SQ	SU	US
Information Quality								
Learning Effectiveness	0.461							
Loyalty Intention	0.522	0.466						
Monitoring Quality	0.277	0.298	0.203					
Service Quality	0.560	0.485	0.522	0.253				
System Quality	0.530	0.536	0.604	0.303	0.558			
System Use	0.540	0.431	0.546	0.249	0.534	0.527		
User Satisfaction	0.538	0.425	0.548	0.258	0.575	0.558	0.565	

Figure 2 shows that all loadings were above 0.5, thus approving the study's measurement model.

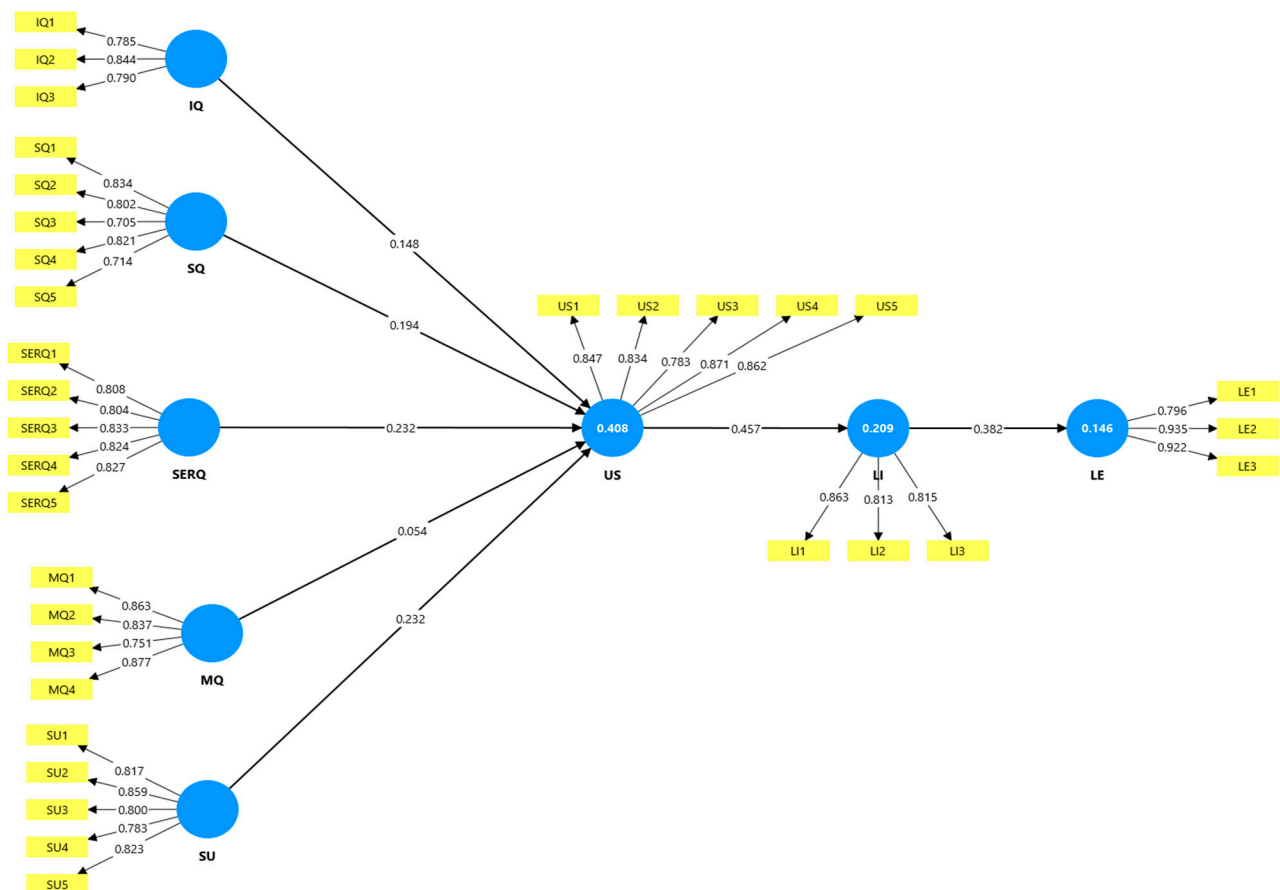


Figure 2. Results of measurement model.

4.2. Assessment of the Structural Inner Model

The structural model is evaluated to determine the distinction of the endogenous variables from the exogenous variable [68]. In determining the model fitness, this study followed Chin's [72] suggestion; that is, R^2 should be 0.10 or greater for a satisfactory

fit. Results showed that user satisfaction, loyalty intention, and learning effectiveness achieved a satisfactory R^2 value of 0.408, 0.209, and 0.146, respectively. As for SRMR value, it should be 0.08 or lower, while NFI should be at least 0.90 to ensure that the model has a good fit to the data [67,70]. This study attained SRMR of 0.067 and NFI of 0.913, affirming goodness of fit (GoF). Additionally, bootstrapping alongside its t-value was applied in determining the path coefficient. As presented in Table 5, a total of seven hypotheses were proposed. Results showed positive and statistically significant relationships among the hypothesized constructs, with the exception of Monitoring Quality, as the construct did not have a significant effect on user satisfaction.

Table 5. Results.

Hypothesis	Sample Mean (M)	T Statistics	<i>p</i> Values	Results
IQ → US	0.148	4.000	0.000	Supported
MQ → US	0.054	1.604	0.109	Not supported
SERQ → US	0.232	5.527	0.000	Supported
SQ → US	0.194	4.770	0.000	Supported
SU → US	0.232	6.088	0.000	Supported
US → LI	0.457	12.821	0.000	Supported
LI → LE	0.382	10.026	0.000	Supported

Results of the structural model as illustrated in Figure 3 were generated using SmartPLS (Version 4.0.9.9; SmartPLS GmbH, Oststeinbek, Germany). The figure illustrates the relationships among the constructs, including the standardized path coefficients and their corresponding significance levels. This graphical presentation complements the tabulated results by clearly demonstrating the strength and direction of the conjectured relationships in the structural model.

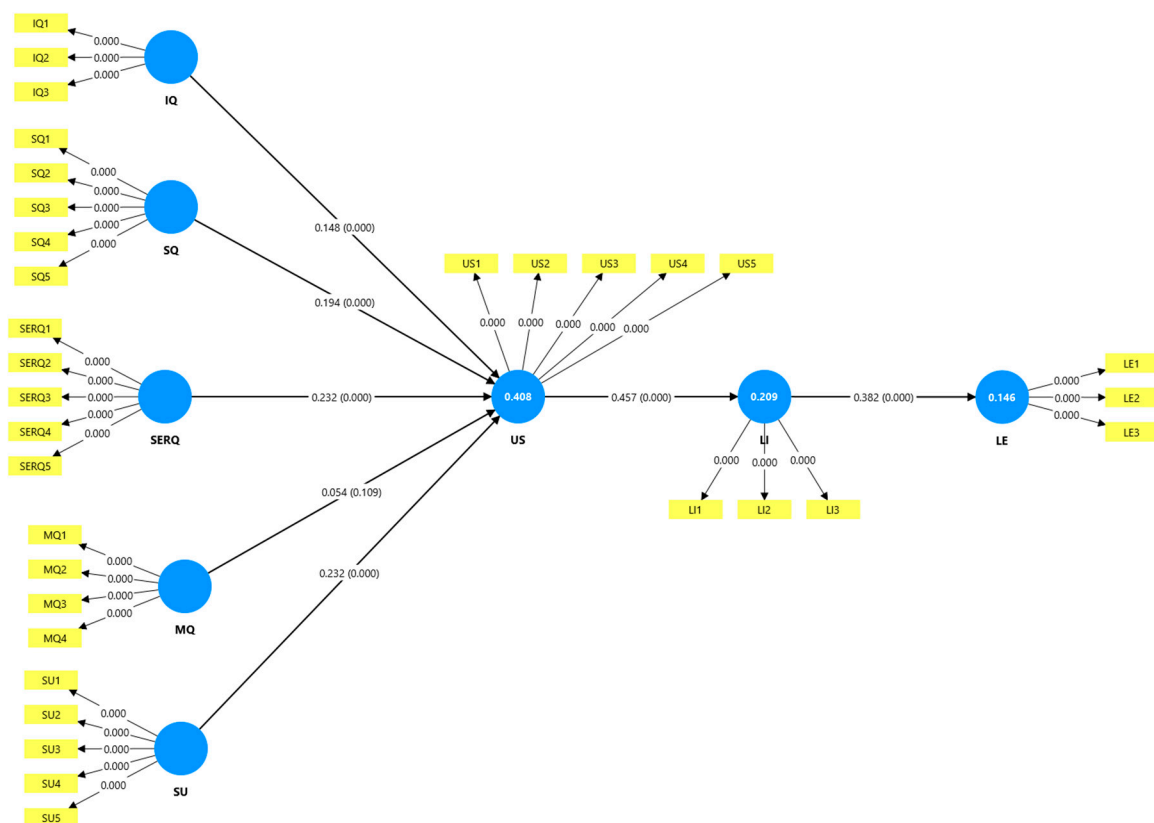


Figure 3. R square and path coefficient.

Results demonstrated that User Satisfaction was positively and significantly impacted by Information Quality, System Quality, Service quality and System Use, supporting H1, H2, H3, and H5. Results showed that User Satisfaction was not affected by Monitoring Quality. Thus, H4 was not supported. Results showed that User Satisfaction affected Loyalty Intention, and subsequently, Learning Effectiveness, positively and significantly. Hence, H6 and H7 were supported.

5. Discussion

Overall, results showed that in e-learning systems, user satisfaction appears to be affected by information quality and service quality. This demonstrates that both information quality and service quality acted as determinants of user satisfaction. The impact of user satisfaction on loyalty intention was also demonstrated, which is in agreement with Al-Fraihat et al. [10], Wang et al. [58], and Wang [61]. Information quality, service quality and user satisfaction are thus vital in e-learning system success.

Results demonstrated that monitoring quality does not impact on user satisfaction. A similar finding was also reported by Chen et al. [3]. This finding may suggest that the overall satisfaction of students toward e-learning systems is not significantly impacted by self-monitoring and self-evaluation. Further, despite being facilitated by the e-learning environments in tracking and assessing their own learning progress, students may perceive system-related factors (e.g., service quality, system quality, and information quality) as more influential (than the e-learning environment) in shaping their overall satisfaction perceptions [14]. Previous studies [7,10,42,73–76] have also reported competence of learners affecting their e-learning process and perceived satisfaction, as well as their continuance intention, suggesting that students perceive self-monitoring functions as merely supportive learning features, not the key determinants of their overall satisfaction with the e-learning system.

Also, results demonstrate that employees, when encouraged to use the information system in their organization, are likely to increase their actual use of the system in the organization. Furthermore, integrated information systems with high functionalities, flexibility, and reliability will increase user satisfaction. Also, results demonstrated positive and direct impact of learning effectiveness on loyalty intention, demonstrating the need for consistent learning intention to promote new learning skills, knowledge, and performance.

5.1. Implications

The findings of this study have important implications for information management and decision-making in higher education institutions. By demonstrating the influence of information quality, system quality, service quality, and monitoring quality on user satisfaction, system use, and learning effectiveness, the proposed model provides educational leaders with a decision-support framework for evaluating and improving e-learning environments. The information generated through successful e-learning systems enables university administrators to make evidence-based decisions regarding technology investments, curriculum planning, student support services, resource allocation, and institutional quality enhancement. Consequently, the study extends the information systems success model beyond system evaluation by highlighting its value as a strategic tool for informed decision-making in educational institutions. In practice, this study has some major implications, especially to higher learning institutions, developers of educational technology, and decision-makers, in the implementation of digital learning systems. Firstly, given that User Satisfaction was significantly impacted by Information Quality, System Quality, and Service Quality, it is necessary for education institutions to focus on improving their system reliability, content accuracy, and technical support services in their assessment of the

effectiveness of e-learning systems. Hence, for universities, it is necessary to continuously evaluate their learning content—rather than just evaluating the general accessibility of the system—to make sure that the learning content is relevant, up to date, and in alignment with the academic needs of the students.

Second, as Monitoring Quality and User Satisfaction did not show a significant link, it may mean that the overall satisfaction of students towards the e-learning system was not meaningfully affected by self-monitoring or progress-tracking functions. This finding demonstrates the need for educational institutions to focus on enhancing the quality of their content delivery and their system functionality, as well as their service responsiveness, instead of merely focusing on monitoring the related features.

Third, considering the significant impact of User Satisfaction on System Use and Student Loyalty, a student-centered evaluation strategy should be adopted by education institutions. This involves routine assessment of satisfaction perceptions of students as a major indicator of the long-term success of an e-learning system. To reinforce continued system usage and long-term acceptance, it is necessary for education institutions to consistently improve their overall practice by improving user experience rather than just focusing on the system implementation itself.

In essence, results demonstrate the significant impact of technological and service-related dimensions on students' overall satisfaction, implying the need for education institutions to prioritize these dimensions. In other words, education institutions should be aware that each feature of the system contributes differently to digital learning adoption success. Universities, particularly, need to improve their information quality by providing students with reliable, accurate, and up-to-date learning materials. Not only that, the materials provided need to meet the academic needs of the students. As for system quality, it can be improved by reducing the technical disruptions, increasing the effectiveness of student-instructor communication, and by making the system more reliable and the platform more responsive. With respect to service quality, it can be improved through proper guidance, timely technical support, and regular training so that students can utilize the e-learning platform more effectively. Also, considering the significant impact of user satisfaction on loyalty intention and learning effectiveness, universities need to make efforts towards increasing student satisfaction to enhance their overall learning experience and to increase their likelihood to continue using the e-learning system.

In theory, this study is a valuable enrichment of the IS domain. Firstly, this study expands the information systems success research by enriching the DeLone and McLean information systems success model by adding the factor of Monitoring Quality as a quality dimension in evaluating e-learning systems. In addition, this study enriches the technology adoption research, as it puts forth a combination of information systems success viewpoint and technology acceptance constructs to concurrently examine the technological quality factors and user-centered behavioral outcomes. Last but not least, this study is a valuable addition to the expanding research on digital learning and higher education information systems through its empirical evidence from Jordan as a developing economy—Jordan has not been adequately studied in terms of the joint effects of technological quality dimensions and user behavioral responses within the settings of e-learning.

5.2. Limitations and Future Work

The present study had limitations. Firstly, despite the vastness of the data obtained—as they were obtained from countless of representatives of major universities—the said data were not sufficiently comprehensive. The other limitation is the data source, namely Jordan, which is a developing Middle East country, which means that the outcomes may not be as generalizable to other countries. Considering these limitations, it is recommended that

future studies employ the model proposed in this study with a bigger scope, specifically, with countries and nations other than Jordan. This would enhance the explanatory capabilities of the model, consequently increasing the impact strength of System Quality on other constructs. Regardless, this study proved the explanatory capabilities of system quality in understanding user satisfaction.

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