A Model for Evaluating the Success of Learning Management Systems in Higher Education

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Abstract

Over the past two decades, numerous universities worldwide have implemented various learning management systems (LMS) to facilitate the electronic management of teaching and learning processes. Research into LMS usage can help universities improve their understanding of educational management. This study aims to explore the complex interactions and collective influence of critical components within the e-learning environment, focusing on the interdependencies and combined effects of key factors on User Satisfaction (US). After conducting an extensive literature review, we developed a conceptual model for LMS success by integrating constructs from established models and incorporating the dimension of User Loyalty (UL). To validate this model, we conducted a case study at the Faculty of Economics and Administration, Arts & Humanities, English Language Institute, and Computing and Information Technology at King Abdulaziz University, Saudi Arabia Kingdom. The relationships among the model's determinants were analyzed using structural equation modeling. This paper presents our findings, emphasizing the significance of Information Quality (InQ), System Quality (SyQ), Service Quality (SvQ), Perceived Usefulness (PU), and Perceived Ease of Use (PeU) on US, and highlighting the impact of US on UL within the proposed model hypotheses.

Keywords: Information Quality, Perceived Usefulness, System Quality, User Loyalty, Service Quality, Perceived Ease of Use, User Satisfaction, and Learning Management Systems.

1. Introduction

Today, the advent of computers in daily life has sparked significant changes globally, leading to advancements across various fields, including education. The integration of the Internet and emerging technologies has enhanced numerous e-learning systems, transforming teaching and

learning practices for the better in higher education institutions [1]. Additionally, Information and Communication Technology (ICT) has further elevated the quality of education [2].

A LMS is a type of software used for managing, reporting, and conducting various training activities [3]. An effective LMS introduces innovative approaches to learning in higher education and professional development. With everything now organized electronically and stored digitally, technological advancements have led to the creation of flexible and collaborative platforms that enhance the learning experience. Moodle, for instance, is an LMS gaining global traction [4]. While some faculty members in Jordan have successfully integrated LMS into their teaching, others still face challenges in adopting and utilizing basic LMS technologies and tools designed to support modern learning methods [5]. The authors in [6] note that the culture and norms within higher education institutions are key factors influencing the adoption and implementation of LMS.

Information and Communication Technology has emerged as a key area of interest in education. Integrating ICT into teaching offers numerous advantages, including enhanced learning quality [7], the development of technological skills in students, increased interactivity [8], improved performance and motivation for both teachers and students, and the overcoming of time and space constraints in teaching [9]. The rise of ICT has introduced new concepts in education, such as e-learning, virtual classrooms, digital content, knowledge management, and web-based learning. Moreover, the role of educators has significantly evolved in the 21st century. Once primarily conveyors of information, they are now seen as facilitators and mentors [10].

LMS, also referred to as Virtual Learning Environments (VLEs) or Course Management Systems (CMSs), are valuable tools for both students and instructors in online learning settings [7, 11]. An LMS is defined as a web-based technology that supports the planning, distribution, and evaluation of learning processes [12]. According to Sallum [13], an LMS is a comprehensive solution that facilitates the delivery and management of educational content and resources for students and staff. This system includes software applications and features that make learning materials accessible and manageable, and it aids instructors in providing materials and handling student registration.

In Saudi Arabia, the Ministry of Higher Education has acknowledged the significance of ICT across universities nationwide. As a result, the ministry integrated e-learning into the national strategy to support distance learning, e-learning, and blended learning in higher education. This initiative led to the creation of the Saudi Electronic University in 2011. Additionally, many universities in the kingdom established deanships of e-learning and hired staff to facilitate blended learning and the adoption of LMS in their courses [14]. A study conducted with 160 diploma students from the Department of Information Systems at King Khalid University utilized the Technology Acceptance Model (TAM) and found that students were adept at using the E-Learning System. The study revealed that both the PeU and PU significantly influenced students' attitudes towards the E-Learning System [15].

Revythi and Tselios [16] examined both technology acceptance and behavioral intention to use LMS using the TAM. They investigated eight variables: self-efficacy, year of study, PU, PeU, system access, social norms, and behavioral intention. Their aim was to

understand how these factors influence students' acceptance of educational learning systems. The study involved 345 students from Patras University and found that system access, social norms, and self-efficacy significantly affect students' intentions to use LMS effectively [16].

Juhary [17] explored students' perceptions of using the Learning Management System (LMS) at the Defence University of Malaysia, utilizing the original TAM. The study found that students' perceptions of the LMS's usefulness and ease of use influenced their attitudes toward it. In turn, these attitudes impacted their intention to use the LMS. Specifically, students who perceived the LMS as useful and easy to use developed positive attitudes towards it, which subsequently led to stronger intentions to use the LMS [17].

Mabed and Koehler [18] expanded on the TAM by incorporating self-efficacy and SyQ into their proposed model to examine factors influencing students' acceptance of the Open Learning and Training (OLAT) system at a school in Egypt. They used a questionnaire previously employed in other studies, selecting 27 items to cover all variables in their research model. The results indicated that PeU was the key variable linking attitude, PU, and system usage. Additionally, the study highlighted a strong, positive impact of SyQ on PU, PeU, and self-efficacy. While self-efficacy enhanced PU and PeU, it did not significantly influence attitudes towards using OLAT [18].

2. Research Model

US is considered one of the most important indicators of information system (IS) success. Evaluating user satisfaction entails assessing consumers' overall contentment with service performance, gathering user feedback, and considering national circumstances [2]. The D&M model has facilitated numerous researchers, who have tested it empirically in diverse settings or provided critiques and enhancements to certain aspects [3]. Examining advancements in particular quality dimensions can result in heightened satisfaction and diminished dissatisfaction. Additionally, US plays a key role in fostering loyalty toward service providers; greater satisfaction typically promotes ongoing service usage [1]. Within the service domain, value and quality are viewed as foundational elements leading to satisfaction, with their effects on loyalty being influenced by satisfaction levels [4].

Several studies have adapted the D&M model for e-learning contexts. For instance, Tella modified the model to assess the effectiveness of e-learning systems at the University of Botswana. The study found that content quality, SyQ, support SvQ, teaching and learning quality, self-regulated learning, intention to use, US, and net benefits were crucial factors in evaluating the success of e-learning content management systems [20].

In this study, the proposed model includes the following dimensions: InQ, SyQ, SvQ, PU, PeU, US, UL, and net benefits. Figure 1 outlines the main dimensions of the proposed Conceptual Model.

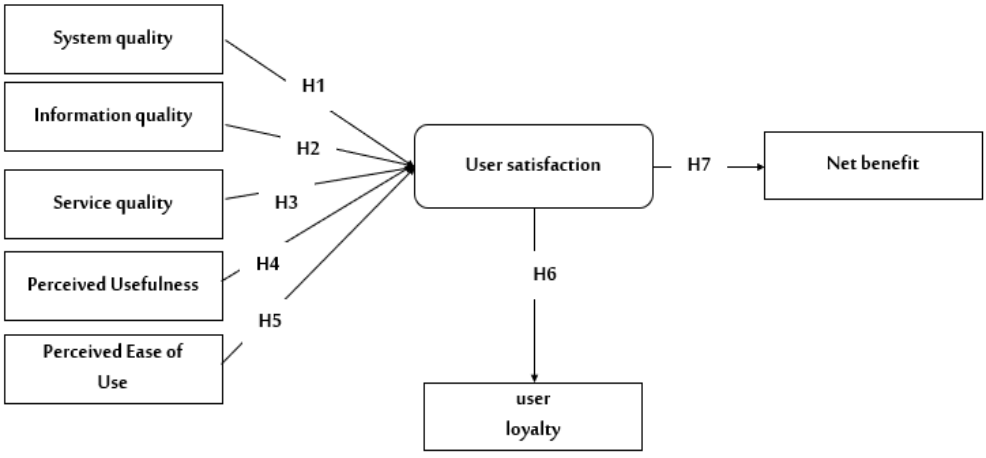

Figure 1: outlines the main dimensions of the proposed Conceptual Model.

- InQ: the accuracy, relevance, clarity, and timeliness of the information provided by the system, which impacts the effectiveness and value of the content delivered to users.
- SyQ: the technical performance and functionality of the system, including its reliability, usability, and efficiency, which directly affects the user experience and effectiveness of the system.
- SvQ: the overall effectiveness and efficiency of the support and services provided to users, including technical assistance, training, and system maintenance, which impacts their overall satisfaction and system experience.
- PU: the degree to which users believe that utilizing the system will enhance their performance, productivity, or effectiveness in achieving their educational or work-related goals.
- PeU: the degree to which users believe that using the system is straightforward and free from effort, which influences their willingness to adopt and effectively use the system.
- US: the degree to which users feel content with their experience using the system, encompassing aspects such as functionality, support, and overall effectiveness in meeting their needs and expectations.
- UL: the extent to which users consistently prefer and continue to use the system over time, demonstrating a strong commitment and positive attitude toward the system based on their overall experience and satisfaction.
- Net benefits: the overall positive impact and value derived from using the system, measured by the extent to which it enhances performance, achieves goals, and provides tangible advantages compared to its costs or alternatives.

The conceptual model is depicted in Fig. 1. Therefore, the following seven hypotheses will be evaluated:

- H1: SyQ has positive impacts on US;
- H2: InQhas positive impacts on US;
- H3: SvQ has positive impacts on US;
- H4: PU has positive impacts on US;
- H5: PeU has positive impacts on US;
- H6: US has positive impacts on UL;
- H7: US has positive impacts on Net benefit.

3. Research Methodology

- Data collection

Data were collected from September 9 to December 27, 2023, through an online questionnaire distributed to university students enrolled in distance or online classes. Participants were selected using convenience sampling. Before completing the questionnaire, each recipient was informed about the questionnaire's content and the research's purpose. Only those who confirmed their enrollment in college and participation in online classes were permitted to complete the survey, while responses from individuals who were not college students or were not taking online classes were excluded. All responses were anonymous. The target sample for the study was 400 students, but only 175 completed the survey in full. A 5-point Likert scale, spanning from "strongly disagree" to "strongly agree," was employed to evaluate the questionnaire items.

- Data analysis

Data analysis was conducted using SPSS and AMOS software. Initially, a frequency analysis assessed the demographic characteristics of the survey participants. Following this, confirmatory factor analysis was performed on each item to evaluate the validity and reliability of the survey tool, with Cronbach's α coefficient calculated to ensure internal consistency among the items. The reliability test yielded Cronbach's alpha values ranging from 0.80 to 0.90, indicating a well-constructed scale [21]. Specifically, the administered questionnaire achieved a reliability score of 0.887, further confirming the scale's robustness. Table 1 presents the reliability test results for each construct.

Table 1: Cronbach's Alpha.

Item Reliability	Item Reliability
SyQ	0.893
InQ	0.886
SvQ	0.836
PU	0.895
PeU	0.878
US	0.880

UL	0.821
Net benefit	0.826

- Characteristics of participants

Table 2 below presents details about the 175 students, including 80 males and 95 females. The breakdown by academic year is as follows: 40 first-year students (22.9%), 63 second-year students (36%), 45 third-year students (25.7%), and 27 fourth-year students (15.4%). Regarding their educational backgrounds, 42 were majoring in humanities and social sciences (24%), 41 in education (23.4%), 35 in Computer Science and Information Technology (20%), 33 in health (18.9%), and 24 in other fields (13.7%). Additionally, 54.9% of respondents reported taking online classes for one to two semesters, while 56.6% attended online classes three to four times per week, making these the most common frequencies reported.

Table 2: Demographic information.

Characteristics		n	Percentage
Gender	Male	80	45.7
	Female	95	54.3
	Total	175	100%
Year	First-year	40	22.9
	Second year	63	36.0
	Third year	45	25.7
	Fourth-year	27	15.4
	Total	175	100%
Major	Humanities and Social Sciences	42	24.0
	Education	41	23.4
	Computer Science and Information Technology	35	20.0
	Health	33	18.9
	Other	24	13.7
	Total	175	100%
Class method	Only online classes	97	55.4
	Both online and offline classes	78	44.6
	Total	175	100%
Period	< 1 Semester	7	4.0
	1 Semester	37	21.1
	1–2 Semesters	96	54.9
	> 2 Semesters	35	20.0
	Total	175	100%
Frequency of lessons per week	1–2 times	25	14.3
	3–4 times	99	56.6
	5 or more times	51	29.1
	Total	175	100%

- Descriptive statistics

Descriptive statistics were run to analyze the collected data, The purpose of using descriptive statistics is to condense large datasets into simpler summaries, transforming them into graphic diagrams and numerical methods that allow readers to interpret and understand the information easily [22]. Descriptive statistics and frequency distributions were employed to give an overall perspective and highlight the characteristics of the collected data [23]. For the scaled variables, descriptive statistics such as means and standard deviations were calculated, as detailed in Table 2 below.

Table 3 shows that all mean values exceed 3.75 and are relatively similar, indicating that the responses are closely grouped around the mean. Additionally, the standard deviations being below 1.00 suggests minimal variation in the responses.

Table 3: Descriptive statistics.

Factors	Mean	SD
SvQ	3.94	0.899
InQ	3.75	0.877
SyQ	3.81	0.881
PU	3.95	0.894
PeU	3.96	0.884
US	3.92	0.883
UL	3.89	0.878
Net benefit	3.88	0.881

- Fit Measure

To estimate the proposed measurement model, Structural Equation Modeling (SEM) was utilized [24]. SEM generally comprises two sub-models: the measurement model and the structural model. The measurement model assesses the relationships between unobserved and manifest variables, while the structural model analyzes the relationships among independent and dependent variables [24, 25]. Given the main purpose of this study, we focused on estimating the measurement model.

Confirmatory Factor Analysis (CFA) evaluates how effectively the theoretical pattern aligns with the actual data [25]. It serves as a statistical method for assessing the validity of a measurement model [26]. In essence, CFA enables us to determine the extent to which the theoretical measurement model corresponds to the study's data, providing a confirmatory test for the model [25].

In structural equation modeling, the chi-square statistic (χ^2) is the most frequently reported measure of fit [27]. This statistic assesses how much the observed data differs from the hypothesized model. A higher P-value (related to CMIN) indicates a better alignment between the hypothesized model and an ideal fit [28, 29]. In the current study, the chi-square value is 14.988 with a P-value of 0.010, suggesting that the model aligns with existing theories and exhibits minimal deviation. The overall fit, shown by a Chi-square/df ratio of 2.664 with 5 degrees of freedom, reflects a very good fit.

To assess the validity of the proposed measurement model, a confirmatory factor analysis (CFA) was conducted. The model's fit indices, presented in Table 4, align with established recommendations and demonstrate a strong fit to the data. This supports the hypothesis that the model's items effectively measure their intended latent variables.

Table 4: The model fit indices.

Fit measures	Model fit	Recommended value
P value	0.010	>0.05
CFI	0.971	>0.90
RMSEA	0.135	<0.08
CMIN/Df	2.664	<3

- Hypotheses Testing and Discussion

While SEM excels at testing multiple hypotheses simultaneously within a model, it's often valuable to analyze and evaluate each hypothesis individually [30] (see Table 5). In the proposed model, all pathways demonstrated statistical significance. AMOS provides a metric called the critical ratio (C.R.), determined by dividing the coefficient by its standard error.

As shown in table 5, the lowest C.R. was observed in Hypothesis 2, which examines the relationship between InQand US, with a C.R. of 2.822, still indicating a significant effect. In contrast, Hypothesis 3, connecting SvQ and US, exhibited the strongest relationship with a C.R. of 2.931. Notably, US also significantly influenced Net benefit (Hypothesis 7) with a C.R. of 2.885 and a p-value of 0.001. These C.R. results suggest that SvQ has a more pronounced impact on US than SyQ, InQ, PU, and PeU.

Table 5: Results of Hypothesis Testing

Hypothesis	C.R.	P	Result
H1: SyQ has positive impacts on US;	2.894	0.001	Significant
H2: InQ has positive impacts on US;	2.822	0.001	Significant
H3: SvQ has positive impacts on US;	2.931	0.002	Significant
H4: PU has positive impacts on US;	2.923	0.001	Significant
H5: PeU has positive impacts on US;	2.889	0.001	Significant
H6: US has positive impacts on UL;	2.911	0.001	Significant
H7: US has positive impacts on Net benefit.	2.885	0.001	Significant

As part of a university strategy to enhance the use of e-learning systems in its courses, this study aimed to gain a deeper understanding of how students learn and find satisfaction in online courses. The study evaluated students' satisfaction and learning, and the instruments used were validated.

This study examines US with technology in online courses, focusing specifically on LMS. Our findings demonstrate that SvQ, SyQ, InQ, PU, and PeU significantly impact US. This satisfaction, in turn, mediates the effect of these factors on the overall net benefit of using the LMS. Our research builds upon the existing literature on US by incorporating key factors identified in previous studies. We propose a model that analyzes the LMS and reveals hypothesized interrelationships within its components.

This model aims to measure the cause-and-effect dynamics between success factors and success measures, suggesting that the model itself can influence the quality of the LMS, either positively or negatively. This, in turn, affects US, UL, and the overall net benefit of using the LMS. The findings of this study have implications in several areas. SvQ is the key factor in the US. This implies that providing reliable 24/7 support, user-friendly features, and thorough training through the LMS can enhance US, ultimately leading to increased system usage; The proposed model suggests that the PU of the LMS promotes more frequent use of online courses by instructors and encourages students to follow suit. This is due to PU being a crucial factor that enhances the system's usage for engaging with distance-learning students; SyQ significantly impacts US, as issues like availability and accessibility can impede its use. When these challenges occur, they may cause dissatisfaction and lead to a decrease in usage; InQ represents the smallest portion among the factors discussed, as its effectiveness hinges on the accuracy and quality of the content, which in turn depends on how effectively the instructor utilizes the system

and the LMS services. Nevertheless, good InQ can still enhance US and improve the learning process; SvQ and PU had the most significant impact on US. Therefore, the LMS should be tailored to meet the needs of both instructors and students by integrating the latest technologies. On the other hand, neglecting the specific requirements of instructors in distance learning courses during LMS development will adversely affect the outcomes and benefits of these courses; This study confirms that PeU positively affects US. To enhance satisfaction, providers can simplify interfaces, offer clear instructions, streamline workflows, provide responsive support, conduct usability testing, and supply extensive training and onboarding resources. Regular usability testing and feedback collection lead to continuous improvements. Comprehensive training and onboarding reduce the learning curve and boost confidence, thereby further improving PeU and satisfaction; This study offers important insights into US and its effect on UL. The results show that US has a notable direct impact on UL, which supports H6. Consistent findings from earlier research [31] also reveal a positive relationship between US and UL.

4. Conclusion

The research emphasizes the crucial impact of InQ, SyQ, SvQ, PU, and PeU in improving US, as well as the key role that US plays in fostering UL within LMS platforms. Institutions should focus on developing intuitive, reliable systems, providing clear and relevant content, and offering responsive, supportive services to users. This study highlights the importance of these factors in enhancing US and underscores the role of US in promoting loyalty, as reflected in the proposed model hypotheses. It can be confidently concluded that investing in and actively improving these factors is an effective strategy for enhancing US in an organizational or corporate setting. These findings provide valuable insights for decision-makers aiming to improve user experience and satisfaction.

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