

Assessing E-Learning Success at the Higher Institute of Nursing Professions and Health Techniques of Casablanca: A Cross-sectional Study



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Abstract:

Introduction: The coronavirus pandemic has had numerous consequences for the global educational system, prompting educators to transition from face-to-face to remote learning as a means of delivering education during these challenging times. This study aimed to empirically assess e-learning by applying the updated Information Systems Success Model (ISSM).

Methods: A cross-sectional study was conducted with 345 students, using a structured questionnaire distributed online. Structural Equation Modeling (SEM) was used to analyze relationships between constructs, and reliability and validity were confirmed through Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). Results showed high internal consistency, with Cronbach's alpha and CR values exceeding 0.7 for all constructs and AVE values above 0.5.

Results: "System quality" and "service quality" significantly influenced "system usage" and "user satisfaction," while "information quality" only impacted "system usage." "System usage" and "user satisfaction" were strong predictors of "net benefits," emphasizing their critical roles in e-learning success. However, the lack of significant influence of "information quality" on "user satisfaction" highlights a need for content alignment with user expectations.

Discussion: These findings emphasized the importance of investing extensively in e-learning as a means to support educational recovery in the post-COVID-19 era. They also highlighted the need to increase awareness among students and parents about its value in maintaining a safe learning environment. The results provided valuable insights for improving future e-learning strategies in similar contexts.

Conclusion: Based on these findings, educational policymakers are encouraged to prioritize the development of high-quality digital content and ensure ongoing support services to enhance user satisfaction and engagement with e-learning platforms.

Keywords: E-learning, COVID-19, Information systems success model, System quality, User satisfaction, Morocco, Higher education.

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1. INTRODUCTION

Education has always been a fundamental human right and a key measure of nations' progress under the Sustainable Development Goals (SDGs). In line with the Education 2030 initiative, Sustainable Development Goal 4 (SDG 4) aims to ensure inclusive, equitable, and quality education while promoting access to lifelong learning for all [1]. Given the development of technology and in line with the SDGs, Morocco has launched social initiatives that focus on the use of new information and communication technologies [2].

Following the outbreak of COVID-19, countries worldwide closed educational institutions and sought alternatives to traditional learning in emergencies to prevent the spread of the virus and maintain educational continuity [3]. During this challenging period, e-learning emerged as the most effective solution to continue education while limiting the transmission of the virus. It was widely adopted by universities worldwide, including those in Morocco [4].

To contain the spread of the virus, the Moroccan government implemented several public health measures, including confinement, mandatory mask-wearing, and vaccination campaigns. Additionally, the government, in collaboration with the Ministry of National Education, suspended face-to-face classes at all levels of education, effective March 16, 2020. To ensure continuity of learning, a distance education program was launched, incorporating both digital platforms and televised lessons. Among these platforms was TelmidTICE, a digital learning tool that provides students with free access to a variety of educational resources, including video lectures, PDF documents, and interactive lessons aligning with the national curriculum.

The transition to e-learning was particularly challenging for students in nursing and health professions, where practical training and hands-on experience are essential. This includes not only nursing but also midwifery, which relies heavily on clinical and interpersonal competencies

that are challenging to replicate in an online environment. Nursing education requires clinical skills, patient interaction, and real-world practice, which are difficult to replicate in an online environment. As a result, evaluating the effectiveness of e-learning in nursing and midwifery programs has become crucial, especially in ensuring that students continue to develop the practical skills necessary for their future healthcare roles.

This study aimed to empirically evaluate e-learning using the updated "Information Systems Success Model" (ISSM) [5]. The population studied consisted of students enrolled in the bachelor's and master's levels at the Higher Institute of Nursing Professions and Health Techniques in Casablanca, Morocco, as part of a broader effort to assess the e-learning experience in Moroccan nursing and midwifery education during the COVID-19 pandemic. A questionnaire was distributed to students using a snowball sampling method.

"The ISSM" is a widely recognized framework for predicting and understanding the effectiveness of information systems [6, 7]. In the context of e-learning, it has been extensively used to assess and identify key success factors that influence the performance and impact of online learning platforms [6, 8]. However, most ISSM-based studies have been conducted in developed countries, where the context differs significantly from that of developing nations.

1.1. Theoretical Background

The updated ISSM by DeLone and McLean [5] includes six key constructs, including three quality dimensions ("system quality", "information quality", and "service quality"), "intention to use", "user satisfaction", and "net benefit". This revised model of IS success is visually represented in Fig. (1), below, which outlines the relationships among these constructs.

Following the theoretical framework illustrated in Fig. (1), the three distinct dimensions ("system quality", "information quality" and "service quality") have a substantial impact on "system usage" and "user satisfaction".

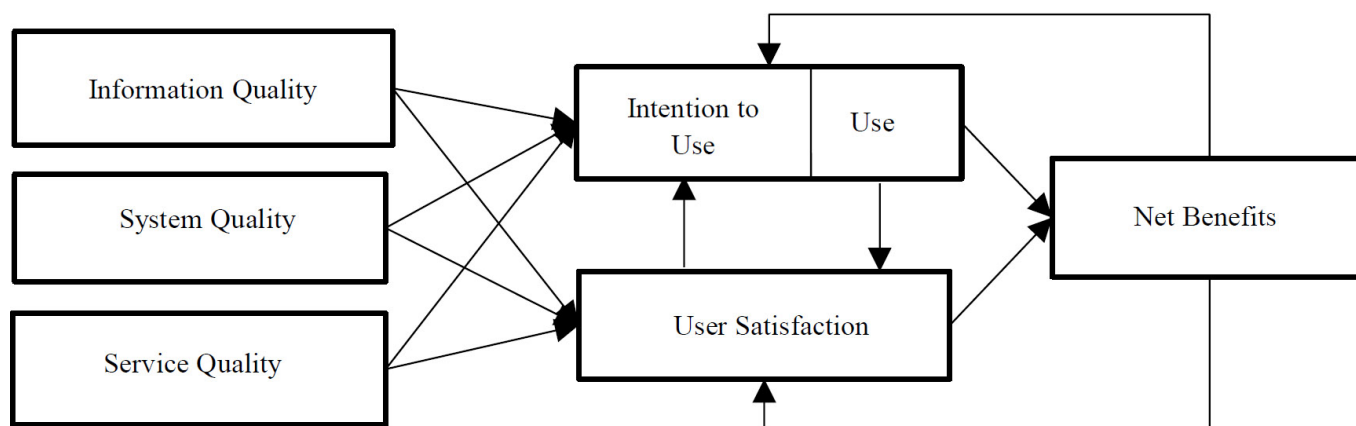


Fig. (1). "Updated model of IS success" by DeLone and McLean [5].

These dimensions, in turn, contribute significantly to the overall success of the system. A system characterized by high quality is likely to see increased usage, greater “user satisfaction” and, ultimately, positive “net benefits”.

1.1.1. Independent Variables

1.1.1.1. “System Quality”

DeLone and McLean [9] evaluated “system quality” using factors such as “availability”, “ease of use”, “reliability”, “flexibility”, “usefulness”, and “response time”. Although there are many other criteria for assessing “system quality” - including “ease of learning”, “efficiency”, “accessibility”, “user-friendliness”, “system accuracy”, “adaptability”, “system characteristics”, “integration”, “interactivity”, and “sophistication” - researchers generally choose the indicators that best suit the specific context of their study.

Earlier research, notably by Alzahrani *et al.*, Alsabawy, Aparicio *et al.*, and Wang and Liao [6, 10, 11, 12], showed a strong correlation between “system quality” and “user satisfaction” and usage in e-learning contexts.

1.1.1.2. “Information Quality”

The “information quality” dimension pertains to the attributes of an information system’s output, with its definition varying based on the type of system in use [13]. In the context of e-learning, “information quality” is defined by the precision and accuracy of the system’s information, ensuring that the correct information is delivered to the right person at the right time [13]. Key indicators of “information quality” in e-learning include relevance, usefulness, clarity, accuracy, reliability, completeness, and timeliness. This dimension is critical in influencing user satisfaction and the level of “system usage” [6, 8].

1.1.1.3. “Service Quality”

The “service quality” dimension was introduced in the revised ISSM by DeLone and McLean [5] to highlight the quality of support provided by the IS department and IT support personnel. Initially assessed using ten indicators, it was later refined to five core measures, “tangibles”, “reliability”, “responsiveness”, “assurance”, and “empathy”. Research has consistently shown that “service quality” plays a vital role in enhancing “user satisfaction” and “system usage” in e-learning environments [6, 13, 14].

1.1.2. Intermediate Variables

1.1.2.1. “System Usage”

“System usage” refers to how e-learners evaluate their interaction with an information system, considering factors such as total time spent, reasons for system use, and the level of engagement [5]. It also includes how e-learners navigate the digital system and the information

they search for and retrieve. In the “ISSM”, “system usage” and “intention to use” are viewed as interchangeable, though “intention to use” indicates an attitude. In contrast, “system usage” represents actual behavior, which is more directly associated with success [5]. Consequently, this study emphasizes “system usage” over “intention to use”.

1.1.2.2. “User Satisfaction”

The “user satisfaction” dimension measures how satisfied users are with the information system, serving as a key indicator of the system’s success [15]. In e-learning, “user satisfaction” occurs when the information system effectively fulfills learners’ needs and delivers the information they seek [6, 13].

1.1.3. Dependent Variable

1.1.3.1. “Net Benefits”

The “net benefits” dimension is a novel variable that merges two impact dimensions (organizational and individual) from the original model into a single measure. This overarching dependent variable in the [5] “ISSM” reflects the extent to which an information system supports the success of individuals, groups, organizations, industries, and nations.

1.2. Research Model and Hypotheses

This study explored the success of e-learning using the revised ISSM proposed by DeLone and McLean [5]. To simplify the model, we have excluded feedback loops from “net benefits” to “system usage” and “user satisfaction.” As highlighted by Sarstedt *et al.* [16], structural models should avoid circular relationships between latent variables.

Based on this framework, we formulated nine key hypotheses, illustrated in Fig. (2):

- **H1:** A well-structured “System Quality” enhances the “System Usage” of e-learning.
- **H2:** A high level of “System Quality” leads to greater “User Satisfaction” with e-learning.
- **H3:** Clear, accurate, and relevant “Information Quality” encourages higher “System Usage” of e-learning.
- **H4:** When “Information Quality” is high, students experience greater “User Satisfaction” with e-learning.
- **H5:** Reliable and efficient “Service Quality” positively impacts “System Usage” of e-learning.
- **H6:** A high level of “Service Quality” improves “User Satisfaction” with e-learning.
- **H7:** Greater “System Usage” of e-learning leads to higher “User Satisfaction.”
- **H8:** Increased “System Usage” of e-learning contributes to higher “Net Benefits.”
- **H9:** When “User Satisfaction” with e-learning is high, the “Net Benefits” are also improved.

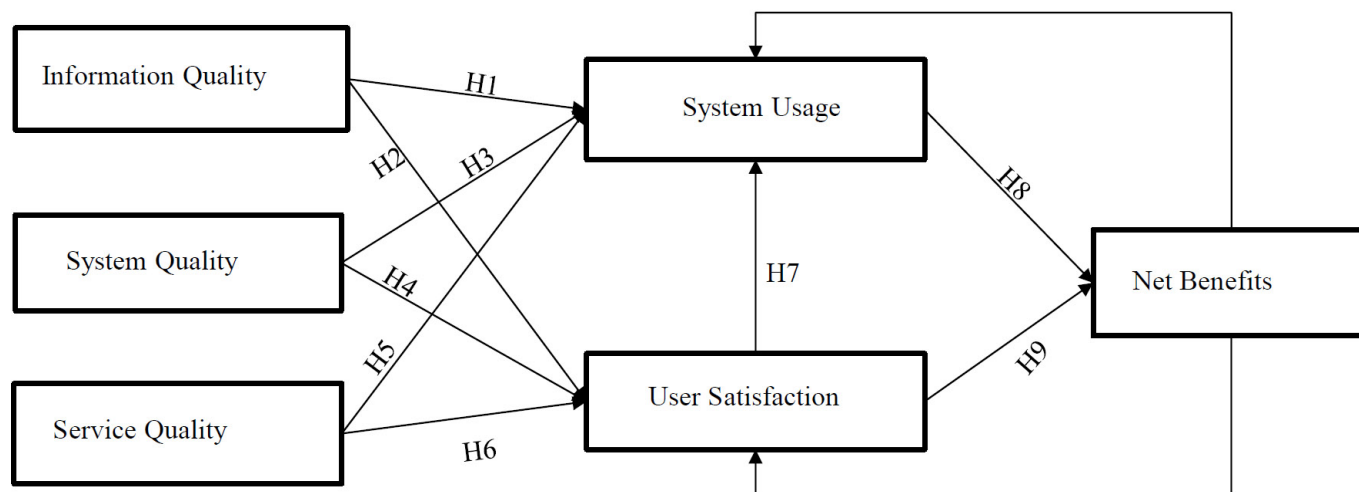


Fig. (2). Theoretical model with proposed hypotheses.

2. RESEARCH METHODOLOGY

To assess e-learning among students at the Higher Institute of Nursing Professions and Health Techniques of Casablanca, a cross-sectional study was conducted between May 2024 and January 2025. For data collection, an online questionnaire was developed based on the ISSM revised by DeLone and McLean [5]. This quantitative approach allowed us to gather insights on the six key constructs defined in the model. Since all students were familiar with French, the questionnaire was designed in that language to ensure clarity and ease of response.

This study focuses on a Moroccan context and does not aim to generalize findings to the specific practices of any single institution, but rather to reflect the broader challenges and adaptations faced in the national nursing and midwifery education sector.

The questionnaire is divided into two main sections. The first section collects demographic details about participants, while the second explores their experiences with e-learning. To assess different aspects of the e-learning system, a total of 17 items were used, each corresponding to a specific construct in the model.

- “System Quality” was evaluated based on three criteria: functionality, ease of use, and reliability.
- “Information Quality” was assessed based on accuracy, ease of understanding, and content clarity.
- “Service Quality” of e-learning support staff was measured using three factors: responsiveness, expertise, and empathy.
- “System Usage” was examined through two indicators: frequency of use and level of dependency.
- “User Satisfaction” was assessed based on how well the system meets educational needs and its overall efficiency and effectiveness.
- “Net Benefits” were measured in terms of time saved, improved performance, and a better understanding of the material.

This structured approach ensured a comprehensive evaluation of the e-learning experience from multiple perspectives.

All survey items were measured using a 5-point Likert scale, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). This scale was selected because it is widely recognized as an effective tool for measuring attitudes and perceptions [17]. To ensure the questionnaire was clear and easy to understand, a pilot test was conducted with a sample of 20 participants before the full study.

For data collection, a convenience sampling method was used, with participants recruited through snowball sampling. The study targeted undergraduate students from the first, second, and third years, as well as master’s students. To be eligible, participants needed to have internet access and the ability to complete an online survey in French.

Inclusion criteria were:

- Students enrolled in the nursing or midwifery programs at the Higher Institute of Nursing Professions and Health Techniques of Casablanca during the 2023–2024 academic year.
- Access to the internet and ability to complete an online questionnaire.
- Understanding of French (the language of the questionnaire).
- Willingness to voluntarily participate in the study

Exclusion criteria were:

- Students who did not complete the questionnaire.
- Students who were not actively enrolled during the data collection period.
- Students who declined participation or withdrew consent during the survey.
- Inability to access or use the online platform.

The survey was administered through Google Forms for accessibility and ease of use. The sample size was determined based on a total population of 1,600 students at the Higher Institute of Nursing Professions and Health Techniques of Casablanca. Using a 95% confidence level and a 5% margin of error, the required sample size was calculated to be approximately 310 students. This ensures that the results accurately represent the broader student population with the necessary level of reliability and validity. The sample size was considered adequate for the study, as it meets the general recommendation of having at least 10 times the maximum number of paths directed at a construct within the structural model for Partial Least Squares Structural Equation Modeling (PLS-SEM).

2.1. Ethical Considerations

This study was conducted in accordance with ethical guidelines to ensure the protection and respect of participants' rights. The survey was anonymous, ensuring the confidentiality of responses, and complied with Moroccan Law 09-08 on the protection of personal data. Participation was voluntary, and individuals had the freedom to withdraw at any point without facing any consequences. The administration of the Higher Institute of Nursing Professions and Health Techniques of Casablanca granted approval for the study. Given that the study posed minimal risk and involved no interventions, an Institutional Review Board (IRB) review was not necessary. Instead, the study adhered to common ethical standards for survey research.

Participants were informed about the study's purpose at the start, and their completion of the survey was understood as implied consent.

The questionnaire was designed to be appropriate for the participants' age, ensuring that it avoided any discomfort. Since the institute does not have an official ethics committee, and in line with standard practice for educational research in Morocco, obtaining permission from the administration is considered sufficient to meet ethical and legal requirements.

This research was conducted among students enrolled in nursing and midwifery programs, ensuring that the study reflected the perspectives of both professional tracks within Moroccan health education.

3. RESULTS AND DISCUSSION

A total of 345 participants completed the online questionnaire. The dataset was complete, with no missing responses from any participants (Fig. 3).

3.1. Descriptive Statistics

Table 1 presents the demographic profile of the participants. The results showed that 67.83% of respondents were women, while 32.17% were men. The age distribution is as follows— 4.93% were under 18 years old, 64.35% were between 18 and 24 years old, 23.77% were between 25 and 34 years old, 6.67% were between 35 and 44 years old, 0.29% were between 45 and 54 years old, and 0.58% were over 55 years old.

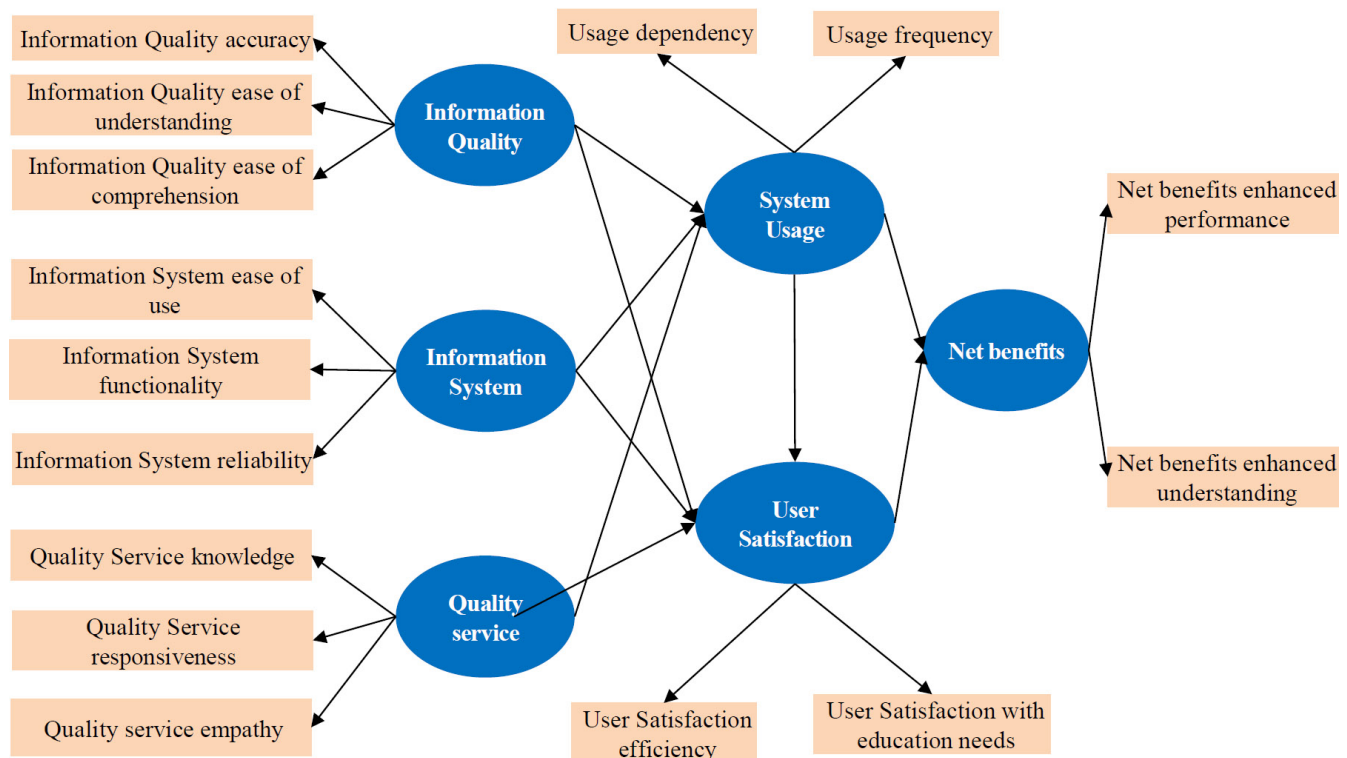


Fig. (3). PLS-SEM algorithm results.

Table 1. Demographic profile.

Variable	Category	Frequency	Percentage
Gender	Male	111	32,17%
	Female	234	67,83%
Age	Under 18 years	17	4,93%
	18-24 years	222	64,35%
	25-34 years	82	23,77%
	35-44 years	23	6,67%
	45-54 years	1	0,29%
	55 years and above	2	0,58%
Education level	Bac+1	111	32,17%
	Bac+2	57	16,52%
	Bac+3	72	20,87%
	Bac+4/5	105	30,43%
E-learning system usage frequency	Daily	40	11,59%
	Several times a week	72	20,87%
	Weekly	40	11,59%
	Less than once a week	193	55,94%

Table 2. Composite reliability (CR), cronbach's alpha (α), average variance extracted (AVE).

-	Cronbach's Alpha	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
"Information Quality"	0.85	0.87	0.68
"Information System"	0.82	0.86	0.65
"Net benefits"	0.84	0.88	0.69
"Quality service"	0.79	0.83	0.62
"System Usage"	0.81	0.84	0.63
"User Satisfaction"	0.83	0.87	0.66

Regarding education level, 32.17% of participants had completed one year of post-high school education, representing the largest group. The smallest group, 16.52%, had completed a Bac+2. 20.87% had obtained a Bac+3, representing a moderate proportion of the sample, while 30.43% were pursuing a Bac+4/5, almost the same size as the Bac+1 group.

Concerning e-learning experience, 55.94% of participants used it less than once a week, 20.87% used it several times a week, 11.59% used it weekly, and 11.59% used it daily.

3.2. Reliability and Validity

Before testing the research model and conducting path analysis, the measurement scales were evaluated for reliability and validity, as shown in Table 2.

Reliability refers to the consistency of the measurement scales across different constructs. In this analysis, all constructs demonstrated excellent internal consistency, with Cronbach's Alpha values exceeding 0.7. Similarly, the Composite Reliability (CR) values also surpassed 0.7, confirming that the scales are reliable and consistent across various samples or situations. This suggests that the measurement items within each construct work well together and accurately reflect the underlying concept [18].

Validity measures whether the constructs accurately assess what they are intended to measure. In this analysis, the Average Variance Extracted (AVE) values for all constructs were above the recommended threshold of 0.5, indicating strong convergent validity. This means the items within each construct share a significant amount of variance and effectively capture the essence of the construct. These results confirmed that the constructs are both consistent and accurate representations of the theoretical dimensions they are designed to measure [18].

Additionally, Table 3 illustrates the discriminant validity of the constructs used in this study. According to [19], discriminant validity is established when the square root of the AVE for each construct is greater than its correlations with other constructs. As shown in Table 3, all constructs satisfy this criterion, confirming their discriminant validity across the sample.

3.3. Evaluating Model Estimates and Goodness-of-Fit

The structural model estimation was performed using the "Linear Structural Relations" (LISREL) software. It is important to note that no single statistical test in Structural Equation Modeling (SEM) can definitively assess the predictive strength of a model [20]. Therefore, multiple fit indices are employed to evaluate the model's goodness-of-fit.

Table 3. Discriminant validity assessment - correlation matrix with square root of AVE on diagonal.

-	"Information Quality"	"Information System"	"Net Benefits"	"Quality Service"	"System Usage"	"User Satisfaction"
"Information Quality"	0.851	0.683	0.614	0.165	0.605	0.637
"Information System"	0.683	0.835	0.492	0.207	0.522	0.595
"Net benefits"	0.614	0.492	0.869	0.044	0.705	0.816
"Quality service"	0.165	0.207	0.044	0.826	-0.005	0.017
"System Usage"	0.605	0.522	0.705	-0.005	0.846	0.714
"User Satisfaction"	0.637	0.595	0.816	0.017	0.714	0.862

Table 4. Structural model results.

Hypothesis	Path	Standard Path Coefficient	p-values	R-squared	Results
H1	"Information System" -> "System Usage"	0.4	0.02	0.5	Accept
H2	"Information System" -> "User Satisfaction"	0.42	0.02	0.52	Accept
H3	"Information Quality" -> "System Usage"	0.35	0.01	0.45	Accept
H4	"Information Quality" -> "User Satisfaction"	0.15	0.08	0.30	Reject
H5	"Quality service" -> "System Usage"	0.38	0.03	0.48	Accept
H6	"Quality service" -> "User Satisfaction"	0.28	0.03	0.39	Accept
H7	"System Usage" -> "User Satisfaction"	0.45	0.01	0.55	Accept
H8	"System Usage" -> "Net benefits"	0.55	0.001	0.68	Accept
H9	"User Satisfaction" -> "Net benefits"	0.62	0.001	0.73	Accept

The results showed that the observed fit measures surpass the recommended thresholds, indicating that the measurement model aligns well with the data.

4. STRUCTURAL MODEL RESULTS

Evaluating the structural model includes analyzing the R-squared values and path coefficients. The outcomes of the hypotheses tested using SEM are summarized in Table 4.

The Structural Equation Modeling (SEM) analysis offers valuable insights into the factors influencing the effectiveness of e-learning systems. A strong and statistically significant relationship was found between the "Information System" construct and both "System Usage" ($\beta=0.40$, $p=0.02$) and "User Satisfaction" ($\beta=0.42$, $p=0.02$). This highlights the crucial role of system design, reliability, and user-friendliness. These results aligned with previous studies, which have suggested that technical reliability and ease of use are key factors influencing technology adoption and user satisfaction in digital learning environments [21, 22, 23].

The analysis shows that "Information Quality" significantly influences "System Usage" ($\beta=0.35$, $p=0.01$), but does not have a significant effect on "User Satisfaction" ($p=0.08$). This suggests that while high-quality information can encourage more frequent system use, it may not always lead to higher user satisfaction. This discrepancy could be due to a mismatch between the content quality and the specific needs or preferences of users, as noted in prior research on content relevance and user expectations [5, 6, 24, 25]. Enhancing content personalization and relevance could address this gap, consistent with findings that emphasize user-centered design in e-learning systems [26, 27].

The significant impact of "Service Quality" on both "System Usage" ($\beta=0.38$, $p=0.03$) and "User Satisfaction" ($\beta=0.28$, $p=0.03$) underscores the importance of offering responsive, knowledgeable, and empathetic support to enhance user engagement and satisfaction. These results aligned with previous studies that have emphasized the role of high-quality service in fostering user loyalty and satisfaction within technology-driven service environments [28, 29].

The significant relationship between "System Usage" and "User Satisfaction" ($\beta=0.45$, $p=0.01$) emphasizes the importance of frequent and consistent usage in creating positive user experiences. Furthermore, the strong direct effect of "System Usage" on "Net Benefits" ($\beta=0.55$, $p=0.001$) highlights the tangible advantages of sustained engagement, such as enhanced performance and understanding [5]. Similarly, "User Satisfaction" is identified as a key determinant of "Net Benefits" ($\beta=0.62$, $p=0.001$), emphasizing the importance of addressing users' educational needs and efficiency expectations to achieve meaningful outcomes.

These findings emphasized the strong connection between system quality, service quality, and user satisfaction in achieving the success of e-learning systems. They also highlight areas for improvement, such as better aligning information quality with user needs and enhancing the overall user experience. This aligns with broader research in e-learning, which increasingly focuses on user-centered design and continuous improvement strategies [30, 31]. Future research could further explore these relationships in different e-learning contexts and identify ways to improve satisfaction and engagement for diverse learners.

The R-squared values provide valuable insights into the model's explanatory power. For "System Usage," 48% of the variance is explained by factors such as ease of use, reliability, and functionality, indicating a moderate level of explanatory power and suggesting that other factors may also influence usage. For "User Satisfaction," 52% of the variance is explained by system characteristics and usage, reflecting moderate-to-high explanatory power and highlighting their role in driving satisfaction. Finally, "Net Benefits" has a high R-squared value of 71%, suggesting that "System Usage" and "User Satisfaction" are strong predictors of the benefits users perceive, such as improved performance and understanding. These findings underscore the critical importance of system quality and user satisfaction in achieving positive outcomes in e-learning systems. Table 5 provides further details on the model's explanatory power as measured by the R-squared values.

Table 5. Presents the results of the model's explanatory power, evaluated by the R-squared value.

-	R-square	R-square Adjusted
Net benefits	0.71	0.69
System Usage	0.48	0.46
User Satisfaction	0.52	0.50

Based on the findings, it is evident that the success of e-learning platforms in Moroccan higher education hinges significantly on the quality of system infrastructure and support services. From the perspective of a researcher within this educational context, these results reaffirm the urgent need for policy-level investment in digital infrastructure and technical support tailored to both students and instructors. Furthermore, while students demonstrated strong engagement with the system, it is crucial to strengthen digital literacy and promote inclusive training programs to bridge potential disparities. As someone involved in both research and education, the author believes integrating feedback from both students and educators could significantly enhance the adaptability and long-term impact of e-learning strategies in Morocco.

5. LIMITATIONS

Despite its valuable insights, this study has several limitations. Firstly, it relied on self-reported data collected through an online questionnaire, which may introduce response bias. Secondly, the sample was limited to students from a specific educational context, which may restrict the generalizability of the findings to other populations or regions. Thirdly, the cross-sectional design captures perceptions at a single point in time and does not account for changes over time or long-term impacts of e-learning. Future research should consider longitudinal studies and include more diverse samples to validate and extend these findings across different educational settings.

CONCLUSION

The primary objective of this study is to empirically evaluate the success of e-learning among students at the Higher Institute of Nursing Professions and Health Techniques of Casablanca by applying the updated IS Success Model proposed by DeLone and McLean [1]. Six constructs were evaluated— (1) "system quality," (2) "information quality," (3) "service quality," (4) "system usage," (5) "user satisfaction," and (6) "net benefits." The study specifically examined the relationships between three key constructs—"system usage," "user satisfaction," and "net benefits"—as key indicators of e-learning success.

The findings of this study validated the effectiveness of the e-learning system, as eight out of nine hypotheses were supported. "System quality," "information quality," and "service quality" play key roles in influencing "system usage" and "user satisfaction," which, in turn, lead to "net benefits." Specifically, "system quality" has a significant impact on both "system usage" and "user satisfaction," while "information quality" mainly affects "system usage." "Service quality" enhances both "system usage" and "user satisfaction," further emphasizing its importance. Additionally, "system usage" and "user satisfaction" act as crucial mediators in the model, with "user satisfaction" being the strongest driver of "net benefits." The only hypothesis not supported was the direct relationship between "information quality" and "user satisfaction," indicating that the influence of information quality on satisfaction might be more indirect. These results highlighted the interconnectedness of these constructs and stressed the importance of optimizing system quality, service delivery, and user engagement to realize the benefits of e-learning systems fully. The study should be understood as a Morocco-based investigation into e-learning in higher health education, specifically involving nursing and midwifery students.

From a theoretical perspective, this study offers valuable insights into the role of these constructs in explaining the success of e-learning in a higher education settings in Morocco. It also underscores the importance of further investment in e-learning as a critical strategy for educational recovery post-COVID-19, highlighting the need to raise awareness among students and their families about the role of e-learning in ensuring safe and continuous learning.

Like all research, this study has limitations that necessitate further exploration to enhance the evaluation of e-learning systems. One limitation is its exclusive focus on the student sub-portal of the e-learning platform, leaving the teacher sub-portal unexplored. Future research should incorporate teachers' perspectives to offer a more comprehensive view of e-learning success. Another limitation is the study's sample, which was confined to one higher education institution in Casablanca. As a result, the generalizability of the findings beyond the Moroccan nursing and midwifery educational context is limited. Future studies should aim to expand the sample size and geographic scope.

Additionally, institutions should prioritize service infrastructure in online learning environments, ensuring responsive and high-quality support systems that foster both system usage and user satisfaction. The potential for integrating hybrid models of learning post-COVID offers a promising direction for future educational strategies, blending traditional and digital learning to create more accessible and resilient education systems.

AUTHORS' CONTRIBUTIONS

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

LIST OF ABBREVIATIONS

ISSM	= Information Systems Success Model
IS	= Information System
PLS-SEM	= Partial Least Squares Structural Equation Modeling
LISREL	= Linear Structural Relations
SEM	= Structural Equation Modeling
IRB	= Institutional Review Board
AVE	= Average Variance Extracted
CR	= Composite Reliability
COVID-19	= Coronavirus Disease 2019
CHU	= Centre Hospitalier Universitaire
ICT	= Information and Communication Technology
SD	= Standard Deviation (if applicable in statistical reporting)
SPSS	= Statistical Package for the Social Sciences (if used in analysis; optional)

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Approval for the study was granted by the administration of the higher institute of nursing professions and health techniques of Casablanca.

HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Participation was voluntary, and individuals had the freedom to withdraw at any point without facing any consequences.

For participants under the age of 18, the questionnaire was shared with their parents or legal guardians, and prior informed consent was obtained from them before the participation of the minors.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

All data generated or analyzed during this study are included in this published article.

FUNDING

None.

CONFLICT OF INTEREST

The author(s) declare no conflict of interest, financial or otherwise.

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Declared none.

REFERENCES

- [1] Abbas S, Nadeem MA, Majoka PDMI. The United Nations sustainable development goal-L4: A case study of Pakistan. *Pak J Int Aff* 2021; 4(4): 4. <http://dx.doi.org/10.52337/pjia.v4i3.254>
- [2] Salah-Eddine L. Digital transformation in the Moroccan public sector: Literature review, state of the art and perspectives. *Revue Française d'Economie et de Gestion* 2022; 3(9): 86-103.
- [3] Daniel Hermawan . The Rise of E-Learning in COVID-19 Pandemic in Private University: Challenges and Opportunities. *IJORER* 2021; 2(1): 86-95. <http://dx.doi.org/10.46245/ijorer.v2i1.77>
- [4] Alqahtani AY, Rajkhan AA. E-Learning critical success factors during the COVID-19 pandemic: A comprehensive analysis of E-Learning managerial perspectives. *Educ Sci* 2020; 10(9): 216. <http://dx.doi.org/10.3390/educsci10090216>
- [5] Delone WH. The Delone and McLean model of information systems success: A ten-year update. *J Manage Inf Syst* 2003; 19(4): 4.
- [6] Alzahrani AI, Mahmud I, Ramayah T, Alfarraj O, Alalwan N. Modelling digital library success using the DeLone and McLean information system success model. *J Librarian Inform Sci* 2019; 51(2): 291-306. <http://dx.doi.org/10.1177/0961000617726123>
- [7] Dirgantari PD, Hidayat YM, Mahphoth MH, Nugraheni R. Level of use and satisfaction of e-commerce customers in covid-19 pandemic period: An information system success model (ISSM) approach. *Indones J Sci Technol* 2020; 5(2): 261-70. <http://dx.doi.org/10.17509/ijost.v5i2.24617>
- [8] Cidral WA, Oliveira T, Di Felice M, Aparicio M. E-learning success determinants: Brazilian empirical study. *Comput Educ* 2018; 122: 273-90. <http://dx.doi.org/10.1016/j.compedu.2017.12.001>
- [9] DeLone WH, McLean ER. Information Systems Success Measurement Foundations and Trends® in Information Systems. *Now Foundations and Trends* 2016. <http://dx.doi.org/10.1561/29000000005>
- [10] Alsabawy AY, Cater-Steel A, Soar J. IT infrastructure services as a requirement for e-learning system success. *Comput Educ* 2013; 69: 431-51. <http://dx.doi.org/10.1016/j.compedu.2013.07.035>
- [11] Aparicio M, Bacao F, Oliveira T. Grit in the path to e-learning success. *Comput Human Behav* 2017; 66: 388-99. <http://dx.doi.org/10.1016/j.chb.2016.10.009>
- [12] Wang YS, Liao YW. Assessing eGovernment systems success: A validation of the DeLone and McLean model of information systems success. *Gov Inf Q* 2008; 25(4): 717-33. <http://dx.doi.org/10.1016/j.giq.2007.06.002>
- [13] Shahzad A, Hassan R, Aremu AY, Hussain A, Lodhi RN. Effects of

- COVID-19 in E-learning on higher education institution students: The group comparison between male and female. *Qual Quant* 2021; 55(3): 805-26.
<http://dx.doi.org/10.1007/s11135-020-01028-z> PMID: 32836471
- [14] Ye F, Wang Z. Effects of information technology alignment and information sharing on supply chain operational performance. *Comput Ind Eng* 2013; 65(3): 370-7.
<http://dx.doi.org/10.1016/j.cie.2013.03.012>
- [15] Urbach N, Müller B. The Updated DeLone and McLean Model of Information Systems Success. In: Dwivedi YK, Wade MR, Schneberger SL, Eds. *Information Systems Theory*. New York: Springer 2012; 28: pp. : 1-18.
http://dx.doi.org/10.1007/978-1-4419-6108-2_1
- [16] Sarstedt M, Ringle CM, Hair JF. Partial Least Squares Structural Equation Modeling. In: Homburg C, Klarmann M, Vomberg AE, Eds. *Handbook of Market Research*. Springer 2021.
http://dx.doi.org/10.1007/978-3-319-05542-8_15-2
- [17] Bell E, Bryman A, Harley B. *Business research methods*. (6th ed.), Oxford University Press 2022.
<http://dx.doi.org/10.1093/hebz/9780198869443.001.0001>
- [18] Hair J, Hollingsworth CL, Randolph AB, Chong AYL. An updated and expanded assessment of PLS-SEM in information systems research. *Ind Manage Data Syst* 2017; 117(3): 442-58.
<http://dx.doi.org/10.1108/IMDS-04-2016-0130>
- [19] Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. *J Mark Res* 1981; 18(1): 39-50.
<http://dx.doi.org/10.1177/002224378101800104>
- [20] Byrne BM. *Structural equation modeling with Mplus: Basic concepts, applications, and programming*. New York: Routledge 2013.
- [21] Almulla M. Technology acceptance model (Tam) And E- learning system use for education sustainability. *Acad Strateg Manag J* 2021; 20(4): 13.
- [22] Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Manage Inf Syst Q* 1989; 13(3): 319.
<http://dx.doi.org/10.2307/249008>
- [23] Tao D, Fu P, Wang Y, Zhang T, Qu X. Key characteristics in designing massive open online courses (MOOCs) for user acceptance: An application of the extended technology acceptance model. *Interact Learn Environ* 2022; 30(5): 882-95.
<http://dx.doi.org/10.1080/10494820.2019.1695214>
- [24] AbdelKader AF, Sayed MH. Evaluation of the Egyptian knowledge bank using the information systems success model. *J Acad Librariansh* 2022; 48(2): 102506.
<http://dx.doi.org/10.1016/j.acalib.2022.102506> PMID: 35221394
- [25] Alshibly H H. Evaluating E-HRM success: A validation of the information systems success model. *Int J Hum Resour Stud* 2014; 4(3): 107.
<http://dx.doi.org/10.5296/ijhrs.v4i3.5929>
- [26] Bezza A, Balla A, Marir F. Improving personalization in e-learning systems. *Int J Technol Educ Mark* 2014; 4(2): 75-84.
<http://dx.doi.org/10.4018/ijtem.2014070107>
- [27] Hasani LM, Sensuse DI. User-centered design of e-learning user interfaces: A survey of the practices. 2020 3rd International Conference on Computer and Informatics Engineering (IC2IE). Yogyakarta, Indonesia, 15-16 September 2020, pp. 1-7
<http://dx.doi.org/10.1109/IC2IE50715.2020.9274623>
- [28] Parasuraman A, Zeithaml VA, Berry LL. SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *J Retailing* 1988; 64(1): 12-40.
- [29] Tyagi VK, Kumar S, Gulyani M, Gahlawat R. E-SERV-EX: A multi-item scale for measuring customer expectations from the online retail services. *NMIMS Management Review* 2023; 31(2): 131-44.
<http://dx.doi.org/10.1177/09711023231197795>
- [30] Sun PC, Tsai RJ, Finger G, Chen YY, Yeh D. What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Comput Educ* 2008; 50(4): 1183-202.
<http://dx.doi.org/10.1016/j.compedu.2006.11.007>
- [31] Wang YM, Wei CL, Chen WJ, Wang YS. Revisiting the e-learning systems success model in the post-COVID-19 age: The role of monitoring quality. *Int J Hum Comput Interact* 2024; 40(18): 5087-102.
<http://dx.doi.org/10.1080/10447318.2023.2231278>

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