Using the Delone and McLean Success Model to Evaluate Moodle's Information System Success

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ABSTRACT

This study evaluated the Moodle Professional Learning Management System (PLMS), based on user experience during the global pandemic of COVID-19, to explore the impact of system, service, information, education, learner, and instructor qualities on user satisfaction (SAT), perceived ease of use (PEOU), and perceived usefulness (PU). Data were collected using previously validated scales. Using SmartPLS structural equation modeling, data from 403 college students were analyzed to test 22 hypotheses. The results show that system and information quality positively affect PEOU. Although service quality had a partially significant impact on PU, it negatively affected SAT and PEOU. The quality of the education system had a partially positive impact on PU but a negative impact on PEOU and SAT. Learner quality positively affected PEOU, PU, and SAT. Although PU and PEOU significantly and positively affected benefits (BEN), SAT had only a partially significant impact. The results support the need for continued integration of e-learning with traditional learning schemas. This comprehensive analysis demonstrates how quality dimensions affect user experiences and outcomes in a unique cultural and emergency context, thus contributing to the e-learning body of knowledge.

Keywords-DeLone and McLean information systems success model; e-learning; Moodle; professional learning management system (PLMS); system qualities

I. INTRODUCTION

This study evaluates the success of Moodle PLMS in an emerging economy during the COVID-19 pandemic. E-learning is the infusion of Information Technology (IT) and formalized teaching, where educational material is delivered fully or partially through online platforms [1]. In 2020, the COVID-19 pandemic interrupted traditional in-class learning on a global scale. Although institutions had gradually implemented e-learning to complement traditional education systems, the pandemic catalyzed this transition. E-learning became necessary as academic institutions were forced to inculcate e-learning modules to continue the academic process. This is especially true in Kuwait, a country that is aggressively promoting digital advancement in different fields [2].

In Kuwait, academics and students used e-learning platforms in public and private universities, and Moodle was used predominantly in the latter. Despite this, limited published research has addressed the extent of Moodle use and its success rate among Kuwaiti students during the pandemic. On the contrary, some studies examined other e-platforms such as Microsoft Teams, Google Classroom, and Blackboard [3-5]. Most research on the use of e-learning resources has been carried out in industrialized countries [6,7] as opposed to emerging countries. The sudden change in required usage after the onset of the pandemic provided an opportunity to examine both the uptake and efficacy of these platforms. Due to the transient nature of pandemics [6], the knowledge acquired from this study can contribute to future emergency plans and the continued digital transformation.

Although the quality and success of E-Learning Systems (ELS) during and after the pandemic have previously been examined [8-10], and Behavioral Intentions (BI) have been integrated with quality factors [11,12], applying these concepts in the context of Kuwait is still in its early stages. This study aims to address this research deficit for Kuwait, exploring student experiences with Moodle PLMS during the COVID-19 pandemic. Six quality measures related to this ELS were examined using the DeLone and McLean success model, and relationships between them were evaluated through Perceived Ease Of Use (PEOU), Perceived Usefulness (PU), Satisfaction (SAT), Benefits (BEN), and Intentions to Use E-learning (IUE). Specifically, this study investigates the success and BEN of Moodle during the pandemic in Kuwait by examining System Quality (SQ), Service Quality (SRQ), Information Quality (IQ), Educational System Quality (ESQ), Learner Quality (LQ) and Instructor Quality (InQ), and their impact on SAT and subsequent BEN. This study also examines BI (such as PU and PEOU) and their influence on BEN and subsequent IUE, to draw a more comprehensive picture of the success and efficiency of Moodle. Using these characteristics, five questions are examined: How do quality variables (SQ, SRQ, IQ, ESQ, LQ, and InQ) influence 1) PU in Moodle, 2) perceived SAT, and 3) PEOU, 4) how PU, PEOU, and SAT influence BEN, and 5) how BEN influences intentions.

Moodle was tested during the pandemic in Kuwait based on the Information System Success Model (ISSM), the Technology Acceptance Model (TAM), and other constructs such as LQ and InQ [7] for emergency online learning situations. Moodle and e-learning were investigated in an emerging country with unique digital transformation challenges and opportunities. This study contributes to theory by using an integrated model that combines ISSM and TAM with other quality constructs such as LQ and InQ. This study expands the current body of knowledge by situating the factors that contribute to the effectiveness of e-learning platforms in the context of an emergency in a new geographic area. The six qualities examined were used to gain insight into how each contributes to the success and user perception of PLMS. Areas where improvement can be made to improve user experience were identified. This provides a more comprehensive evaluation of the Moodle PLMS. The integration of various quality factors enables a deeper understanding of their influence on user SAT, PU, and PEOU, which are crucial for the effective implementation and long-term viability of ELS. This approach not only builds upon previous models and theories but also evaluates their relevance and strength in a novel and demanding circumstance. The results and their interpretation provide policymakers, administrators, and other relevant parties in Kuwait with the information required to tailor academic programs to a specific audience. Key areas where the government can maximize e-learning, which is essential to developing successful policies on digital education, were identified. Developers and system designers can learn from this study about the needs and preferences of users in Middle Eastern educational settings.

II. LITERATURE REVIEW

E-learning is an online learning system for the diffusion of information and knowledge to learners through IT [1]. It is a contemporary approach to the transfer of information and knowledge using both technology and education. Several platforms are currently available, the most popular being a mix of open-source and commercial systems [13]. Moodle is a popular open-source platform, whose efficacy has been reported in several countries during the pandemic [14-15]. In [16], the acceptance of Moodle by LIS students in Kuwait was evaluated using the Unified Theory of Acceptance and Use of Technology (UTAUT) and website quality. No serious difficulties with the use of Moodle were identified, and most of the students considered it a useful and beneficial tool for learning. Other studies identified Moodle as an important e-learning tool. In [17], Moodle was classified into five main domains, in ascending order: vitality, educational value, content domain, usage characteristics, and usage. Faculty members also reported being satisfied with ELS and considered that it facilitated the learning process [18].

Two studies in Jordan evaluated e-learning. In [19], the successful development of an integrated e-learning model was reported by testing ISSM with TAM, and quality features such as student SAT, PU, and system use were important predictors of student performance. In [20], an extension of the DeLone and McLean IS success model was used to test factors that lead to continued use of e-learning platforms, showing that students were satisfied and planned to continue using e-learning based on their positive experience with SRQ, SQ, and IQ. This study extended the UTAUT by testing new constructs (learning tradition, self-directed learning, and e-learning self-efficacy). The findings further indicated that performance expectancy, e-learning self-efficacy, effort expectancy, facilitating conditions, and social influence positively affected students' continued use of the ELS. In [7], the different levels of e-learning success factors were highlighted. Learner SAT with the ELS was related to technical system quality, IQ, SRQ, learner support system quality, LQ, and InQ. In [21], it was found that the academic performance of students with a background in computing and IT skills was higher with Moodle. In [22], Malaysian students reported poor experiences with Moodle, with online learning barriers such as unfamiliarity with the system (being new to them), slow internet connection, and health symptoms such as eye strain. In [23], the experience of Romanian students with Moodle was tested in a two-year longitudinal study during the pandemic. In the first year, students transitioning to e-learning interacted slowly with the system, while in the second year, students showed higher acceptance and participation. The experience of Algerian students using e-learning showed a preference for traditional face-to-face learning as the main medium of information transfer [24]. However, they accepted Moodle, along with other e-learning platforms, as a complementary source of learning.

In [25], e-learning user SAT was investigated, showing that it is generated by IQ, SQ, instructor's attitude toward e-learning, diversity in assessing the user, and user interaction with others. User SAT is an important component of e-learning and influences information use. Considering the SRQ of the

ELS, the levels of service, support, and degree of responsiveness that institutions have offered their users were examined in [26, 27]. No significant impact of SRQ on use, user SAT, and individuals has been reported [25, 27-29]. However, there are conflicting accounts when examining similar constructs. A positive relationship has been reported between SRQ, use, and user SAT, as the better the SRQ an institution offered to its users, the greater its use and user SAT with the learning system [30, 31]. The higher the IQ, the higher the user use and SAT with the ELS [25, 27, 30-32].

SQ involves overall ELS robustness (e.g., functionality, security and verification, system functions, page personalization, and design). SQ has been reported to significantly affect use and user SAT [25, 27-29]. The ESQ assesses the quality of the ELS compared to traditional campus learning. Components include communication features such as chats, forums, and announcements, different learning styles such as presentations, videos, links, and images, and evaluation components such as assessment material, quizzes, and assignments. These factors positively affect user SAT and ELS use [33]. Finally, LQ describes the user's perception of online learning. It evaluates how well users perceive the online learning system, and their ability to use and perform tasks successfully without anxiety or fear [7].

Based on this review, 22 hypotheses were posited to examine relationships between Moodle PLMS quality measures, as shown in Table I.

TABLE I.   PROPOSED HYPOTHESES

H1	SQ positively influences the PU of the ELS
H2	SQ positively influences the SAT of the ELS
H3	SQ positively influences the PEOU of the ELS
H4	IQ positively influences the PEOU with the ELS
H5	IQ positively influences SAT with the ELS
H6	IQ positively influences the PU of e-learning
H7	ESQ positively influences the PU of the ELS
H8	ESQ positively influences the PEOU of the ELS
H9	ESQ positively influences SAT with the ELS
H10	SRQ positively influences the PU of the ELS
H11	SRQ positively influences SAT with the ELS
H12	SRQ positively influences the PEOU of the ELS
H13	InQ positively influences SAT with the ELS
H14	InQ positively influences the PU of the ELS
H15	InQ positively influences the PEOU of the ELS
H16	LQ positively influences the PEOU of the ELS
H17	LQ positively influences the PU of the ELS
H18	LQ positively influences SAT with the ELS
H19	PEOU positively influences BEN of the ELS
H20	PU positively influences BEN of the ELS
H21	SAT toward the ELS positively influences BEN
H22	BEN of the ELS positively influence Intentions

BEN: Benefits; ELS: E-Learning System, ESQ: Educational System Quality, InQ: Instructor Quality, IQ: Information Quality, IUE: Intentions to Use E-learning, LQ: Learner Quality, PEOU: Perceived Ease of Use, PU: Perceived Usefulness. SAT: Satisfaction. SQ: System Quality, SRQ: Service Quality

III.   THEORETICAL FRAMEWORK

Delone & McLean [34] developed the ISSM, which serves as a fundamental framework to evaluate the efficacy of Information Systems (IS) in organizations. It takes a broad approach considering several interrelated aspects of system success. However, the validity of quantifying BI has been questioned. To address this, the Davis [35] Technology Acceptance Model (TAM) was included in the ISSM. This integration uses the theoretical rigor of TAM to evaluate user behavior with technology, providing strong antecedents for BI [36]. By merging ISSM and TAM, a deeper understanding of the factors that influence IS performance can be gained, along with the business intelligence that generates user benefit and SAT. The incorporation of these models improves the framework's explanatory and predictive capabilities. This integrated approach can provide significant insights into factors that affect the success of ELS [37], as a detailed model is required to assess its effectiveness [38-40].

IV.   METHODOLOGY

A. Research Design and Participants

A quantitative approach was employed, based on an electronically generated and randomly distributed questionnaire using non-probability sampling. In total, 403 respondents participated in the survey, comprising college-age Kuwaiti business students of different majors.

B. Data Collection Tool

The model was designed and tested by [7]. The questionnaire, divided into two parts, was adapted and modified to meet the research goals. Part one examined the general demographic information of the participants. Part two included questions about the PLMS quality measures. Dependent variables were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) [41]. Six PLMS quality measures (SQ, IQ, SRQ, ESQ, LQ, InQ), in addition to user SAT, were examined.

C. Data Screening and Analysis

Structural Equation Modeling (SEM) was employed, using SmartPLS v.4 for data analysis. SEM-based models included assessment of measurements and structure. A bootstrapping procedure was employed to evaluate the robustness of the structural model and test the significance of path coefficients. Bootstrapping is a resampling technique that generates multiple subsamples from the original dataset to estimate the sampling distribution of a statistic. 10,000 bootstrap samples were performed. This provided standard errors, t-statistics, and p-values for path coefficients. Data were first screened and cleaned to remove possible anomalies. Missing data were removed from the analysis. Respondent misconduct was then assessed by testing the standard deviation (SD) of responses [42]. Those with an SD less than 0.25 were removed from further analysis. The final sample used for analysis comprised 403 responses.

V.   DATA ANALYSIS AND RESULTS

The inter-relationships of the quality characteristics (SQ, IQ, ESQ, SrQ, InQ, and LQ), PEOU, PU, SAT, BEN, and IUE were analyzed.

TABLE II.   FACTOR LOADINGS, CRONBACH'S ALPHA,
COMPOSITE RELIABILITY, AND CONVERGENT VALIDITY

Constructs	Loadings	Cronbach's α	Composite reliability (rho_c)	AVE
System Quality		0.818	0.880	0.649
SQ2	0.807			
SQ3	0.703			
SQ4	0.839			
SQ5	0.864			
Information Quality		0.878	0.925	0.804
IQ1	0.886			
IQ2	0.906			
IQ3	0.898			
Education System Quality		0.777	0.871	0.692
ESQ1	0.843			
ESQ2	0.844			
ESQ3	0.808			
Service Quality		0.660	0.813	0.608
SrQ1	0.885			
SrQ2	0.902			
SrQ3	0.477			
Instructor Quality		0.670	0.816	0.598
InQ1	0.758			
InQ2	0.833			
InQ3	0.724			
Learner Quality		0.885	0.929	0.813
LQ1	0.904			
LQ2	0.895			
LQ3	0.906			
Perceived Ease of Use		0.907	0.942	0.843
PEOU1	0.934			
PEOU2	0.922			
PEOU3	0.898			
Perceived Usefulness		0.959	0.969	0.860
PU1	0.909			
PU2	0.931			
PU3	0.939			
PU4	0.934			
PU5	0.925			
Satisfaction		0.951	0.965	0.872
SAT1	0.934			
SAT2	0.941			
SAT3	0.926			
SAT4	0.935			
Benefits		0.917	0.948	0.858
BEN1	0.917			
BEN2	0.927			
BEN3	0.935			

A. Measurement Model Assessment

Factor loadings were first assessed in the measurement model. Recommended factor loadings should normally exceed a threshold of 0.70 [43], but in social science research, not all items of a construct reach this threshold. Therefore, items with loadings between 0.40 and 0.70 should be removed from the analysis only if their removal can improve the construct's reliability and validity. As part of the initial model assessment, except SrQ3, all items had a loading greater than 0.70. SrQ3 was not removed from the analysis, because reliability and validity were already achieved for the construct. One item (SQ1) was cross-loaded with an item from SAT, and it was removed from the analysis to establish discriminant validity.

The model was re-run with the final items set to assess the measurement model. To evaluate factor loadings, construct reliability was assessed using Cronbach's alpha and Composite Reliability. Cronbach's alpha was < 0.70 for two constructs (SrQ and InQ). However, for all constructs, composite reliability exceeded the recommended threshold (0.70). This construct reliability can be referred to as being established, since Cronbach's alpha is a conservative measure of reliability and is reliant on the number of items in a construct. A more liberal measure of reliability, composite reliability, has recently been established [43]. Construct validity was also established, including convergent and discriminant validity. Convergent validity was established using Average Variance Extracted (AVE) [44], which is established when an AVE value is greater than 0.50. All constructs had greater than 0.50 AVE, establishing convergent validity. Table II presents the results for factor loadings. Discriminant validity was established through the Fornell and Larcker [44] criterion, which is established when the square root of AVE for the construct exceeds its correlation with all other study constructs (the construct variable exceeded the shared variance). The square root of AVE exceeded its correlation with all other study constructs, establishing discriminant validity, and Table III presents the results.

TABLE III.   DISCRIMINANT VALIDITY

	1. SQ	2. IQ	3. ESQ	4. SrQ	5. InQ	6. LQ	7. PEOU	8. PU	9. SAT	10. BEN
1. SQ	**0.806**									
2. IQ	0.807	**0.897**								
3. ESQ	0.707	0.723	**0.832**							
4. SrQ	0.695	0.662	0.617	**0.780**						
5. InQ	0.579	0.608	0.637	0.503	**0.773**					
6. LQ	0.769	0.752	0.696	0.635	0.634	**0.902**				
7. PEOU	0.739	0.716	0.646	0.593	0.574	0.775	**0.918**			
8. PU	0.768	0.700	0.664	0.628	0.601	0.783	0.828	**0.928**		
9. SAT	0.805	0.758	0.702	0.655	0.644	0.878	0.786	0.853	**0.934**	
10. BEN	0.721	0.700	0.671	0.594	0.622	0.717	0.823	0.847	0.773	**0.926**

Note. Bold values on the diagonal show the square root of AVE for the construct.

B. Structural Model

A structural model was assessed to substantiate the proposed hypotheses. A bootstrapping procedure with 10,000 samples was carried out to assess path coefficients and their significance. Table IV shows the results of the hypothesis tests. Significant ($p < 0.001$) positive correlations existed between SQ and PU ($B = 0.324$, $t = 5.395$), SAT ($B = 0.242$, $t = 5.388$), and PEOU ($B = 0.230$, $t = 4.062$), so H1 to H3 were supported. IQ significantly positively affected PEOU ($B = 0.137$, $t = 2.300$, $p = 0.011$), so H4 was also supported. There was no significant relationship between IQ and SAT ($B = 0.040$, $t = 0.863$, $p = 0.194$) or PU ($B = -0.003$, $t = 0.050$, $p = 0.480$), so neither H5 nor H6 were supported.

TABLE IV.   HYPOTHESIS TESTING

Hypothesis	PC	SD	*t*	*p*	Result
1 SQ -> 8. PU	0.324	0.060	5.395	0.000	S
2 SQ -> 9. SAT	0.242	0.045	5.388	0.000	S
3 SQ -> 7. PEOU	0.230	0.057	4.062	0.000	S
4 IQ -> 7. PEOU	0.137	0.059	2.300	0.011	S
5 IQ -> 9. SAT	0.040	0.046	0.863	0.194	S
6 IQ -> 8. PU	−0.003	0.064	0.050	0.480	S
7 ESQ -> 8. PU	0.065	0.049	1.330	0.092	PS
8 ESQ -> 7. PEOU	0.049	0.049	1.002	0.158	NS
9 ESQ -> 9. SAT	0.036	0.039	0.919	0.179	NS
10 SrQ -> 8. PU	0.072	0.053	1.362	0.087	PS
11 SrQ -> 9. SAT	0.042	0.036	1.162	0.123	NS
12 SrQ -> 7. PEOU	0.024	0.048	0.509	0.305	PS
13 InQ -> 9. SAT	0.083	0.033	2.496	0.006	S
14 InQ -> 8. PU	0.092	0.043	2.148	0.016	S
15 InQ -> 7. PEOU	0.053	0.046	1.149	0.125	NS
16 LQ -> 7. PEOU	0.413	0.051	8.145	0.000	S
17 LQ -> 8. PU	0.386	0.050	7.664	0.000	S
18 LQ -> 9. SAT	0.558	0.039	14.360	0.000	S
19 PEOU -> 10. BEN	0.369	0.064	5.776	0.000	S
20 PU -> 10. BEN	0.478	0.077	6.212	0.000	S
21 SAT -> 10. BEN	0.075	0.052	1.458	0.072	PS
22 BEN -> 12. Intentions	−0.682	0.030	22.643	0.000	NS

NS: Not Supported, *p*: *p*-value, PC: Path Coefficient, PS: Partially Supported, S, supported, SD: Standard Deviation, *t*: *t*-statistic

ESQ had a partially significant impact on PU (*B* = 0.065, *t* = 1.330, *p* = 0.092), so H7 was partially supported. There was no significant relationship between ESQ and PEOU (*B* = -0.049, *t* = 1.002, *p* = 0.158) or SAT (*B* = 0.036, *t* = 0.919, *p* = 0.179), so neither H8 nor H9 were supported. SrQ had a partially significant impact on PU (*B* = 0.072, *t* = 1.362, *p* = 0.087), so H10 was partially supported. There was no significant relationship between SrQ and SAT (*B* = 0.042, *t* = 1.162, *p* = 0.123) or PEOU (*B* = 0.024, *t* = 0.509, *p* = 0.305), so neither H11 nor H12 were supported. InQ had a significant and positive impact on SAT (*B* = 0.083, *t* = 2.496, *p* = 0.006) and PU (*B* = 0.092, *t* = 2.148, *p* = 0.016), so H13 and H14 were supported. InQ did not significantly affect PEOU (*B* = 0.053, *t* = 1.149, *p* = 0.125), so H15 was not supported. LQ had a significant (*p* < 0.001) and positive impact on PEOU (*B* = 0.413, *t* = 8.145), PU (*B* = 0.386, *t* = 7.664), and SAT (*B* = 0.558, *t* = 14.360), so H16 to H18 were supported. PEOU had a significant and positive impact on BEN (*B* = 0.369, *t* = 5.776, *p* < 0.001), so H19 was supported. PU had a significant and positive impact on BEN (*B* = 0.478, *t* = 6.212, *p* < 0.001), so H20 was supported. SAT has a partially significant impact on BEN (*B* = 0.075, *t* = 1.458, *p* = 0.072), so H21 was partially supported. Finally, BEN had a significant but negative impact on Intentions (*B* = -0.682, *t* = 22.643, *p* < 0.000), so H22 was not supported.

C. R^2 and Q^2

In addition to hypothesis tests, the model's explanatory power was evaluated using R^2, where the values for PEOU, PU, and SAT were 0.683, 0.694, and 0.821, respectively. This showed that a 68.3% change in PEOU, 69.4% change in PU, and 82.1% change in SAT were accounted for by the quality dimensions SQ, IQ, ESQ, SrQ, InQ, and LQ. The R^2 for BEN was 0.766, indicating that a 76.6% change in BEN was accounted for by PEOU, PU, and SAT. The R^2 for Intentions

was 0.465, indicating that a 46.5% change in Intentions was accounted for by BEN. Predictive relevance was evaluated using Q^2, with values > 0 for each study variable, indicating that the model has predictive relevance [45]. Table V presents R^2 and Q^2 results. Figure 1 shows the model structure.
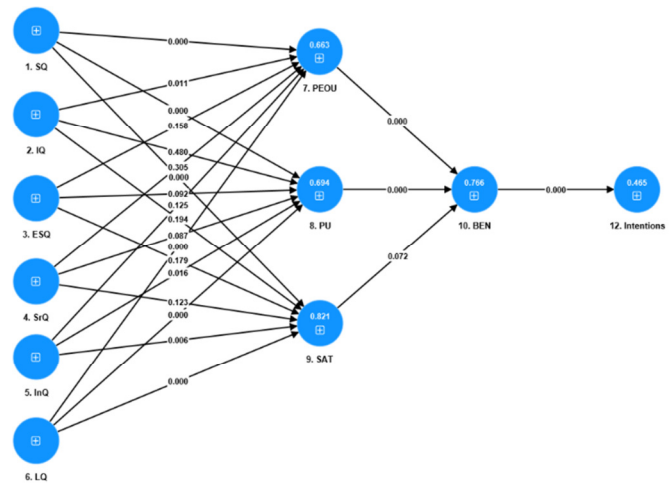

Fig. 1.   Structural model.

TABLE V. R^2 AND Q^2 RESULTS

Variable	R^2	Q^2 predict
10. BEN	0.766	0.607
12. Intentions	0.465	0.423
7. PEOU	0.663	0.652
8. PU	0.694	0.681
9. SAT	0.821	0.815

BEN: Benefits, PEOU: Perceived Ease Of Use, PU: Perceived Usefulness, SAT: Satisfaction

VI.   DISCUSSION

This study aimed to explore the Moodle system's e-learning platform and evaluate its success in user experience during the COVID-19 pandemic by testing various system quality measures. The results of this study differ from previous reports in diverse ways. The results showed that SQ significantly and positively affects PU, SAT, and PEOU, a finding that differs from previous studies that reported that SQ had no significant impact on use and user SAT [25, 27-29]. IQ was found to significantly and positively affect PEOU, but not SAT or PU, while previous studies reported that IQ affected both use and user SAT in cases where a higher IQ was associated with greater use and SAT [25, 27, 30-32, 46]. ESQ was found to have a partially significant impact on PU, but an insignificant impact on PEOU and SAT, a finding that diverges from [33] which reported ESQ to positively affect user SAT and ELS use. SrQ was found to partially affect PU and PEOU, but not SAT, a finding that is consistent with [30, 31] but differs from [25, 27-29] which reported that SrQ affected user SAT.

InQ significantly and positively affected SAT and PU but not PEOU. The results also showed that LQ had a significant and positive impact on PEOU, PU, and SAT, consistent with [7]. PU and PEOU significantly and positively affected BEN, and SAT had a partially significant impact on BEN. This may

be because users found ELS more beneficial if it helped their study and was easy to use. PU and PEOU are two important factors for users to perceive and appreciate system benefits [47]. SAT was partially supported, suggesting that students may not be fully satisfied, but found the system useful and easy to use. BEN had a significant but negative impact on Intentions.

VII. CONCLUSIONS

E-learning has been implemented in the educational sector worldwide, as evidenced by the transition from traditional face-to-face learning schemes to online ones. This study examined the Moodle ELS, which has been under-researched in comparison to other learning platforms, using a quantitative approach to examine its success by testing quality measures surrounding user experience. The results confirmed that users could overcome operational difficulties and transition to PLMS in a reasonable time.

A. Theoretical Implications

The theoretical contribution stems from the application of the TAM and DeLone and McClean models to develop an overall understanding of the use and success of e-learning programs using Moodle. This study advances what was known about the subject by empirically testing user experiences and the overall perceived success of Moodle as an ELS.

B. Managerial Implications

This study reported system features that allowed students to use Moodle, recognize its benefit as an ELS, and highlight the importance of building simple and useful systems to increase student and teacher success for system adoption. Although a heavy dependence on traditional and face-to-face interaction between students and instructors has given way to e-learning, a gap remains between the required level of student e-learning knowledge and the requisite know-how to perform academic coursework. Thus, it is important to continue using Moodle as an e-learning tool, with mandatory use throughout the academic year as opposed to just during crises. This requires Moodle to be integrated and incorporated with an education platform in parallel to traditional learning schemas. For higher adoption rates for student success, intensive training and practice programs are necessary for students and instructors. As learning is necessary for societal development, governments must stress the importance of e-learning for successful 21st-century learning.

C. Limitations and Future Research

This research was carried out during the COVID-19 pandemic, which presented an exceptional and possibly unrepeatable scenario. Accordingly, the findings may not be relevant to normal situations where the use of ELS, such as Moodle, may be more variable in user involvement and perception. The sample population was also from a single location and education level, so the extent to which the findings can be generalized to other populations is unknown. Future studies can improve the generalization of the results by using a larger and more diverse sample. Finally, the results pertain exclusively to the use of Moodle ELS, and different platforms may produce different results. Previous studies [48] have also

recommended that further research is needed. Future research could involve longitudinal studies that track user perceptions and behaviors, as users become more accustomed to ELS. Comparative studies across different e-learning platforms could also identify specific features that contribute to better user SAT, usefulness, and PEOU. Furthermore, the research could be expanded to include primary and secondary education levels and formal and informal learning settings to allow investigation of how different groups respond to a platform, and if and how ELSs can be tailored to meet specific educational needs.

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