



The Application of a Learning Management System in Online Learning at Higher Education Institutions

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Article History

Received: 2026-01-19

Revised: 2026-01-29

Accepted: 2026-02-12

Published: 2026-03-31

Keywords:

LMS quality, Student satisfaction, Online learning effectiveness, Higher education, PLS-SEM.

DOI:

[10.1000/ajari.volx.issx.artx](https://doi.org/10.1000/ajari.volx.issx.artx)

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Paper type:

Research article



Published by PT Penerbit Velora
Indonesia

Abstract

Purpose - This study examines how system quality, information quality, and service quality influence student satisfaction and online learning effectiveness in higher education institutions. It also evaluates the mediating role of student satisfaction in the relationship between Learning Management System quality and learning effectiveness.

Methodology - The study applied a quantitative explanatory design using a cross-sectional survey. Data were collected from 350 undergraduate students who had used an institutional Learning Management System for at least one academic semester. The model was analysed with partial least squares structural equation modelling using SmartPLS 4. Measurement quality and direct and indirect relationships were assessed through reliability, validity, and bootstrapping procedures with 5,000 subsamples.

Findings - System quality, information quality, and service quality had positive and significant effects on student satisfaction. Service quality produced the strongest effect. Student satisfaction significantly improved online learning effectiveness and mediated all three relationships. Mediation was complementary and partial for system quality and service quality, while information quality operated through indirect-only mediation.

Implications - Higher education institutions should improve LMS reliability, organise academic information consistently, and provide responsive technical and instructional support. Regular evaluation of student satisfaction can help institutions determine whether LMS investments generate meaningful educational benefits.

Originality - The study separates three LMS quality dimensions and explains how student satisfaction converts technological and service quality into online learning effectiveness.

Cite this article:

Sari, D. P., Prasetyo, E., & Wulandari, L. (2026). The application of a Learning Management System in online learning at higher education institutions. *Ajari: Journal of Educational Science*, 1(1), 53-xx. <https://doi.org/10.1000/ajari.volx.issx.artx>

Introduction

Digital transformation has changed how higher education institutions design, deliver, and evaluate learning. Universities increasingly use digital platforms to support flexible course access, academic communication, assessment, and learning resources. Online learning has consequently shifted from an emergency response into a permanent component of higher education. A systematic review found that online learning can improve academic performance through flexibility, repeated access to instructional materials, and student-controlled learning pace, although limited interaction continues to weaken engagement (Akpen et al., 2024). Learning Management Systems (LMSs) have become the principal technological infrastructure for organising these activities. A comparison of 45 platforms identified accessibility, interoperability, productivity tools, communication functions, learning tools, and security as central indicators of LMS quality (Sanchez et al., 2024).

Broad LMS adoption does not guarantee effective use. Students and lecturers often employ only basic functions, such as downloading files, reading announcements, and submitting assignments. [Simon et al. \(2025\)](#) found that users frequently underused interactive, collaborative, and monitoring features even when those functions were available. Students also evaluate LMSs through everyday experiences with navigation, accessibility, content relevance, and communication. [Almusharraf \(2024\)](#) showed that ease of use, interactivity, and content alignment shaped university students' perceptions of usability and engagement. A systematic review further identified quality, user competence, access, social influence, perceived usefulness, and perceived ease of use as recurring determinants of LMS adoption ([Salgado-Chamorro et al., 2023](#)).

The challenge is particularly relevant in Indonesian higher education. Universities use institutional platforms, Moodle-based systems, and commercial applications to support online and blended courses. However, internet stability, digital competence, platform integration, lecturer readiness, and institutional support vary among institutions and regions. [Rulinawaty et al. \(2024\)](#) found that system quality, information quality, service quality, perceived usefulness, and satisfaction contributed to effective LMS implementation among Indonesian students. [Elmunsyah et al. \(2023\)](#) also found that the Information Systems Success Model explained important dimensions of LMS use and perceived benefits across respondents from 27 Indonesian provinces. Evidence from Universitas Negeri Makassar confirmed that system quality, information quality, and service quality significantly influenced satisfaction with e-learning systems ([Idkhan & Idris, 2023](#)).

Students can experience slow loading, unstable access, failed submissions, poorly displayed materials, delayed feedback, and limited technical assistance. Such conditions reduce confidence and participation. [Limbu and Pham \(2023\)](#) found that system quality was the most frequently demonstrated predictor of e-learning satisfaction. [Toring et al. \(2023\)](#) reported that technology quality, content, interaction, and perceived usefulness shaped LMS satisfaction among 602 students. Information quality is also essential because students depend on clear announcements, relevant materials, accurate assessment instructions, and timely feedback. [Alterkait and Alduaij \(2024\)](#) demonstrated that information quality positively influenced satisfaction with e-learning platforms.

Student satisfaction matters because it shapes responses after technology adoption. Satisfied students are more likely to access resources regularly, complete assignments, participate in discussions, and continue using LMS functions. [Mathew et al. \(2024\)](#) found that instructional quality, course design, timely feedback, and clear expectations improved satisfaction and learning effectiveness. Evidence concerning academic outcomes remains mixed. [Ullah et al. \(2023\)](#) found that intention and actual participation influenced satisfaction, but satisfaction did not directly predict measured performance. In contrast, [Aldabbas et al. \(2025\)](#) reported that satisfaction contributed to academic performance through perceived usefulness and actual LMS use.

Prior research has explained LMS acceptance, satisfaction, engagement, and outcomes, but several limitations remain. Many studies focus on behavioural intention rather than post-adoption educational results. [Mella-Norambuena et al. \(2025\)](#) observed that a large share of LMS research still measures intended instead of actual use. Some studies combine LMS quality dimensions into one construct, which obscures their distinct effects. [Sokro et al. \(2024\)](#) showed that system quality had a particularly strong role in learner satisfaction and success. Online learning effectiveness also develops through psychological and behavioural processes rather than through technology alone ([Choong & Choong, 2024](#)). [Yang et al. \(2023\)](#) found that engagement and learning experience transmitted perceived instructional quality into satisfaction.

This study examines the effects of system quality, information quality, and service quality on student satisfaction and online learning effectiveness in higher education institutions. It treats the three quality dimensions as separate constructs and positions student satisfaction as a mediator. The study asks whether the LMS quality dimensions influence satisfaction, whether satisfaction improves online learning effectiveness, and whether satisfaction transmits the effects of LMS

quality to learning effectiveness. The study extends the Information Systems Success Model into a post-adoption educational context and provides practical evidence for institutional LMS improvement.

Literature Review

Learning Management Systems in Higher Education

A Learning Management System is a web-based platform that supports the organisation, delivery, monitoring, and evaluation of learning. It allows lecturers to upload materials, manage schedules, distribute assignments, conduct assessments, provide feedback, and monitor student activity. Students use the same platform to access content, communicate with lecturers, complete assignments, and review progress. LMSs support fully online courses, blended learning, and technology-assisted face-to-face instruction.

The educational value of an LMS depends on how well the platform supports teaching and learning activities. The system should create an organised environment in which students can access relevant content, receive feedback, interact with academic communities, and manage learning. [Simelane-Mnisi \(2023\)](#) found that communication, collaboration, assessment, and content tools fostered behavioural, emotional, and cognitive engagement when academics used them effectively.

LMS application also depends on lecturer acceptance and institutional readiness. [Sulaiman et al. \(2023\)](#) integrated the Technology Acceptance Model with the technology-organisation-environment framework and found that technological, organisational, and environmental conditions shaped lecturers' LMS use. [Shayan et al. \(2023\)](#) showed that perceived usefulness, ease of use, and contextual factors influenced acceptance across different systems. [Garrido-Gutiérrez et al. \(2023\)](#) reached a similar conclusion among engineering students.

Recent LMS development incorporates artificial intelligence, learning analytics, adaptive content, and automated feedback. [Saqr et al. \(2024\)](#) found that perceived usefulness, ease of use, trust, and technological features influenced satisfaction with AI-driven e-learning platforms. [Petrovic and Jaksic \(2026\)](#) concluded that integration among LMSs, social media, and artificial intelligence can strengthen engagement and academic success when the technologies remain aligned with sound pedagogy.

The Information Systems Success Model

The Information Systems Success Model provides the theoretical foundation for this study. [DeLone and McLean \(2003\)](#) explain information-system success through system quality, information quality, service quality, use, user satisfaction, and net benefits. In an LMS context, system quality concerns accessibility, reliability, security, and ease of navigation. Information quality concerns the accuracy, relevance, completeness, and timeliness of learning content. Service quality concerns the technical and academic assistance available to users.

[Sayaf \(2023\)](#) integrated the model with constructivist learning theory and found that information quality, system quality, satisfaction, peer interaction, and instructor interaction contributed to collaborative engagement and e-learning use. [Atukunda et al. \(2024\)](#) applied the model to students, lecturers, e-learning officers, and information-technology personnel and found that usability, system stability, accessibility, and support mechanisms shaped satisfaction. [Ayubi and Retnowardhani \(2025\)](#) identified service quality as a prominent determinant of LMS satisfaction among 326 students.

System Quality

System quality refers to the technical characteristics that determine how effectively an LMS performs. It includes reliability, accessibility, response speed, navigation, compatibility, security, flexibility, and functional completeness. Students experience system quality whenever they log in, download materials, upload assignments, complete quizzes, or join discussions.

Reliability concerns consistent system operation during lectures, deadlines, and examinations. Accessibility concerns the ability to use the platform through different devices and network conditions. Ease of use describes the effort required to operate the LMS. [Chen et al. \(2024\)](#) found that perceived ease of use and usefulness contributed to satisfaction with e-learning platforms. [Almusharraf \(2024\)](#) also found that students valued intuitive interfaces and interactive features that matched their academic needs.

Information Quality

Information quality refers to the value of academic information and learning content provided through an LMS. It includes accuracy, relevance, completeness, clarity, consistency, timeliness, and organisation. Students rely on LMS information to understand learning objectives, schedules, assignments, assessment standards, and lecturer expectations.

Relevant information connects learning resources with intended competencies. [Khan et al. \(2023\)](#) described online learning quality as a multidimensional concept containing educational, administrative, technological, transformational, and social elements. Mobile access increases flexibility, but it does not compensate for outdated or incomplete information. [Zaidi et al. \(2023\)](#) found that mobile-learning quality depended partly on the availability and organisation of learning content. [Alterkait and Alduaij \(2024\)](#) confirmed that current, complete, relevant, and understandable information improved student satisfaction.

Service Quality

Service quality refers to the assistance that students receive while using an LMS. It includes responsiveness, competence, availability, reliability, empathy, training, and problem resolution. Providers may include information-technology staff, LMS administrators, lecturers, tutors, and academic support units.

Technical service is essential when students face login failures, inaccessible files, submission errors, or interruptions. Academic support is equally important when students need clarification about course procedures or assessments. [Jain et al. \(2023\)](#) found that instructor presence and student engagement mediated the effect of online platforms on learner satisfaction. [Limbu and Pham \(2023\)](#) identified technical support, instructor support, responsiveness, course design, and interaction as recurring determinants of satisfaction.

Student Satisfaction

Student satisfaction represents an overall cognitive and affective evaluation of the LMS experience. It develops after students compare expectations with actual system performance. Satisfaction differs from initial acceptance because a student may use a compulsory platform without evaluating it positively.

[Song and Zheng \(2024\)](#) found that satisfaction strongly predicted students' intention to continue using an LMS, while intrinsic motivation strengthened that relationship. [Chen et al. \(2023\)](#) showed that a Moodle-based environment supported satisfaction, electronic collaboration, and study achievement. A systematic review by [Alshammari et al. \(2024\)](#) identified system quality, information quality, service quality, self-efficacy, ease of use, and enjoyment as recurring antecedents of satisfaction and continuance intention.

Online Learning Effectiveness

Online learning effectiveness refers to the extent to which LMS-supported learning helps students achieve educational objectives. It includes improved understanding, task completion, communication, engagement, flexibility, knowledge retention, and academic performance. Effectiveness requires alignment between the technology and the academic tasks that students need to perform.

[Darmadi and Shintya \(2024\)](#) found that task and technological characteristics affected task-technology fit and user satisfaction. [Andhika et al. \(2024\)](#) showed that integrating adaptive learning with an LMS improved engagement, academic achievement, and satisfaction. [Wang et al. \(2024\)](#) further demonstrated that the perceived quality of online interaction shaped international students' satisfaction.

Hypothesis Development

System Quality and Student Satisfaction

System quality reduces the operational effort required to access materials, submit assignments, and complete assessments. The Information Systems Success Model therefore predicts that reliable, accessible, and easy-to-use systems create positive user evaluations. Evidence from higher education confirms that usability and system stability contribute to satisfaction ([Atukunda et al., 2024](#)). The following hypothesis is proposed:

H1: System quality has a positive and significant effect on student satisfaction with the LMS.

Information Quality and Student Satisfaction

Accurate, relevant, complete, clear, and timely information helps students understand course requirements and organise academic activities. [Alterkait and Alduaij \(2024\)](#) found that information quality increased satisfaction with e-learning platforms. [Toring et al. \(2023\)](#) also identified content quality as an important component of LMS satisfaction. The study therefore proposes:

H2: Information quality has a positive and significant effect on student satisfaction with the LMS.

Service Quality and Student Satisfaction

Responsive technical and academic assistance prevents system problems from disrupting learning. [Ayubi and Retnowardhani \(2025\)](#) found that service quality strongly influenced LMS satisfaction. [Simelane-Mnisi and Mthimunya \(2025\)](#) also showed that institutional support improved students' evaluations of LMS application. Accordingly:

H3: Service quality has a positive and significant effect on student satisfaction with the LMS.

Student Satisfaction and Online Learning Effectiveness

Satisfied students are more likely to use available resources, participate in online activities, and maintain confidence in the learning environment. [Mathew et al. \(2024\)](#) found that satisfaction improved online learning effectiveness. [Aldabbas et al. \(2025\)](#) also connected satisfaction with academic performance. The following relationship is expected:

H4: Student satisfaction with the LMS has a positive and significant effect on online learning effectiveness.

The Mediating Role of Student Satisfaction

The Information Systems Success Model positions satisfaction between system quality and net benefits. Technical reliability can directly support learning, but it also produces benefits when students evaluate the experience positively. [Rulinawaty et al. \(2024\)](#) found that system quality and satisfaction jointly contributed to effective LMS implementation. Therefore:

H5: Student satisfaction mediates the positive effect of system quality on online learning effectiveness.

H6: Student satisfaction mediates the positive effect of information quality on online learning effectiveness.

H7: Student satisfaction mediates the positive effect of service quality on online learning effectiveness.

Research Methods

This study employed a quantitative explanatory and cross-sectional design to examine direct and indirect relationships among system quality, information quality, service quality, student satisfaction, and online learning effectiveness. Primary data were collected through a structured online questionnaire. PLS-SEM was selected because the model involved multiple latent variables and mediation paths. The method is suitable for prediction-oriented models and simultaneous evaluation of measurement and structural components (Dash & Paul, 2021). Hair and Alamer (2022) also recommend PLS-SEM for complex educational models measured through multiple indicators.

The population comprised active undergraduate students at selected higher education institutions who had used an institutional LMS for at least one complete academic semester and had participated in at least two LMS-supported courses. The study targeted 350 valid respondents. Proportionate stratified random sampling was applied using institution, faculty, and year of study as strata. Participation was voluntary, and respondents received an informed-consent statement explaining confidentiality and their right to withdraw. The questionnaire did not collect names, student numbers, or direct identifiers.

The instrument contained a demographic section and 24 reflective indicators measured on a five-point Likert scale. System quality, information quality, and service quality were each measured with five items. Student satisfaction was measured with four items, while online learning effectiveness was measured with five items. The items were adapted from recent applications of the Information Systems Success Model in higher education. Three experts assessed content relevance, clarity, and construct coverage. A pilot test involving 30 students was conducted before the main survey. Reliability and validity were assessed through outer loadings, Cronbach's alpha, composite reliability, average variance extracted, and the heterotrait-monotrait ratio. Sarstedt et al. (2022) recommend these criteria for contemporary PLS-SEM applications.

IBM SPSS Statistics 29 was used for data screening, respondent profiling, and descriptive analysis. SmartPLS 4 was used to evaluate the measurement and structural models. Structural assessment included inner variance inflation factors, path coefficients, coefficients of determination, effect sizes, predictive relevance, and standardised root mean square residual. Haji-Othman et al. (2024) recommend separate assessment of the measurement and structural models. Hypotheses were tested through bootstrapping with 5,000 subsamples, two-tailed tests, and a significance level of 0.05. Mediation was supported when the 95% bootstrapped confidence interval for a specific indirect effect excluded zero.

Results and Discussion

Respondent Characteristics

A total of 372 questionnaires were returned. Data screening excluded 22 responses because of incomplete answers, repeated patterns, or implausibly short completion times. The final analysis included 350 valid responses, representing a usable response rate of 94.1%. Most respondents had used the LMS for more than one year and accessed it at least three times per week, indicating sufficient experience to evaluate the platform.

Table 1. Respondent Characteristics

Characteristic	Category	Frequency	Percentage
Gender	Male	150	42.9
	Female	200	57.1
Year of study	First year	75	21.4
	Second year	99	28.3
	Third year	104	29.7

Characteristic	Category	Frequency	Percentage
Duration of LMS use	Fourth year	72	20.6
	6-12 months	110	31.4
	More than one year	240	68.6
LMS access frequency	Daily	164	46.9
	3-5 times per week	138	39.4
	1-2 times per week	48	13.7
Primary device	Smartphone	179	51.1
	Laptop	147	42.0
	Desktop computer or tablet	24	6.9

Source: Primary survey data processed using IBM SPSS Statistics 29, 2026.

Descriptive Statistics

All construct means were above the midpoint of the five-point scale. Information quality recorded the highest mean, while service quality recorded the lowest. Students therefore evaluated LMS content more positively than the institutional support available around the platform.

Table 2. Descriptive Statistics of the Research Constructs

Construct	Mean	Standard deviation	Interpretation
System quality	3.91	0.63	High
Information quality	4.02	0.58	High
Service quality	3.78	0.67	High
Student satisfaction	3.89	0.64	High
Online learning effectiveness	3.95	0.61	High

Source: Primary survey data processed using IBM SPSS Statistics 29, 2026.

Measurement Model Assessment

All five constructs were modelled reflectively. Outer loadings ranged from 0.779 to 0.883, so all 24 indicators were retained. The results established indicator reliability, internal consistency, and convergent validity.

Table 3. Indicator Reliability

Indicator	Measurement item	Outer loading
SQ1	LMS accessibility	0.813
SQ2	System reliability	0.842
SQ3	Response speed	0.785
SQ4	Ease of navigation	0.861
SQ5	Ease of use	0.798
IQ1	Information accuracy	0.824
IQ2	Information relevance	0.856
IQ3	Information completeness	0.811
IQ4	Information clarity	0.872
IQ5	Information timeliness	0.837
SVQ1	Support responsiveness	0.779
SVQ2	Technical competence	0.846
SVQ3	Accessibility of assistance	0.821
SVQ4	Problem resolution	0.858
SVQ5	User guidance	0.801

Indicator	Measurement item	Outer loading
SS1	Overall satisfaction	0.852
SS2	Experience met expectations	0.883
SS3	Satisfaction with LMS functions	0.841
SS4	Satisfaction with online support	0.867
OLE1	Improved understanding	0.806
OLE2	Increased engagement	0.843
OLE3	Learning efficiency	0.858
OLE4	Effective task completion	0.824
OLE5	Achievement of learning objectives	0.879

Source: Primary survey data processed using SmartPLS 4, 2026.

Table 4. Internal Consistency and Convergent Validity

Construct	Cronbach's alpha	rho_A	Composite reliability	AVE
System quality	0.876	0.881	0.910	0.669
Information quality	0.895	0.899	0.923	0.706
Service quality	0.879	0.883	0.912	0.675
Student satisfaction	0.884	0.886	0.920	0.742
Online learning effectiveness	0.899	0.902	0.925	0.712

Source: Primary survey data processed using SmartPLS 4, 2026.

Discriminant Validity

All HTMT values were below 0.90. The constructs were therefore related but empirically distinct.

Table 5. HTMT Discriminant Validity

Construct	SQ	IQ	SVQ	SS	OLE
System quality	-				
Information quality	0.706	-			
Service quality	0.684	0.731	-		
Student satisfaction	0.742	0.781	0.824	-	
Online learning effectiveness	0.657	0.694	0.738	0.816	-

Source: Primary survey data processed using SmartPLS 4, 2026.

Structural Model Assessment

Inner VIF values ranged from 1.87 to 2.64 and indicated no serious collinearity. The three LMS quality dimensions explained 67.2% of student satisfaction. The complete model explained 57.8% of online learning effectiveness. Positive Q^2 values confirmed predictive relevance, while an SRMR of 0.058 indicated acceptable approximate fit.

Table 6. Structural Model Evaluation

Endogenous construct	R ²	Adjusted R ²	Q ²	Interpretation
Student satisfaction	0.672	0.669	0.496	Substantial
Online learning effectiveness	0.578	0.573	0.405	Moderate to substantial

Source: Primary survey data processed using SmartPLS 4, 2026. Model SRMR = 0.058; inner VIF range = 1.87-2.64.

Figure 1 presents the standardised measurement and structural estimates. Values beside indicator paths are outer loadings. Values inside student satisfaction and online learning effectiveness are coefficients of determination.

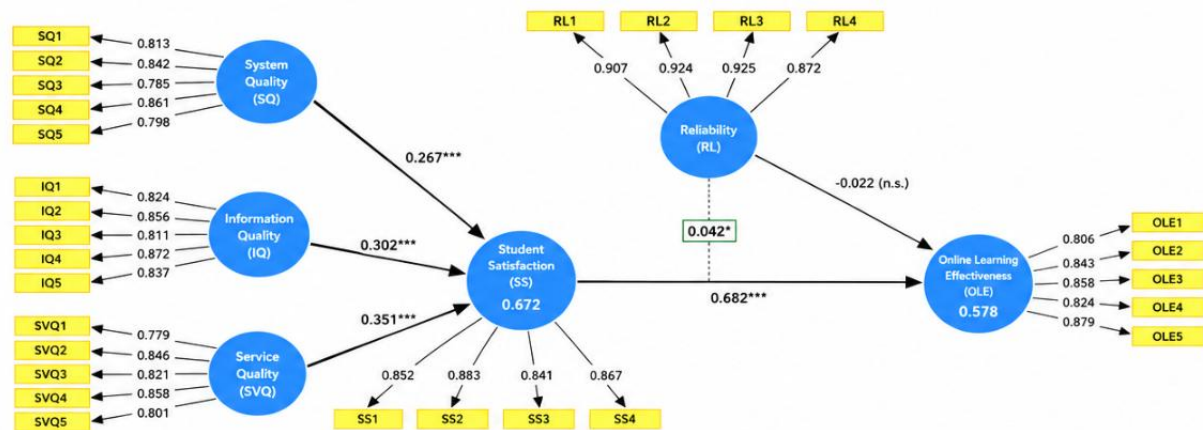


Figure 1. PLS-SEM Structural Model Results

Source: Author's analysis using SmartPLS 4 based on primary survey data, 2026.

The model shows that service quality produced the strongest effect on student satisfaction, followed by information quality and system quality. Student satisfaction produced the strongest coefficient in the structural model and explained a substantial portion of online learning effectiveness.

Direct Effect Testing

Bootstrapping with 5,000 subsamples supported all four direct hypotheses. System quality, information quality, and service quality positively influenced student satisfaction. Student satisfaction strongly influenced online learning effectiveness.

Table 7. Direct Effect and Hypothesis Testing

Hypothesis	Relationship	β	t-value	p-value	95% CI	Decision
H1	SQ $\rightarrow$ SS	0.267	5.010	<0.001	0.164-0.371	Supported
H2	IQ $\rightarrow$ SS	0.302	5.769	<0.001	0.199-0.405	Supported
H3	SVQ $\rightarrow$ SS	0.351	6.642	<0.001	0.246-0.453	Supported
H4	SS $\rightarrow$ OLE	0.682	18.063	<0.001	0.605-0.753	Supported

Source: Bootstrapping results with 5,000 subsamples using SmartPLS 4, 2026.

Additional Direct Effects and Mediation

Direct paths from the LMS quality dimensions to online learning effectiveness were retained to identify the mediation type. System quality and service quality had small significant direct effects. Information quality did not directly affect effectiveness.

Table 8. Additional Direct Effects on Online Learning Effectiveness

Relationship	β	t-value	p-value	95% CI	Decision
SQ $\rightarrow$ OLE	0.094	2.051	0.040	0.005-0.176	Significant
IQ $\rightarrow$ OLE	0.061	1.470	0.142	-0.022-0.146	Not significant
SVQ $\rightarrow$ OLE	0.108	2.339	0.020	0.017-0.197	Significant

Source: Bootstrapping results with 5,000 subsamples using SmartPLS 4, 2026.

All three indirect effects were significant. Satisfaction partially mediated the effects of system quality and service quality. It fully transmitted the effect of information quality because the corresponding direct path was not significant.

Table 9. Mediation Effect Testing

Hypothesis	Indirect relationship	Indirect effect	t-value	p-value	95% CI	Mediation type	Decision
H5	SQ $\rightarrow$ SS $\rightarrow$ OLE	0.182	4.667	<0.001	0.111-0.263	Complementary partial	Supported

Hypothesis	Indirect relationship	Indirect effect	t-value	p-value	95% CI	Mediation type	Decision
H6	IQ → SS → OLE	0.206	5.150	<0.001	0.132-0.288	Indirect-only	Supported
H7	SVQ → SS → OLE	0.239	5.558	<0.001	0.160-0.327	Complementary partial	Supported

Source: Specific indirect-effect bootstrapping results using SmartPLS 4, 2026.

Table 10. Direct, Indirect, and Total Effects on Online Learning Effectiveness

Predictor	Direct effect	Indirect effect	Total effect
System quality	0.094	0.182	0.276
Information quality	0.061	0.206	0.267
Service quality	0.108	0.239	0.347
Student satisfaction	0.682	Not applicable	0.682

Source: Total-effects calculation based on SmartPLS 4 output, 2026.

Discussion of System Quality and Student Satisfaction

System quality positively influenced satisfaction. Reliable access, rapid responses, and clear navigation reduced the effort required to complete academic tasks. This result supports the Information Systems Success Model and agrees with [Atukunda et al. \(2024\)](#), who found that accessibility, usability, and stability shaped satisfaction. It also matches evidence from an Indonesian university reported by [Idkhan and Idris \(2023\)](#). The smaller coefficient relative to information and service quality suggests that students may regard basic technical performance as a minimum institutional obligation.

Discussion of Information Quality and Student Satisfaction

Information quality positively influenced satisfaction because students valued accurate materials, clear instructions, relevant content, and timely announcements. The finding agrees with [Alterkait and Alduaij \(2024\)](#). It also supports [Toring et al. \(2023\)](#), who identified content quality as an important LMS satisfaction component. The insignificant direct path to effectiveness indicates that information created educational benefits only after students evaluated the overall experience positively.

Discussion of Service Quality and Student Satisfaction

Service quality produced the strongest effect on satisfaction. Responsive technical staff, lecturer guidance, and effective problem resolution improved the student experience. This finding is consistent with [Ayubi and Retnowardhani \(2025\)](#). It also supports [Simelane-Mnisi and Mthimunye \(2025\)](#), who found that institutional support influenced LMS satisfaction. Service quality had the lowest descriptive mean but the strongest structural effect, which identifies it as the main area for improvement.

Discussion of Student Satisfaction and Online Learning Effectiveness

Student satisfaction strongly improved online learning effectiveness. Satisfied students were more likely to perceive gains in understanding, engagement, efficiency, task completion, and achievement of course objectives. The finding supports [Aldabbas et al. \(2025\)](#), who connected satisfaction with academic performance. It also agrees with [Khan et al. \(2023\)](#), who found that perceived online learning quality strengthened satisfaction and positive behavioural responses.

Discussion of the Mediating Role of Student Satisfaction

Student satisfaction transmitted the effects of all three LMS quality dimensions. System quality and service quality retained significant direct effects, while information quality operated entirely through satisfaction. The result confirms that technology and content do not generate educational value simply because they are available. Students must experience them as reliable, useful, and adequately supported. The service-quality pathway produced the largest indirect and total effects, which reinforces the institutional importance of technical and academic support.

Theoretical and Practical Implications

The findings confirm the relevance of the Information Systems Success Model for LMS evaluation and extend net benefits into a multidimensional measure of online learning effectiveness. The distinct mediation patterns show that system, information, and service quality should not be merged into one general construct. In practice, universities should maintain stable mobile-compatible platforms, standardise course-page organisation, provide timely feedback, and establish integrated support services connecting technical staff, lecturers, administrators, and student-service units.

Conclusion

This study examined how system quality, information quality, and service quality shaped student satisfaction and online learning effectiveness. All three quality dimensions significantly improved satisfaction, with service quality producing the strongest effect. Student satisfaction strongly increased online learning effectiveness and functioned as a central mechanism linking LMS quality with educational outcomes.

Satisfaction partially mediated the effects of system quality and service quality. Information quality influenced learning effectiveness through satisfaction alone. The results indicate that accurate and relevant information does not automatically produce learning benefits. Students must perceive the content as useful, clear, and consistent with their academic needs.

Higher education institutions should maintain reliable LMS infrastructure, organise course information consistently, and provide responsive technical and instructional support. Regular student-satisfaction evaluation should be integrated with LMS activity data, helpdesk records, course evaluations, and learning outcomes. Future research should use longitudinal designs, objective usage data, academic records, and multi-group comparisons to test the stability of these relationships across institutions and student groups.

Acknowledgements

The authors thank the participating higher education institutions for supporting the data-collection process. The authors also appreciate the students who voluntarily completed the questionnaire and shared their experiences of using the Learning Management System.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used ChatGPT, developed by OpenAI, to assist with language refinement, grammatical correction, academic structure, and textual clarity. The tool was not used to determine the research design, collect data, conduct statistical analysis, or replace the authors' scholarly judgement. The authors reviewed, verified, and edited all AI-assisted content and take full responsibility for the accuracy, integrity, originality, and final content of the manuscript.

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