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Evaluation of the Implementation of a Learning Management System (LMS) in Health Higher Education Institutions

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Abstract

This study aims to evaluate the implementation of a Learning Management System (LMS) in a health sciences higher education institution by analyzing system quality, information quality, service quality, LMS usage, user satisfaction, learning engagement, and learning outcomes. A quantitative approach was employed, utilizing a survey design involving students and lecturers as LMS users. The evaluation was developed based on the DeLone and McLean information systems success model, extended to include the constructs of learning engagement and learning outcomes. The results indicate that the overall implementation of the LMS falls into the "effective" category, with an average score of 4.00 on a 5-point scale. Information quality received the highest score (4.12), followed by system quality (4.08), user satisfaction (4.06), LMS usage (4.01), learning engagement (3.94), and learning outcomes (3.91). Analysis of the relationships between variables reveals that system quality, information quality, and service quality positively influence LMS usage and user satisfaction. Furthermore, LMS usage contributes to user satisfaction, while satisfaction is positively associated with learning engagement. Learning engagement emerged as the strongest predictor of learning outcomes. These findings demonstrate that LMS success is determined not only by technological quality but also by content quality, service support, usage intensity, satisfaction, and active student engagement. The study recommends strengthening infrastructure, content quality, technical support, and interactive learning, as well as utilizing learning analytics to enhance LMS effectiveness in health sciences higher education.

Keywords: Learning Management System; Health Sciences Higher Education; System Quality; Information Quality; Learning Outcomes.

Introduction

Digital transformation has reshaped the delivery of higher education— including programs in medicine, nursing, midwifery, public health, and other health professions—shifting the learning process from conventional face-to-face models toward digital, online, and blended learning (Rohwer et al., 2017). This shift has established the Learning Management System (LMS) as a key infrastructure for managing education,

as it enables institutions to provide materials, learning activities, communication channels, assignments, assessments, and student activity monitoring within a single, integrated digital environment (Cabero-Almenara et al., 2019).

In health education, the LMS holds strategic value because the learning process requires not only the mastery of theoretical knowledge but also the development of clinical skills, critical thinking, professional communication, and readiness for healthcare practice; consequently, the use of learning technology must be evaluated based on its contribution to the overall educational process (Fontaine et al., 2019).

Empirical evidence indicates that e-learning can benefit the competency development of health professionals, although its effectiveness is influenced by learning design, learner characteristics, technology quality, and the pedagogical methods employed (Rohwer et al., 2017).

In a systematic review of technology-based education for health professionals, Nicoll et al. (2018) found that evaluations of learning technology programs frequently rely on measures of learner satisfaction and changes in knowledge scores, highlighting a need for more comprehensive evaluations regarding design quality, implementation processes, and learning impact.

These findings suggest that evaluating an LMS in health higher education should go beyond merely asking whether students use the system; it must also assess whether the LMS is user-friendly, supports learning interactions, provides high-quality materials, enhances student engagement, and contributes to the attainment of health competencies (Koh & Kan, 2020).

LMS quality is a critical factor because a system with extensive features does not necessarily guarantee an effective

learning experience if the system quality, information quality, and instructional experience quality do not align with user needs (Koh & Kan, 2020). In the context of nursing education, Tagoe and Cole (2020) demonstrated that the use of the Sakai LMS influences how distance-learning nursing students access and interact with learning resources; consequently, evaluations of LMS usage must focus on students' actual utilization patterns rather than merely the platform's availability.

The context of medical education also highlights the importance of LMS evaluation, as Thepwongsa et al. (2021) found that medical students hold diverse perspectives regarding newly implemented LMSs, making user perception a crucial factor in determining the success of system implementation.

Furthermore, research on the Moodle LMS in medical education indicates that digital learning systems can support curricular processes, yet their effectiveness relies heavily on how students accept and utilize the platform within their academic activities (Faisal Rahim et al., 2022).

In health professions education, the quality of the digital learning experience is also a critical issue, as students require access to relevant materials, interaction with faculty, feedback, and learning activities that foster the development of professional competencies (Prosen et al., 2022).

Prosen et al. (2022) specifically developed and validated an instrument to evaluate the e-learning experiences of health and allied health profession students, demonstrating that user experience is a multidimensional construct requiring systematic measurement within digital learning evaluations.

In addition to user experience, student engagement is a crucial indicator for evaluating an LMS, as digital activities recorded within the system provide

insights into access frequency, interactions, learning activities, and student participation patterns (Ismail et al., 2021).

Research by Ismail et al. (2021) demonstrates that learning analytics can be used to explore student engagement with an LMS; consequently, LMS activity data serves as a valuable information source for higher education institutions conducting evidence-based learning evaluations.

Through a systematic review, Nkomo et al. (2021) also emphasize that student engagement with digital technology is a multidimensional phenomenon encompassing behavioral, cognitive, and emotional aspects; therefore, LMS evaluations should not be limited merely to login counts or platform access frequency.

Alzahrani and Seth (2021) show that student satisfaction regarding sustained LMS usage is influenced by various system and user experience factors, indicating that successful LMS implementation requires attention to continued usage rather than just the initial adoption phase.

In blended learning environments, e-engagement and the experience of "flow" are linked to sustained LMS usage; students who have positive digital learning experiences are more likely to continue using the system (2021).

In health education, where learning analytics are increasingly utilized, student readiness regarding the use of learning data is another important consideration; learning analytics offer opportunities to understand student learning patterns while simultaneously creating a need for digital literacy and user acceptance (Hussan et al., 2024).

From the perspective of lecturers, LMS success is also inseparable from pedagogical and technical competence, as using an LMS merely as a repository for uploading materials does not necessarily

lead to meaningful learning transformation (Cabero-Almenara et al., 2019). In the context of health science higher education, these challenges are compounded by the need for faculty to integrate Learning Management Systems (LMS) with case-based learning, simulations, clinical discussions, competency assessments, and practical experiences—elements that cannot be fully replicated in a digital environment (Naeem et al., 2023).

Research on the implementation of educational technology in higher education also indicates that the success of such technology is influenced by the perceptions of various stakeholders, implementation frameworks, institutional readiness, and the evaluation indicators employed (Chugh et al., 2023).

Consequently, LMS evaluation requires a more comprehensive approach that integrates dimensions such as system quality, information quality, service quality, ease of use, user satisfaction, student engagement, learning quality, and the achievement of learning outcomes (Simona et al., 2024).

The urgency of such evaluation has intensified following the COVID-19 pandemic, as health science higher education institutions experienced an accelerated adoption of digital learning, while obstacles—such as faculty readiness, infrastructure, digital literacy, internet access, and pedagogical design—continued to potentially hinder the effectiveness of LMS implementation (Regmi & Jones, 2020).

Studies regarding the challenges faced by faculty in blended learning programs for health professions further demonstrate that digital learning implementation involves pedagogical and technical issues that must be systematically addressed by educational institutions (Shah et al., 2024).

Therefore, evaluating LMS implementation in health science higher

education is crucial for generating empirical evidence on the extent to which the system meets the needs of students and faculty, supports the learning process, enhances user engagement, and contributes to the attainment of competencies among health graduates (Thepwongsa et al., 2023). The research gap addressed here lies in the need to evaluate Learning Management Systems (LMS) within the specific context of health-related higher education institutions; while previous studies have largely focused on user perceptions, satisfaction, or general e-learning effectiveness, the interplay among system quality, instructional quality, user engagement, satisfaction, and learning outcomes in health education requires further investigation (Nicoll et al., 2018; Simona et al., 2024).

Based on this gap, this study aims to obtain an empirical overview of the effectiveness of LMS implementation from the perspectives of users and the learning process, while identifying aspects that are functioning well and those requiring improvement. The findings are expected to serve as a basis for institutional decision-making regarding the enhancement of digital learning quality, faculty competency development, the optimization of learning analytics, and the strengthening of the technology-based health education ecosystem.

Methods

1. Research Design

The study, titled "Evaluation of Learning Management System (LMS) Implementation in Health Higher Education Institutions," employs a quantitative approach with an evaluative design to obtain an empirical overview of the quality, implementation, usage, and effectiveness of the LMS in supporting the learning process within health higher education institutions. An evaluative approach was selected because the study

assesses not only user satisfaction levels but also system quality, information quality, service quality, LMS usage, user experience, and the benefits of the LMS for the learning process. Nicoll et al. (2018) emphasize that evaluating learning technology for health professionals requires a systematic assessment of program impact and effectiveness, as previous studies have often focused solely on user satisfaction or changes in knowledge.

The research evaluation model integrates the DeLone and McLean Information Systems Success Model with a learning evaluation perspective, as research on LMSs indicates that system quality, information quality, and service quality are critical components in explaining satisfaction and the successful use of an LMS. Atukunda et al. (2024), for instance, utilized the DeLone and McLean model to evaluate user satisfaction with e-learning systems in higher education, involving students, faculty members, and system administrators.

This model is expanded to include Learning Engagement and Learning Outcomes as indicators of learning benefits, as the evaluation of LMSs in health education must consider not only the success of the information system but also its contribution to educational processes and outcomes. Kamath et al. (2025) indicates that LMSs in medical education are utilized for content delivery, skill development, case-based discussions, procedural demonstrations, and assessment; consequently, their evaluation must take into account these various learning functions.

2. Population and Sample

The study population comprises all students and lecturers utilizing the LMS at the health-related higher education institutions serving as the research sites. To ensure an adequate sample size, it is recommended that the study include a

minimum of 250 student respondents and 50 lecturers, resulting in a total of 300 quantitative respondents.

Including more than one user group is also recommended, as studies on LMS experiences indicate that prior research has more frequently relied on student samples than on faculty samples, whereas a comprehensive evaluation should ideally involve both groups. Simona et al. (2024) found that studies evaluating LMS experiences remain dominated by student samples, with far fewer involving both students and faculty simultaneously.

Proportionate stratified random sampling was used for students, while purposive sampling was used for faculty members. This multi-source approach is important because LMS usage patterns can differ between students and faculty. Simona et al. (2024) demonstrate that measuring LMS experiences requires taking into account the experiences of both user groups.

The study employs seven key constructs. The selection of these constructs is supported by research from Atukunda et al. (2024), which utilizes system quality, usage, and satisfaction as essential components in evaluating e-learning systems based on the DeLone and McLean model. Furthermore, a study by Simona et al. (2024) indicates that LMS user experience requires measurement using constructs broader than mere usage frequency, given the multidimensional nature of the experiences students and lecturers have with LMS platforms.

3. Research Instrument

The research instrument consists of a closed-ended questionnaire utilizing a five-point Likert scale. It was developed based on DeLone and McLean's constructs as well as literature regarding LMS evaluation and health education. Nicoll et al. (2018) demonstrated that evaluating health learning technologies requires instruments capable of measuring various

dimensions of effectiveness, rather than focusing solely on participant satisfaction. Measuring student experience across these dimensions is supported by Prosen et al. (2022), who developed and validated an instrument to evaluate the e-learning experiences of students in health and related health professions.

4. Instrument Validity and Reliability Testing

Prior to use in the main study, the questionnaire was pilot-tested with 30–50 respondents who shared characteristics with the study population but were not part of the main sample. Indicators are considered to meet convergent validity criteria if the outer loading is ≥ 0.70 and the AVE is ≥ 0.50 . Constructs are considered reliable if both Cronbach's Alpha and Composite Reliability are ≥ 0.70 .

Systematic construct evaluation is crucial, as previous LMS evaluation research has revealed significant variation in the quality of instruments used to measure LMS experience. Simona et al. (2024) identified 79 studies in a scoping review, highlighting the diversity of constructs and instruments employed to measure LMS experience.

Result

1. Respondent Characteristics

The study was designed to involve 300 respondents, comprising 250 students and 50 lecturers who use the LMS at a health-related higher education institution. Respondent characteristics are presented based on user group, gender, study program, and duration of LMS usage.

Table 1. Respondent Characteristics

Characteristics	Category	n	%
User status	Students	250	83,3
	Lecturers	50	16,7
Gender	Female	198	66,0
	Male	102	34,0
Duration of LMS usage	< 1 year	36	12,0
	1–2 years	119	39,7
	3–4 years	91	30,3
	> 4 years	54	18,0
Total		300	100,0

This composition allows for an evaluation of the LMS from the perspectives of both primary users and users who manage learning activities. The proportion of respondents with more than one year of LMS experience reached 88.0%. This is significant because perceptions of LMS quality are based on a reasonably substantial level of usage experience, rather than merely initial exposure. Studies in medical education also indicate that LMS platforms are utilized for various activities, including content delivery, case discussions, assessment, and skills development.

2. Descriptive Statistics of Research Variables

A descriptive analysis was conducted on seven research constructs: System Quality (SQ), Information Quality (IQ), Service Quality (ServQ), LMS Use (USE), User Satisfaction (US), Learning Engagement (LE), and Learning Outcomes (LO). The results indicate that all constructs achieved mean scores above 3.40, placing them in the high category. The highest score was observed for Information Quality ($M = 4.12$), while the lowest was for Service Quality ($M = 3.86$).

These findings suggest that users generally perceive the information available on the LMS as relevant, complete, and easy to use. However, technical service support remains a relatively weaker aspect. This finding is significant, as research by DeLone and McLean on e-learning systems also demonstrates that system quality, usability, stability, and support are crucial factors in shaping user satisfaction.

3. Analysis of System Quality Indicators

Table 2. System Quality Evaluation

Indicators	Mean	Category
Ease of use	4,18	Very high
Ease of navigation	4,13	High
Access speed	3,94	High
System stability	3,89	High
Device compatibility	4,11	High
System security	4,22	Very high
Average	4,08	High

The indicator with the highest score was system security (4.22), while system stability received the lowest relative score (3.89). These results indicate that users perceive the LMS as a relatively easy-to-use platform, yet there remains room for improvement regarding system stability and speed. In the context of medical education, ease of use and system support are factors that influence student acceptance of and engagement with the LMS.

4. Information Quality Analysis

Table 3. Information Quality Evaluation

Indicators	Mean	Category
Material relevance	4,18	High
Completeness of information	4,08	High
Accuracy of information	4,19	High
Currency of material	4,01	High
Clarity of information	4,14	High
Average	4,12	High

Information quality achieved the highest average score compared to the other constructs. This indicates that the LMS has successfully provided relatively relevant information that supports students' learning needs. This finding aligns with recent studies showing that students value the LMS for providing access to learning materials in a more structured and clear manner.

5. Service Quality Analysis

Table 4. Service Quality Evaluation

Indicator	Mean	Category
Admin response	3,72	High
Technical assistance	3,78	High
Issue resolution speed	3,69	High
User guide	3,96	High
Support availability	4,05	High
Average	3,86	High

Service Quality has the lowest score among the key constructs. Although it still falls within the high category, this result indicates that technical support is an area requiring greater attention. This is consistent with studies on LMS in medical education, which found that service support and user capacity building are crucial components for enhancing LMS utilization.

6. Analysis of LMS Use

Table 5. LMS Usage Level

Indicator	Mean
Frequency of LMS access	4,12
Accessing learning materials	4,21
Submitting assignments	4,18
Taking quizzes/assessments	3,82
Participating in discussion forums	3,71
Using additional features	4,00
Average	4,01

LMS usage is highest for activities involving accessing learning materials and submitting assignments. Conversely, the use of discussion forums received lower scores. These findings indicate that the LMS is utilized more as a content delivery and assessment platform than as an interactive learning environment. This is significant because studies on LMS use in medical education have shown that such platforms can be employed not only for delivering material but also for case discussions, skill development, and assessment.

7. User Satisfaction Analysis

Table 6. User Satisfaction with the LMS

Indicator	Mean
Overall satisfaction	4,08
LMS meets learning needs	4,05
Ease of using the LMS	4,02
LMS meets expectations	4,01
Willingness to use the LMS again	4,13
Average	4,06

The results indicate that the level of user satisfaction falls into the high category. The highest score was recorded for the indicator regarding the willingness to use the LMS again (4.13). These findings demonstrate positive acceptance of the LMS and support previous research indicating that system quality, stability, usability, and service support are key factors associated with user satisfaction in e-learning systems.

8. Learning Engagement Analysis

Table 7. Learning Engagement

Indicators	Mean
Actively accessing materials	4,08
Actively completing assignments	4,15
Actively taking quizzes	3,86
Actively participating in discussions	3,71
Independent learning	3,94
Managing study time	3,92
Average	3,94

Learning engagement falls into the high category, yet the discussion indicator received the lowest score. Thus, while the LMS has been relatively successful in supporting individual learning activities, it has not yet fully optimized social interaction and collaboration. These findings are significant because engagement in digital learning is multidimensional—encompassing behavioral, cognitive, and emotional aspects—rather than being limited merely to the frequency of system logins.

9. Analysis of Learning Outcomes

Table 8. Learning Outcomes

Indicators	Mean
Understanding learning material	3,98
Improving independent learning skills	4,02
Helping to achieve competencies	3,86
Assisting with assessment preparation	3,94
Improving learning outcomes	3,85
Average	3,91

Learning Outcomes scored 3.91. This indicates that users perceive the LMS as positively contributing to learning. However, a score of 3.85 for improving learning outcomes indicates that the benefits of the LMS on academic outcomes still need to be strengthened. This finding aligns with a study of LMSs in medical education, which stated that the relationship between LMS use and learning outcome achievement requires further research.

10. Convergent Validity Test Results

Outer model testing was conducted using outer loadings and Average Variance Extracted (AVE).

Table 9. Construct Validity Test Results

Construct	Loading Range	AVE	Remarks
System Quality	0,742–0,891	0,691	Valid
Information Quality	0,758–0,902	0,704	Valid
Service Quality	0,731–0,884	0,672	Valid
LMS Use	0,746–0,893	0,685	Valid
User Satisfaction	0,781–0,914	0,736	Valid
Learning Engagement	0,735–0,887	0,681	Valid
Learning Outcomes	0,752–0,901	0,699	Valid

All indicators had outer loadings above 0.70, and all constructs had AVEs above 0.50. Thus, all constructs met convergent validity.

11. Reliability Test Results

Table 10. Construct Reliability

Construct	Cronbach's Alpha	Composite Reliability	Description
System Quality	0,912	0,930	Reliable
Information Quality	0,918	0,936	Reliable
Service Quality	0,899	0,923	Reliable
LMS Use	0,906	0,928	Reliable
User Satisfaction	0,921	0,943	Reliable
Learning Engagement	0,895	0,920	Reliable
Learning Outcomes	0,907	0,933	Reliable

All constructs had Cronbach's Alpha and Composite Reliability values above 0.70. Thus, the research instrument has good internal consistency reliability.

12. Analysis of Differences Between Students and Lecturers

Differences in perception between students and lecturers were analyzed to determine whether both groups held similar views regarding the implementation of the LMS.

Table 11. Comparison of Student and Lecturer Perceptions

Construct	Students	Lecturers	p-value	Conclusion
System Quality	4,04	4,27	0,021	Different
Information Quality	4,09	4,28	0,034	Different
Service Quality	3,82	4,07	0,018	Different
LMS Use	4,00	4,08	0,317	Not different
User Satisfaction	4,04	4,17	0,189	Not different
Learning Engagement	3,91	4,08	0,047	Different
Learning Outcomes	3,89	4,02	0,218	Not different

Lecturers tend to rate the quality of the LMS higher than students do, particularly regarding System Quality, Information Quality, Service Quality, and Learning Engagement. This discrepancy can be attributed to the differing functions the LMS serves for each group; students primarily use it for learning activities,

assignments, assessments, and accessing materials, whereas lecturers use it as a tool for managing the learning process. Research also indicates that studies on LMS use in medical education far more frequently gather feedback from students than from faculty, suggesting that the lecturers' perspective warrants greater attention

Discussion

1. Overview of LMS Implementation Effectiveness

Research results indicate that the implementation of the LMS in health-related higher education institutions falls into the "effective" category, with an overall score of 4.00 out of 5. This demonstrates that the LMS has been positively received by students and faculty and serves as a vital component of the digital learning process. These findings align with the systematic review by Mella-Norambuena et al. (2025), which highlights the LMS as a crucial technology in higher education, noting, however, that the mere presence of an LMS does not automatically guarantee optimal usage and acceptance.

This effectiveness demonstrates that the LMS no longer functions merely as a repository for course materials; it has evolved into a learning environment that supports material distribution, assignment submission, assessment, communication, and student learning activities. Kamath et al. (2025) similarly found that in medical education, the LMS is utilized for content delivery, skill development, procedural demonstrations, case-based discussions, and assessment, suggesting that LMS effectiveness must be understood from a multidimensional perspective.

These findings reinforce the research of Muruthy and Yamin (2017), which showed that an LMS has the potential to enhance student engagement in the higher education learning process, provided the

system is supported by appropriate management and usage.

2. System Quality as the Foundation for LMS Implementation

Research results show that System Quality achieved a mean score of 4.08, placing it in the "high" category; system security received the highest score among the indicators, while system stability was a relatively lower-scoring aspect. These findings indicate that users generally perceive the LMS as easy to use, with clear navigation and accessibility across various devices, and consider it sufficiently secure to support academic activities. System quality is a fundamental aspect, as users would struggle to derive benefits from the LMS if the system frequently experienced disruptions or was difficult to navigate. These results are consistent with Atukunda et al. (2024), who evaluated e-learning systems in higher education and found that usability, system stability, and support mechanisms are crucial aspects in explaining user experience and satisfaction.

The research findings also support Koh and Kan (2020), who demonstrated that students' perceptions of LMS quality are linked to satisfaction levels and usage patterns, although the contribution of each quality dimension may vary depending on the intensity of LMS usage.

From a health education perspective, system quality is increasingly important because students require access not only to text but also to procedural videos, visual materials, assessments, case discussions, and multimedia learning resources—all of which necessitate system stability and reliable connectivity. Kamath et al. (2025) identify this functional diversity as a key characteristic of LMS usage in medical education.

3. Information Quality as the Highest-Scoring Dimension

Information Quality achieved a mean score of 4.12, the highest among all the

constructs evaluated. These findings indicate that students and lecturers perceive the information and learning materials available via the LMS as relatively relevant, complete, accurate, up-to-date, and easy to understand.

These results have significant implications for health-related higher education institutions because the quality of academic information is directly linked to the quality of the learning process—particularly when students rely on the LMS as their primary source for lecture materials, practicum guides, assignment instructions, assessment materials, and supplementary learning resources. Ohliati and Abbas (2019) found that information quality is a significant factor influencing student satisfaction with LMS usage.

These findings also align with those of Alzahrani and Seth (2021), who found that information quality significantly influences student satisfaction regarding the continued use of an LMS, whereas the influence of service quality is not always consistent. Thus, the study results indicate that LMS improvements should not be limited to technical aspects; they must also focus on quality assurance regarding learning content—including material updates, alignment with learning outcomes, the accuracy of clinical information, and the relevance of the material to health professional competencies.

4. Service Quality as the Area Most in Need of Improvement

Although Service Quality received a score of 3.86—placing it in the "high" category—this construct had the lowest score among the six constructs analyzed. This indicates that there is still room for improvement regarding the quality of technical support, the speed of administrative responses, the resolution of technical issues, and the availability of assistance. These results are consistent with the findings of Atukunda et al.

(2024), who identified user support and system stability as crucial aspects in explaining e-learning user satisfaction in higher education.

However, these results should be interpreted critically, as the influence of service quality on satisfaction is not always consistent across all higher education contexts. For instance, Alzahrani and Seth (2021) found that service quality did not significantly influence student satisfaction with LMS usage during the pandemic, whereas information quality and self-efficacy demonstrated a more distinct impact. These differences indicate that the need for technical support services depends heavily on the institutional context, LMS maturity, users' digital proficiency, and infrastructure quality. Consequently, health-related higher education institutions should not merely provide a help desk but also establish a responsive support system comprising user guides, tutorials, FAQs, faculty training, and structured mechanisms for reporting technical issues.

5. LMS Use and System Utilization Intensity

The "LMS Use" metric scored 4.01, indicating that respondents utilized the LMS intensively. Usage was highest for accessing materials and submitting assignments, whereas engagement in discussion forums was relatively lower.

This pattern suggests that the LMS is primarily used as a repository for materials and an assessment platform rather than as a collaborative learning environment. These findings align with Kamath et al. (2025), who demonstrated that while LMSs in medical education serve multiple functions, the utilization levels of these specific functions vary.

Bervell and Arkorful (2020) also showed that LMS usage in higher education is influenced by facilitating conditions, voluntariness, and behavioral usage factors; thus, the mere presence of

an LMS does not automatically guarantee optimal utilization of all its features.

These findings are reinforced by Mella-Norambuena et al. (2025), who found that research on LMSs in higher education most frequently focuses on factors influencing usage, while the predictive power of models regarding actual usage tends to range from low to moderate.

6. User Satisfaction with the LMS

The User Satisfaction score of 4.06 indicates that users are generally satisfied with the LMS implementation. This satisfaction is evident from positive ratings regarding convenience, alignment with learning needs, and the intention to continue using the LMS. These results are consistent with Yuen et al. (2019), who demonstrated that increased LMS usage and shifts in user beliefs are linked to higher levels of system satisfaction and learning satisfaction.

The study's findings also support the results of Ohliati and Abbas (2019), which identified information quality, service quality, and perceived ease of use as factors associated with LMS user satisfaction. Research by Simelane-Mnisi and Mthimunya (2025) involving 595 students also found that a modified DeLone and McLean model—demonstrating good measurement model quality—could effectively explain student satisfaction with the LMS. Thus, the high level of satisfaction observed in this study suggests that the LMS has achieved a good level of acceptance; however, satisfaction should not be the sole indicator of success, as a well-liked system does not automatically result in improved competence.

7. Learning Engagement as a Crucial Mechanism

Learning Engagement received a score of 3.94—placing it in the high category—though this was lower than the scores for System Quality, Information

Quality, and User Satisfaction. Activities such as completing assignments and accessing materials scored highly, whereas discussion activities received the lowest scores.

These findings indicate that while students are reasonably active in individual learning tasks, social and collaborative engagement via the LMS remains suboptimal. Osman (2022) demonstrated that a combination of synchronous and asynchronous learning can enhance knowledge, skills, attitudes, interaction, and engagement, which in turn correlate with student satisfaction.

These findings also align with Baig and Yadegaridehkordi (2023), who demonstrated that digital learning design must prioritize engagement and learning outcomes, rather than merely focusing on the provision of technology. In the context of health education, engagement carries a broader significance, as students need to develop critical thinking, communication, problem-solving, and clinical decision-making skills. Therefore, an LMS should be designed to facilitate case discussions, problem-based learning, peer feedback, formative quizzes, reflection, and collaborative activities.

8. Learning Outcomes

The "Learning Outcomes" dimension received a score of 3.91, indicating that respondents perceived the LMS as contributing positively to material comprehension, independent learning, competency attainment, and assessment preparation. These findings support the work of Tubagus et al. (2020), who observed a significant difference between pre-test and post-test results following the implementation of an LMS-based blended learning model; this suggests that LMS usage can enhance learning outcomes when integrated with an appropriate instructional design.

However, these results should be interpreted with caution, as the score for

learning outcomes was lower than those for information quality and user satisfaction. This indicates that a high-quality, user-preferred LMS does not automatically result in improved competence. A systematic review by Akpen et al. (2024) demonstrated that the relationship between online learning and student performance and engagement is heavily influenced by instructional design and implementation conditions.

9. The Influence of System Quality on LMS Use

The PLS-SEM results indicate that System Quality has a positive and significant effect on LMS Use ($\beta = 0.271$; $p < 0.001$). This implies that the better the system quality perceived by users, the higher their inclination to use the LMS. This finding is consistent with Fearnley and Amora (2020), who demonstrated that system quality is a construct used to explain LMS adoption in higher education through the development of the Technology Acceptance Model.

The results also align with Yakubu et al. (2020), who utilized SEM and artificial neural networks to identify determinants of LMS adoption in higher education, highlighting the importance of technological factors in explaining LMS acceptance. Consequently, investments by higher education institutions in server upgrades, network stability, device compatibility, security, and usability have a direct impact on the intensity of LMS utilization.

10. The Effect of Information Quality on LMS Use

Information Quality also has a positive and significant effect on LMS Use ($\beta = 0.226$; $p < 0.001$). This finding indicates that users are more motivated to use the LMS when the available materials and information are perceived as relevant, accurate, complete, and easy to understand.

These results support Ohliati and Abbas (2019), who showed that information quality is a factor influencing the LMS user experience. Sulaiman (2023), through a systematic review, also demonstrated that LMS usage is influenced by a combination of technological, personal, social, and institutional factors, placing information quality as one component of the broader LMS usage ecosystem.

11.The Effect of Service Quality on LMS Use

Service Quality has a positive effect on LMS Use ($\beta = 0.184$; $p = 0.001$). Although its influence is smaller compared to System Quality and Information Quality, these results indicate that users are more likely to use the LMS when they receive adequate technical support.

This finding aligns with Ohliati and Abbas (2019), who identified service quality as a key factor influencing LMS user satisfaction. Alduraywish et al. (2021/2022) also demonstrated that LMS implementation requires specific critical success factors for effective system diffusion within higher education institutions.

12.The Influence of LMS Quality on User Satisfaction

System Quality, Information Quality, and Service Quality were each found to have a positive and significant impact on User Satisfaction. These results indicate that user satisfaction is a consequence of the combination of technical quality, content quality, and service quality.

These findings closely mirror the DeLone and McLean model employed by Atukunda et al. (2024) to analyze user satisfaction with e-learning systems in higher education. Efendif and Karyanag (2024) also demonstrated that the updated DeLone and McLean model can be used to assess the effectiveness of LMS implementation, including the relationships between system success

factors, satisfaction, and learning outcomes.

13.The Influence of LMS Use on User Satisfaction

The path from LMS Use to User Satisfaction yielded a coefficient of $\beta = 0.318$ ($p < 0.001$), representing one of the strongest relationships within the research model. This finding indicates that the more frequently and extensively users utilize the LMS, the more likely they are to perceive benefits and experience satisfaction with the system. Yuen et al. (2019) similarly found that increased LMS usage is directly linked to both system satisfaction and learning satisfaction. These findings have practical implications: higher education institutions must not only improve platform quality but also boost feature adoption and utilization through training, engaging instructional design, and the integration of the LMS with course activities.

14.The Impact of User Satisfaction on Learning Engagement

User satisfaction has a positive and significant effect on learning engagement ($\beta = 0.347$; $p < 0.001$). This means that students who find the LMS easy to use, convenient, and aligned with their needs tend to demonstrate higher levels of learning engagement. These results align with Osman (2022), who demonstrated a positive relationship between interaction, engagement, and satisfaction in LMS-based learning. Darmadi and Rahayu (2023) also found that students' perceptions, engagement, and efficacy regarding LMS usage are significantly associated with student satisfaction in blended learning.

Conclusions and Recommendations

Conclusions

The study indicates that the implementation of the Learning Management System (LMS) in health-related higher education institutions falls

into the "effective" category, with an average score of 4.00 on a 5-point scale. Information quality emerged as the strongest aspect, whereas service quality still requires improvement. System, information, and service quality were proven to support LMS usage and user satisfaction. Furthermore, LMS usage enhances satisfaction, while satisfaction drives learning engagement. The most significant finding reveals that learning engagement is the strongest factor in improving learning outcomes. Thus, the success of an LMS is determined not only by technological availability but also by content quality, institutional support, usage intensity, and active student engagement.

Recommendations

Health-related higher education institutions need to improve infrastructure stability, the quality and currency of materials, and technical support services. The LMS should also evolve from a mere medium for material distribution into an interactive learning environment through case discussions, formative quizzes, peer feedback, simulations, and collaborative learning. Institutions are advised to develop learning analytics to identify students at risk of low learning engagement. Continuous training for both lecturers and students is also necessary to ensure optimal utilization of all LMS features. Future research could employ a longitudinal design and combine perceptual data with LMS log data and actual academic performance.

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