Original Article

Electronic Learning Systems' effectiveness in teaching and learning in public universities of Uganda: A case of Mbarara University of Science and Technology (MUST)

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ABSTRACT

This study examined the effectiveness of e-learning systems in enhancing teaching and learning at public universities in Uganda, with a focus on Mbarara University of Science and Technology (MUST). A cross-sectional survey design was used, combining quantitative and qualitative approaches. Data was collected from 237 respondents through questionnaires, interviews, and document reviews. Quantitative data was analyzed using SPSS version 24, while qualitative data underwent thematic analysis. The study assessed how system quality, information quality, and service quality impact teaching and learning. Key challenges identified included low student engagement, inactive distance learning groups, poor internet connectivity, inadequate infrastructure, and courses not optimized for online delivery. Results revealed that e-learning significantly contributes to teaching and learning effectiveness, with system quality accounting for 12.1%, information quality 25.1%, and service quality 54.5% of the impact. High system quality marked by usability and user-friendly interfaces enhances instructional delivery and learning outcomes. Information quality supports curriculum continuity and access to dependable resources. Service quality emerged as the most influential factor, reinforcing the need for efficient technical support and learner assistance. The study recommended upgrading technical infrastructure, forming an Information Quality Task Force, improving system compatibility, strengthening support services, promoting staff training, and formulating a policy to ensure sustainable, high-quality online education at MUST.

INTRODUCTION

E-learning has become a transformative tool in education, offering learners access to knowledge anytime and anywhere without needing a mentor (Encarnacion, Galang, & Hallar, 2021). At Mbarara University of Science and Technology (MUST), e-learning has been implemented to overcome teaching and learning challenges. Nevertheless, issues like limited student participation, unreliable access to online materials, and poorly designed courseware persist (MUST Reports, 2019–2021; MoES, 2021).

Historically, education has evolved with technological progress. Specialized training existed as early as 3000 BC (Nokes, 2019), and basic teaching tools appeared by 561 BC. The launch of correspondence courses in 1840 marked a shift in educational delivery (Ulloa-Brenes, 2021). The integration of electronic tools and Learning Management Systems (LMS) has revolutionized global education (Khadimally, 2020; Clark & Mayer, 2016; Noreen, 2020). African universities, including those in Uganda, have embraced e-learning to improve academic outcomes (Mtebe, 2015). Yet, Uganda continues to face challenges such as high internet costs, inadequate course customization, and insufficient infrastructure (Eton & Chance, 2022).

This study was anchored in Mayer and Moreno's (1999) E-Learning Theory, emphasizing effective multimedia content to reduce cognitive load (Mayer, Sweller & Moreno, 2015; Vasylianskii, 2021). Despite its benefits such as flexibility and independent learning, challenges like academic dishonesty and weak assessment strategies persist (MUST, 2021; MoES, 2021). This study aimed to evaluate e-learning effectiveness at MUST to inform better practices and outcomes.

LITERATURE REVIEW

E-learning is grounded in several pedagogical theories, including the e-learning theory of Mayer, Sweller, and Moreno (2015), which guided this study. The theory focuses on cognitive science principles in designing effective learning systems. It posits that a well-designed, high-quality system can significantly enhance the learning environment. By presenting relevant information in an organized and accessible manner, such systems reduce cognitive load, enabling learners to process information effectively and learn at their own pace.

Kibuku and Ochieng (2018) emphasize that the integration of thoughtful design features and manageable information levels can further improve learning outcomes. When appropriately designed, e-learning systems minimize the challenges of learning, thereby enhancing both teaching and learning experiences. Logan, Johnson, and Worsham (2021) similarly highlight the positive role of e-learning theory, noting that it supports learners in managing instructional tasks and information processing with ease.

Additionally, embedding multimedia principles in the design of e-learning systems is crucial. These principles enable teachers and learners to interact with the system seamlessly, fostering an engaging

and effective learning experience (Clark & Mayer, 2016; Mayer et al., 2015). As such, e-learning theory serves as a foundational framework for optimizing the design and functionality of electronic learning environments. While the e-learning theory offers significant strengths, it also has limitations, like many other learning theories. Janelli (2018) highlights that the theory lacks emphasis on the interaction between learners and instructors, a critical component for effective teaching and learning. Enhancing educational technology requires addressing this gap by fostering interaction and ensuring that users possess the necessary skills for their roles within the system, of which the community of inquiry (CoI) framework by Garrison, Anderson, and Archer (2000) would play a significant role. The following are other theories that incriminate the use of e-learning and the criticism thereof, and they are key evidence that several key learning theories have relevance to e-learning. Siemens, 2004; Downes, 2005. Connectivism theory focuses on learners creating networks to navigate and acquire knowledge, emphasizing the role of digital channels such as social media, forums, and blogs. While connectivism supports collaborative learning through tools like online curation and knowledge-building events, it is limited in fostering critical thinking and deep learning, focusing more on information management. Clarà, M., & Barberà, E. (2013)

Constructivism theory by Vygotsky (1969) stresses the creation of knowledge through interaction with the environment. It is relevant to e-learning through practices like online simulations, case studies, and collaborative activities such as discussion forums and peer reviews that promote active learning and critical thinking. However, the theory does not fully address social and cultural factors in learning and focusing on information acquisition. Scholars like Kirschner, Sweller, and Clark (2006) argue that constructivist approaches often place too much emphasis on discovery learning without sufficient guidance, which can lead to cognitive overload.

According to Skinner (2019), Behaviorism theory emphasizes learning as a stimulus-response process, where learners adapt to stimuli. This theory aligns with online learning environments that offer quizzes, assessments, and timely feedback to reinforce learning. However, the theory only focuses on surface-level learning, but not on promoting deeper understanding. Mayer, R. E. (2004).

These theories can guide the design of effective e-learning environments, but each has its limitations, particularly in fostering deeper critical learning.

System Quality and Teaching and Learning in Public Universities

System quality concerns the design of a system and the technical support provided for that system, directly impacting its perceived usefulness by students and influencing their satisfaction (Pereira, Varajão, & Takagi, 2022). This satisfaction significantly affects teaching and learning outcomes (Alksasbeh et al., 2019; Rui-Hsin & Lin, 2018). Almaiah and Alismaiel (2019) argue that system quality in mobile learning fosters an enabling environment for accessing educational resources, enhancing engagement, flexibility, knowledge transfer, and cost-effectiveness, thereby bridging conceptual gaps in learning.

Rojabi (2019) highlighted that system quality's functionality, responsiveness, and user interface design are critical to effective teaching and learning. However, his study lacked qualitative and statistical depth, which subsequent research addressed through triangulated methodologies, combining interviews and questionnaires. Turnbull, Chugh, and Luck (2020) emphasized that system functionality affects user perceptions of usability and task control, enabling flexible access to learning systems.

The MUST annual report (2020) highlighted ongoing e-learning enhancements supported by improved ICT policies and robust internet infrastructure at the Mbarara and Kihumuro campuses. However, challenges such as limited bandwidth, unstable power supplies, and costly computing devices hinder optimal system use. These issues affect system reliability, damage critical equipment, and impose financial burdens on institutions and users.

Empirical evidence underscores that e-learning systems must be user-friendly, responsive, and equipped with well-designed interfaces to enhance teaching and learning (Fajar & Larasati, 2022). A user-centred interface promotes satisfaction and reinforces the system's importance in education. While such studies affirm system quality's role in teaching and learning in developed contexts, the effectiveness of learning management systems in Uganda's public universities requires further exploration to understand its impact on teaching and learning outcomes, given a much lower level of development as is the case in Uganda where Mbarara university is based.

Information Quality and Teaching and Learning in Public Universities

Information quality focuses on the relevance, accuracy, timeliness, and usability of content within an information system, which significantly impacts teaching and learning (Lee, Sung & Jeon, 2019). High-quality information improves the system's responsiveness and adds value for its users (Nambiar, 2020). Sumi and Kabir (2021) emphasize that when information is relevant, timely, accurate, and complete, it enhances teaching and learning effectiveness, while Sholikah and Sutirman (2020) suggest that improved information quality increases system usability and user benefits. However, these studies did not address how information quality affects student assessment, engagement, learning flexibility, continuity in curriculum access, and

independent learning areas that this study set out to explore.

Achmadi and Siregar (2021) highlight the importance of accuracy, relevance, and accessibility in information quality, noting their role in enabling learners to access error-free, goal-oriented information that supports effective learning. At Mbarara University of Science and Technology (MUST), efforts to enhance information quality included upgrading the university website in 2020, with a focus on content management, standardization of departmental sites, and improved accessibility. These upgrades aimed to foster a better academic environment by improving information presentation and delivery.

Despite these developments, there is limited empirical evidence on the effect of information quality in teaching and learning within Ugandan public universities.

Service/Learner Support Quality and Teaching and Learning in Public Universities

Service quality is about the level of backing and support provided by educational institutions to address technical issues and enhance the learning experience (Ohliati & Abbas, 2019). Almaiah and Almulhem (2019) argue that service quality enables institutions to compete effectively by supporting their learning processes. Pham et al. (2019) found that service quality influences instructors' attitudes toward adopting e-learning, particularly when resources, training, and technical expertise are available. Their study, which conceptualized service quality as responsiveness, reliability, and technical competence, showed a positive impact on student satisfaction and loyalty. However, this research, conducted in Vietnam, did not focus on how service quality specifically impacts learning processes, a gap addressed by this study at MUST.

MUST's Annual Report (2020) highlights limited computer access in computer labs, urging students to use personal devices such as laptops and

smartphones. However, this approach creates inequality due to students' varied financial capabilities, affecting academic performance. Despite network upgrades like fibre optic installations and improved internal connections in medical buildings, bandwidth remains insufficient. This leads to system downtimes that disrupt online teaching and learning.
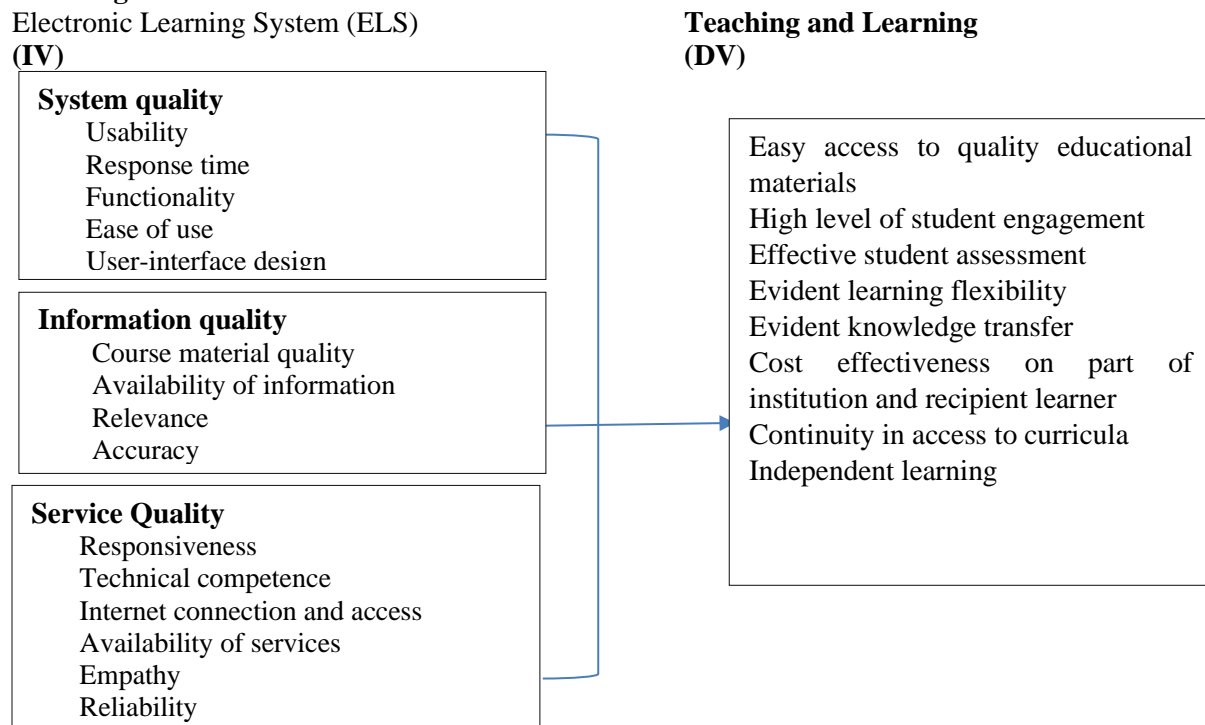
Service quality at MUST is also affected by the need for comprehensive academic staff training in e-learning tools. Such training improves both technical and user support, enabling effective communication and reducing frustration during system usage. Instructional design training is vital to enhance this support, however, the university lacks explicit programs for such training. While its e-Learning Policy reflects an understanding of instructional design's importance, and collaborations with Cyber School Technology Solutions and the Mastercard Foundation have improved infrastructure and policies, these initiatives have not established structured instructional design training.

Low staffing levels in the computing services unit further hinder consistent instructional delivery and knowledge transfer. This weakens the overall e-learning experience and complicates efforts to provide high-quality online education. This study direction lies within the conceptual framework as indicated in Figure 1. Additionally, during the COVID-19 pandemic, the university's transition to formal online teaching via Learning Management Systems and Zoom helped continue academic activities and provided a competitive edge over other institutions unable to offer online learning. Nonetheless, persistent challenges in infrastructure, training, and resource access continue to affect the learning process. These unresolved issues validate the relevance and necessity of this study in assessing and improving the effectiveness of e-learning systems at MUST.

CONCEPTUAL FRAMEWORK

Figure 1. Conceptual Framework for Electronic Learning Systems' Effectiveness and Teaching and Learning in MUST.

Electronic Learning System (ELS) (IV)

Teaching and Learning (DV)

System quality
Usability
Response time
Functionality
Ease of use
User-interface design

Information quality
Course material quality
Availability of information
Relevance
Accuracy

Service Quality
Responsiveness
Technical competence
Internet connection and access
Availability of services
Empathy
Reliability

Easy access to quality educational materials
High level of student engagement
Effective student assessment
Evident learning flexibility
Evident knowledge transfer
Cost effectiveness on part of institution and recipient learner
Continuity in access to curricula
Independent learning

This conceptual framework illustrates the relationship between e-learning systems' effectiveness and teaching and learning at MUST. Adapted from Argyropoulou (2013) and modified by the researcher. E- learning systems' effectiveness is the independent variable. It is defined by system quality, information quality, and service quality. Teaching and learning is the dependent variable. It is measured through access to quality materials, student assessment, and engagement, flexibility, knowledge transfer, cost-effectiveness, and curriculum continuity. The framework supports the hypothesis that a well-designed e-learning system improves learning outcomes. It is grounded in both theoretical and empirical foundations (Encarnacion et al., 2021).

METHODOLOGY

The study adopted a cross-sectional survey design, combining both quantitative and qualitative approaches to provide a comprehensive understanding of the research topic. Data was collected through statistical analysis, insights from key informants, and document reviews. The target population included 406 respondents, 41 staff and 350 students enrolled in MUST's Virtual Learning Environment. A stratified random sampling technique was used to select 237 respondents,

consisting of 36 academic staff and 186 students, based on university strata (Zaman & Bulut, 2023; Iliyasu & Etikan, 2021). Purposive sampling was applied to identify knowledgeable key informants, such as top management, E-Learning Support Unit staff, and Deans/Directors, to assess the effectiveness of e-learning systems (Obilor, 2023).

Three primary data collection methods were used: self-administered questionnaires structured with a six-category Likert scale, face-to-face interviews with open-ended questions, and document reviews. The questionnaires gathered quantitative data from staff and students, while interviews provided qualitative insights from key informants. Document reviews examined annual reports, strategic plans, and e-learning policies for relevant data.

Data Quality Control was done, particularly looking at Validity to ensure that the data collection tools were in a state in which they performed the role they were supposed to do (Kovacic, 2018). A pilot test was done to examine the validity of each question (Aung, Razak & Nazry, 2021).

Using the Content Validity Index (CVI), the questionnaire was also validated with coefficients above 0.7, indicating good content validity as shown in Table 1 below.

Table 1: Content Validity Indices for the Questionnaire

Variable	Number of Items	CVI
System quality	9	.900
Information quality	7	.900
Service quality	12	.800
Teaching and learning	12	.875
Total	**40**	**.869**

Source: *Primary Data (2023).*

Reliability was ensured to confirm the accuracy of data collection tools (Sanatkar & Rubin, 2023). A prior test on 5% of the sample, as recommended by Tappin (2014), was conducted to guarantee the reliability of the instruments. The instruments achieved an average Cronbach's alpha of 0.789,

exceeding the 0.7 threshold, indicating acceptable internal consistency (Zakariya, 2022), as detailed in Table 2.

Table 2: Cronbach's Alpha Coefficient for the Questionnaire

Variable	Number of Items	Cronbach's Alpha
System quality	9	.800
Information quality	7	.839
Service quality	12	.740
Teaching and learning	12	.778
Total	40	.789

Source: *Primary data (2023)*

ANALYSIS AND INTERPRETATION OF FINDINGS

Electronic Learning Systems' Effectiveness in Teaching and Learning at MUST

The study evaluated the effectiveness of electronic learning systems at Mbarara University of Science and Technology (MUST), through descriptive and inferential statistical analyses. Mean scores and standard deviations from a 5-point Likert scale were analyzed to measure respondents' agreement levels.

Pearson's correlation coefficient was employed to determine the degree and direction of the relationship between electronic learning systems and their impact on teaching and learning. Multiple regression analysis was used to test the study hypotheses.

Teaching and Learning in MUST

Table 3: Teaching and Learning Descriptive Findings

Teaching and learning	Mean	SD
There is quick and timely access to quality educational materials at MUST	2.58	.901
There is timely and effective assessment of students at MUST	4.03	.662
There are high levels of students' engagement at MUST	2.06	.880
During assessment, students get immediate feedback at MUST	2.87	.878
Students participate in online discussion forums at MUST	2.78	.945
There is increased understanding of the content by students	3.67	.954
There is timely completion of tasks by students at MUST	3.82	.855
There is continuity in access to curricula at MUST	3.86	.844
There is flexibility for learners to access educational materials and participate in courses	4.06	.681
Teaching and learning at MUST is cost cost-effective	4.03	.689
Students at MUST can learn independently	3.79	.955
There is evident knowledge transfer at MUST (Instructor-led training)	4.01	.786

Source: Primary data (2023)

The results presented in Table 3 offer a comprehensive view of respondents' perceptions regarding teaching and learning at MUST. Eight out of the twelve statements received mean values above 3.0, indicating a high level of agreement among the participants. The majority of respondents strongly agreed that there is a timely and effective assessment of students at MUST (mean=4.03). This suggests that the institution conducts assessments promptly and efficiently, which is crucial for maintaining the quality of education. There was also a significant agreement regarding the flexibility for learners to access educational materials and engage in courses (mean=4.06). This signifies that MUST provide a flexible learning environment, which

potentially enhances the overall learning experience.

Furthermore, the respondents generally agreed with statements regarding the cost-effectiveness of teaching and learning at MUST (mean=4.03, SD=.689), the effective knowledge transfer (mean=4.01, SD=0.786), and the increased understanding of content by students (mean=3.67, SD=0.954). These findings reflect positively on the institution's educational processes and students' capacity to engage with the material. The ability of students to learn independently is also noted, suggesting that students at MUST possess self-directed learning capabilities, a valuable skill for continued education.

On the contrary, there were notable areas of disagreement. There is quick and timely access to quality educational materials at MUST (Mean=2.58, SD=0.90), indicating that students may face delays and difficulties in obtaining high-quality materials promptly when needed. High levels of student engagement (mean=2.06, SD=0.880), and participation in online discussion forums at MUST (mean=2.78, SD =0.945). Lastly, the results revealed that students do not receive immediate feedback after assessments (mean=2.87), further indicating an area that may require attention and improvement. These findings provide valuable insights into the strengths and areas of improvement in teaching and learning at MUST as perceived by the study participants.

Teaching and Learning at MUST: Insights from Stakeholders

This study complemented quantitative findings with qualitative data collected through structured interviews with top management, E-Learning Support Unit staff, Deans, and Directors. The insights validated and deepened the understanding of eight critical dependent variables affecting teaching and learning at MUST.

Looking at easy access to quality educational materials, stakeholders stressed that delayed access to materials across faculties hampers student preparedness. Similarly, delayed feedback on assessments negatively impacts learning, especially in departments requiring frequent evaluations. Low participation in online discussions was seen as a barrier to engagement, notably in faculties like Engineering and Computing and Informatics.

Learning flexibility was praised for accommodating diverse schedules, especially for part-time learners. Knowledge transfer was recognized as a strength, though ongoing staff training is needed to sustain it among all staff. Cost-effectiveness was viewed as a balancing act between institutional efficiency and student affordability, affecting resource access and retention. Continuous access to curricula was emphasized as vital for consistent learning, and independent learning was identified as key for life-long learning across disciplines.

In summary, these variables influenced all departments using e-learning, and addressing them holistically is vital for delivering inclusive, efficient, and high-quality education at MUST.

System Quality of the Electronic Learning System and Teaching and Learning in MUST

Table 4: System Quality Descriptive Findings

System quality	Mean	SD
An electronic learning system has a well-designed user interface	2.63	1.199
An electronic learning system allows me to control over my teaching/learning activities	3.72	.924
I find it easy to develop online content that is well-aligned with the learning outcomes of the course using this system	2.77	1.033
Electronic learning system language and means of communication are effective	4.01	.931
I can easily access the electronic learning system anytime I need to use it	2.88	.992
The use of an electronic learning system gives more teaching /learning options	3.82	.952
An electronic learning system provides information that appears readable, clear, and well-formed	3.77	1.069
It is easy for me to become skilled at using the electronic learning system	3.82	.934
I find it easy to get the electronic learning system to do what I want it to do, corresponding to the ways I teach/learn	3.80	1.002

Source: *Primary data (2023)*

According to Table 4 results presented above, six out of nine items in this category had mean values above 3.0, indicating that, statistically, there is a high level of satisfaction with the system quality of the electronic learning system. This suggests that, overall, users at MUST are content with the electronic learning system's quality, which can positively influence teaching and learning experiences.

A significant majority of respondents affirmed that the electronic learning system allows them control over their teaching and learning activities (mean=3.72, SD=0.924). This empowerment to manage and direct their educational experiences can lead to more personalized, engaging, and efficient learning. Similarly, respondents largely agreed that the language and means of communication within the electronic learning system are effective (mean=4.01, SD=0.931). Effective communication methods and language contribute to improved teaching and learning experiences, accessibility, and inclusive education.

Furthermore, the electronic learning system at MUST was found to provide information that is readable, clear, and well-structured (mean=3.77, SD=1.069). This clear presentation of information supports comprehension and enhances the user experience. Respondents also agreed that the use of the electronic learning system offers more teaching options (mean=3.82, SD=0.952), expanding the possibilities for educators and students and ultimately leading to more customized, engaging, and accessible educational experiences.

The respondents found it easy to get the electronic learning system to align with their teaching or learning preferences (mean=3.80, SD=1.002), demonstrating that users can effectively navigate and utilize the system to meet their specific needs. Additionally, the majority of respondents agreed that it's easy to become skilled at using the electronic learning system (mean= 3.82, SD= 0.934), which contributes to the proficiency of users and enhances their teaching and learning experiences.

On the flip side, most respondents disagreed that the electronic learning system has a well-designed user interface (mean=2.63, SD=1.199), suggesting that there are challenges related to the system's interface

design, potentially leading to usability issues and dissatisfaction. Similarly, the respondents disagreed that they can easily develop online content well aligned with the course learning outcomes using the system (mean=2.77, SD=1.033), highlighting difficulties in creating materials that effectively match course objectives, potentially affecting the quality and efficiency of education. Finally, the majority disagreed that they can easily access the electronic learning system anytime they need to use it (mean=2.88, SD= 0.992), indicating challenges in reliable and convenient access, which is crucial for a seamless educational experience. These findings suggest areas for improvement in terms of the system's design and accessibility at MUST.

System Quality and Teaching and Learning at MUST: A Stakeholder Perspective

Interviews with key stakeholders at MUST, including top management, the E-Learning Support Unit, and Deans and Directors, highlight the critical influence of system quality on teaching and learning. The discussions focused on aspects including usability, response time, functionality, adaptability, user interface design, content development challenges, skills gaps, time-intensive processes, and access barriers.

The findings underscore the institution's commitment to enhancing system quality to support e-learning. Despite the challenges, stakeholders are dedicated to creating a responsive, efficient, functional, adaptable, and user-friendly e-learning environment supported by robust technical infrastructure.

Information Quality of the Electronic Learning System and Teaching and Learning in MUST

Table 5: Information Quality Descriptive Findings

Information quality of the electronic learning system	Mean	SD
The electronic learning system provides me with sufficient information to do my tasks	2.52	.989
I am satisfied with the accuracy of the electronic learning system at MUST	3.83	.836
The electronic learning system provides updated information regarding my tasks	3.47	.983
The electronic learning system at MUST provides information that is exactly what you need (Content Accuracy)	3.78	.948
The electronic learning system provides the information you need at the right time (Availability)	2.74	.915
The Electronic learning system provides information that is relevant to my course (Usability, relevance)	3.86	.896
The Electronic learning system provides up-to-date information	4.06	.829

Source*: Primary data (2023)*

The findings, as presented in Table 5 above, highlight respondents' perceptions of information quality in MUST's electronic learning system. Five out of seven items had mean values above 3.0, indicating overall satisfaction. Respondents were satisfied with accuracy (mean=3.83), relevance (mean=3.86), and the system's ability to provide information as needed (mean=3.78). They also agreed that the system delivers up-to-date content (mean=4.06), enhancing curriculum relevance and learner engagement. However, concerns were raised about the timely availability (mean=2.74, SD= 0.915), and sufficiency of information for tasks (mean=2.52). Addressing these gaps can improve teaching, learning outcomes, and user experience at MUST.

Information Quality and Teaching and Learning at MUST: Stakeholder Insights

In-depth interviews with key stakeholders at MUST, including top management, the E-Learning Support Unit, and Deans and Directors, reveal the significant role of information quality in enhancing teaching and learning. The discussions focused on four key aspects, including course material quality, information availability, relevance, and accuracy.

These findings highlight the institution's commitment to using e-learning systems to improve education delivery. Despite existing challenges, stakeholders are dedicated to ensuring the provision of accurate, accessible, and curriculum-aligned content in the e-learning environment.

Service Quality of the Electronic Learning System and Teaching and Learning in MUST

Table 6: Service Quality Descriptive Findings

Service quality	Mean	SD
The electronic learning system provides the required information on time.	2.89	.881
The electronic learning system provides information that is easy to understand	3.87	.961
The electronic learning system creates easy access to teaching/learning services at MUST	3.82	.778
It is easy to understand how to perform tasks using an electronic learning system	4.00	.876
In general, the electronic learning system is easy to use	3.77	.906
Training on the use of the electronic learning system is sufficient.	3.90	.761
Employees of the electronic learning department have sufficient professional knowledge	2.95	1.020
I can communicate with the technicians through multiple channels when I encounter technical problems	3.78	.750
The training provided can enhance my ability to use the electronic learning system	3.60	.964
Technical support is readily available and responsive	2.51	0.791
The platform is available and responsive without frequent downtime	2.98	1.130
It supports multiple devices (desktop, tablet, mobile) and browsers	2.38	0.790

Source: *Primary data (2023)*

The study on service quality in MUST's electronic learning system reveals overall satisfaction as presented in Table 6 above, with seven out of twelve items scoring above 3.0. Respondents found the system easy to understand (mean=3.87), perform tasks with (mean=4.00), and use (mean=3.77), multiple channel communication (3.78), and sufficient training (3.90), indicating a user-friendly platform that enhances efficiency, engagement, and accessibility. However, five items scored below 3.0, highlighting areas needing improvement to optimize teaching and learning experiences.

Service Quality and Teaching and Learning at MUST: Stakeholder Insights

Qualitative findings from interviews with key stakeholders at MUST, including top management, the E-Learning Support Unit, and Deans and Directors, shed light on how service quality affects teaching and learning at the institution. The discussions probed various dimensions of service quality, including responsiveness, technical competence, internet connection and access, availability of services, empathy, and reliability.

These findings highlight the institution's commitment to using e-learning systems to improve education delivery. Despite existing challenges, stakeholders are dedicated to ensuring the provision of a highly competent technical staff, a readily available accessible internet connection and access, and access to services, among others, in the e-learning environment.

Verification of the Study Hypothesis was Done as Follows;

Correlation Analysis for Electronic Learning Systems' Effectiveness in Teaching and Learning at MUST

The study revealed significant correlations between electronic learning systems' effectiveness factors and teaching and learning at MUST. System quality showed a weak positive relationship with teaching and learning (r=0.267, p=0.000), suggesting that enhancing system quality can improve educational outcomes. Information quality had a moderate positive correlation (r=0.694, p=0.000), highlighting its substantial impact on teaching and learning. Service quality demonstrated a strong positive relationship (r=0.768, p=0.000), indicating its crucial role in enhancing educational experiences.

Table 7: Regression Model of Electronic Learning Systems' Effectiveness

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.789ᵃ	.623	.617	.36659
a. Predictors: (Constant), service quality, system quality, information quality				

Source*: Primary data (2023)*

Table 8: Results of Coefficients of Electronic Learning Systems' Effectiveness in Teaching and Learning in MUST

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.330	.185		7.189	.000
	System quality	.121	.044	.146	2.731	.007
	Information quality	.251	.070	.291	3.613	.000
	Service quality	.545	.069	.596	7.846	.000
a. Dependent Variable: teaching and learning						

Source*: Primary data (2023)*

The study tested the three hypotheses, and all were accepted, indicating that these quality factors significantly influence teaching and learning in public universities in Uganda.

DISCUSSION

System Quality of the Electronic Learning System and Teaching and Learning in MUST

The study investigated the effect of system quality on teaching and learning at MUST, focusing on dimensions including usability, response time, functionality, ease of use, and user interface design.

Notably, the study echoes the findings by Fajar and Larasati (2022), emphasizing user-friendly interfaces as vital for improving teaching and learning outcomes. Similarly, Turnbull, Chugh, and Luck (2020) highlight functionality and flexibility as essential for remote access and teaching control, resonating with the MUST study. The importance of system response time, as identified by Sayfouri

(2016), also aligns with the study's emphasis on fast, consistent performance for user satisfaction.

Research by Almaiah and Alismaiel (2019) corroborates the link between system quality and user satisfaction, while Rabiman et al. (2020) highlight responsiveness and reliability as critical for Learning Management System success, further validating the MUST findings. Holmes and Prieto-Rodriguez (2018) and Rojabi (2019) reinforce the role of usability, interactivity, and system functionality in effective teaching and learning.

Information Quality of the Electronic Learning System and Teaching and Learning in MUST

This study investigated the influence of information quality on teaching and learning at MUST, focusing on dimensions including course material quality, information availability, relevance, and accuracy.

E-Learning Theory highlights the critical role of well-designed instructional materials that are accurate, relevant, clear, and well-structured, attributes emphasized in the study. These findings align with prior research by Alshehri, Rutter, and Smith (2019), which also underscores the pivotal role of information quality in enhancing educational outcomes. The study concludes that improving information quality is essential for fostering effective teaching and learning processes at MUST.

Service Quality of the Electronic Learning System and Teaching and Learning in MUST

This study examined the impact of electronic learning system service quality on teaching and learning at MUST. Service quality was assessed across key dimensions including responsiveness, technical competence, internet connectivity and access, availability of services, empathy, and reliability.

The results align with E-Learning Theory, particularly the emphasis on responsiveness and technical competence in reducing extraneous cognitive load. A responsive e-learning system that promptly addresses user concerns allows educators and learners to concentrate on instructional content, thereby enhancing learning outcomes. Furthermore, the findings are consistent with MUST's annual reports, which highlight how improved services, well-trained staff, and robust infrastructure positively impact teaching and learning.

CONCLUSION

As far as the System quality of the electronic learning system and teaching and learning in MUST is concerned, this study examined the role of system quality in shaping teaching and learning outcomes at MUST. The findings demonstrated that a high-quality electronic learning system significantly enhances teaching practices and learning outcomes.

On the Information quality of the electronic learning system and teaching and learning in MUST, this study highlighted the significant impact of information quality on teaching and learning at MUST. The findings underscore the importance of maintaining good information quality to support effective teaching and improved learning outcomes.

As far as the Service quality of the electronic learning system and teaching and learning in MUST is concerned, this study established that service quality significantly and positively affects teaching and learning at MUST. The findings emphasize the critical role of good service quality in fostering effective teaching practices and enhancing the learning experience within the institution.

RECOMMENDATIONS

On the System quality of the electronic learning system and teaching and learning in MUST, this research recommends that MUST should enhance its electronic learning system by upgrading internet infrastructure, ensuring reliable Wi-Fi, and implementing network redundancy to minimize disruptions. This should follow a 12-month phased plan, beginning with a connectivity audit and budgeting, then procurement and implementation. Infrastructure upgrades must be integrated into the

university's annual strategic plan. A dedicated user experience design team should collaboratively redesign the system's interface with input from students and faculty. Faculty training in online content development should be conducted quarterly, funded through the staff development budget and managed by the academic affairs office. The IT department should perform quarterly system audits, explore cloud-based solutions, and ensure annual budget allocation for maintenance. A structured feedback system including semesterly surveys and performance dashboards should be introduced for continuous monitoring and improvement.

As far as the Information quality of the electronic learning system and teaching and learning in MUST is concerned, this research recommends that MUST should establish an Information Quality Task Force in the first quarter, comprising academic staff, ICT personnel, and quality assurance officers, with defined mandates and terms of reference. By the second quarter, a biannual content review aligned with semester cycles should be implemented to maintain relevance and consistency in materials. Standardized content creation guidelines, developed in the first quarter, should be rolled out via targeted training in the second quarter. These initiatives should be funded through the e-learning and quality assurance budgets, with progress tracked in quarterly reports to university management.

On the Service quality of the electronic learning system and teaching and learning in MUST, this research suggests that a dedicated technical support team should be established within the ICT Department by the second quarter, with clearly defined roles and operational funding. Staff professional development should be institutionalized through semi-annual training sessions coordinated by the Human Resource Directorate and funded via the staff development fund. To ensure system compatibility and accessibility, a comprehensive system testing plan covering various devices and browsers should be

created by the third quarter. System updates and bug fixes should follow a structured six-month release cycle managed by the IT team. All efforts must align with the university's ICT Policy and undergo annual evaluations for compliance and effectiveness.

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